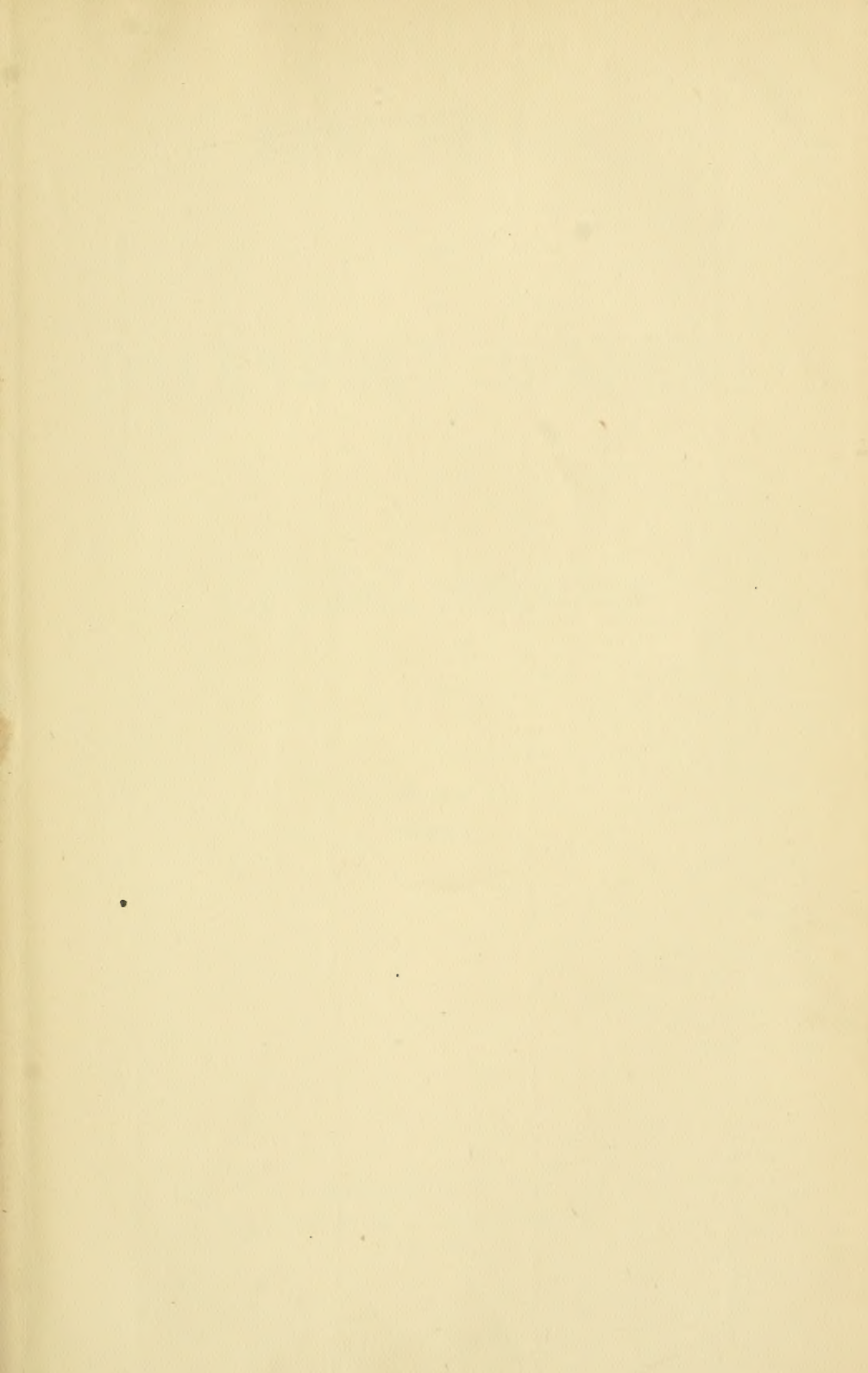


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PROCEEDINGS
OF THE
DAVENPORT ACADEMY
OF
NATURAL SCIENCES.

VOLUME II.
1876-1878.



DAVENPORT, IOWA:
PUBLISHED BY J. D. PUTNAM.
1877-1880.

R665
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PUBLICATION COMMITTEE — 1879.

J. D. PUTNAM, *Chairman*. DR. C. C. PARRY. REV. W. H. BARRIS.
DR. R. J. FARQUHARSON. DR. C. H. PRESTON.

The authors of the various papers are alone responsible for what is contained in them.
The date of the printing of each sheet is printed in the signature line.
Pages 1-148, and Plates I-III, constituting Part I, were published in July, 1877.

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PREFACE.

THE publication of the first volume of the proceedings of the Academy was so well received, and resulted in such large additions to its library and museum, it was decided to continue it; and in now presenting another volume it may be of interest to continue the brief sketch of its progress commenced in the former one.

The year 1876 was largely occupied with preparing the material, printing and publishing the first volume of PROCEEDINGS; but the scientific work was not neglected, and active Biological, Historical, Archæological and Geological Sections were formed, holding frequent meetings in addition to the general meetings of the Academy. The collections continued to increase faster than space could be provided, and the first fruits of the publication were seen in the shape of large numbers of books received in exchange.

Early in 1877 the printing of the second volume of PROCEEDINGS was commenced. The 22d of February of this year was made memorable by the donation of a building lot by Mrs. P. V. Newcomb. A subscription was started, plans drawn, contracts let, and the year closed with a well-constructed building nearly ready for occupancy—the first of its kind west of the Mississippi. Other notable events of the year were the discovery of two inscribed tablets in a mound on the Cook Farm, and the donation by Prof. T. S. Parvin, of his extensive geological collection. Donations to the Library and Museum were received from more than 700 persons.

In 1878, on February 22d. the anniversary of Mrs. Newcomb's gift, the new building of the Academy was opened to the public. This led to a great and rapid increase in the collections, taxing the ability of the curator to the utmost to care for them. The deposit of the botanical collections of Dr. C. C. Parry and entomological collections of J. D. Putnam, the exhuming of another inscribed tablet by Messrs. Gass, Harrison and Hume, and the addition to the museum of an antique pipe carved in the form of an elephant are events of the year worthy of note.

At the annual meeting held January 1st, 1879, a new departure was taken, and a lady, Mrs. Mary L. D. Putnam, to whose zeal the prosperity of the Academy is largely due, was elected President. Early in this year No. 1 of the Third Volume of PROCEEDINGS was published, containing the Reports presented at the annual meeting. The increase of the library and museum was greater than during any previous year. The most noticeable additions were the elegant mineralogical collections of the late Geo. W. Doe, and of the late D. S. True. During all these years Capt. W. P. Hall has continued his indefatigable explorations throughout the entire length of the Mississippi river, and of many of its

branches, gathering each year many thousands of stone and flint implements and earthen vessels. These, together with the results of the labors of Rev. J. Gass, and other members, has rendered the archæological collection of the Academy one of unusual interest.

The present year, 1880, the thirteenth in the life of the Academy, opens with a fair promise of continued progress.

This volume contains the proceedings of the Academy for three years, 1876, 1877, and 1878, and is published under an arrangement with the corresponding secretary, who has attended to all the details of editing, printing, illustrating and paying the bills. It was the original intention to issue the work in monthly or quarterly parts, but this was not found practicable. Part I, containing 148 pages and three plates was published in July, 1877, and part II completing the volume is now issued, having been delayed a year longer than was expected by the destruction of the lithographic plates originally prepared to illustrate it. Six plates (V, VI, by W. O. Gronen, VII, VIII, X, XI by A. D. Churchill) had been beautifully drawn on stone during the summer of 1878, but were ruined by the lithographic printer before 200 impressions were taken. After much delay these plates have been reproduced by etchings on steel by Messrs. W. O. Gronen, W. H. Pratt and J. D. Putnam. Being first attempts, and without personal instruction, they are not as artistic as could be desired, but will serve to illustrate the text, being fairly correct in outlines. The cuts also, are, many of them, first attempts at engraving on wood.

From January 1876 to June 1877 (Page 1-148) the minutes of the various meetings have been very fully printed. After that date all business matters, except such as had an important bearing on the welfare of the Academy, have been omitted, thus giving greater space for scientific matter. A very full index was prepared, but is omitted on account of the cost of printing it.

Acknowledgments are due to Prof. Spencer F. Baird, of the Smithsonian Institution for supervising the preparation of Plates I-III; to Messrs. Charles F. Steel, President and James Bannister, Chief Engraver of the Franklin Bank Note Co., 107 Liberty St., New York, from whom the plates and materials for etching were obtained, for their brief and practical directions and suggestions; to Messrs. Harroun & Bierstadt, 58 Reade St., New York, who prepared the albertype and artotype plates; to Mr. Herman Strecker, Reading, Pa., who engraved Plates IV and IX; to Messrs. Hastings, White & Fisher, Davenport, who prepared the negatives for Plate VII; to the Gazette Company of Davenport, who have done the printing with care and patience, worthy of the highest praise; to the various engravers of the plates and cuts, and to all members and correspondents of the Academy who have taken part in the work.

CONTENTS.

	PAGE.
Preface.....	iii
Contents.....	v
List of Illustrations.....	vii
Election of Officers for 1876.....	1
Standing Committees for 1876.....	5
Standing Rules of the Biological Section.....	9
Resolutions on the death of A. U. Barber.....	13
Standing Rules of the Historical Section.....	14
Committees of the Historical Section.....	15
By-Laws of the Section of Geology and Archaeology.....	16
Horned toads in the collection of the Academy. J. D. PUTNAM.....	22
On the young of a species of <i>Lycosa</i> . J. D. PUTNAM.....	23
Exploration of a Mound near Utah Lake. JULIA J. WIRT.....	29, 82
Notice of the late I. A. Lapham, LL. D. DR. C. C. PARRY.....	29
Manufacture of Pottery by Mojave Indian Women. DR. E. PALMER.....	32
Remarks on <i>Galeodes pallipes</i> Say. J. D. PUTNAM. Illustrated.....	35
Shell Money and other Primitive Currencies. W. H. PRATT. Illustrated.....	39
Annual Meeting, Jan. 3, 1877.....	47
Treasurer's Report for 1876. JOHN HUME.....	47
Curator's Report for 1876. W. H. PRATT.....	45
Additions to the Museum during 1876. W. H. PRATT.....	50
Recording Secretary's Report for 1876. C. H. PRESTON.....	56
Librarian's Report for 1876. R. J. FARQUHARSON.....	57
Additions to the Library during 1876, J. D. PUTNAM.....	57
Corresponding Secretary's Report for 1876. J. D. PUTNAM.....	64
Report of the Committee of Publication. J. D. PUTNAM.....	65
President's Annual Address. REV. W. H. BARRIS.....	75
Election of Officers for 1877.....	77
Standing Committees for 1877.....	80
Mound Explorations in Jackson County, Iowa. C. T. LINDLEY. Illustrated.....	83
Remarks on Coral Formations. PROF. H. T. WOODMAN.....	85
Donation of Geological Collection by Prof. T. S. Parvin.....	89
Deed of Building Lot donated by Mrs. P. V. Newcomb.....	90
Explorations of Mound No. 3, Cook's Farm Group, and Discovery of Inscribed Tablets. REV. J. GASS. Illustrated.....	92
Call upon Mrs. Newcomb, and Address by Rev. S. S. Hunting.....	99
On the Inscribed Tablets found by Rev. J. Gass. R. J. FARQUHARSON. Illustrated.....	103
Amendment to Article IX of By-Laws, On Committees.....	117
Report of the Director of the Biological Section. J. D. PUTNAM.....	120
Description of <i>Caloptenus picticornis</i> . DR. CYRUS THOMAS. Illustrated.....	124
Contributions to the Flora of Iowa. J. C. ARTHUR.....	128
On a collection of Mollusks from Utah and Colorado. ERNEST INGERSOLL.....	130
Conference with Library and Art Associations.....	136
A recent find of Skulls and Skeletons in Ohio. REV. S. D. PEET.....	138
Report of Exploration of Mound No. 10, Cook's Farm Group. REV. J. GASS. Illustrated.....	141
Description of inscribed stones found in Cleona Township, Scott Co., Iowa. REV. J. GASS.....	142
Deed of Additional land donated by Mrs. P. V. Newcomb.....	143
Remarks on Missouri and Iowa Mound Pottery. PROF. F. E. NIPHER.....	147
Exploration of Mounds on the Farm of Col. Wm. Allen. W. H. PRATT.....	148, 154
Report of Conference Committee.....	151
Report of Building Committee.....	152, 164, 165

FEB 5 - 1901

	PAGE
Examination of a large Mound in Jackson County, Iowa. REV. J. GASS.....	155
The Shell Beds of the vicinity of Davenport. W. H. PRATT. Illustrated.....	156
Proposition of Trustees of Griswold College	162
Battle of Fort Stephenson. W. C. PUTNAM.....	165
Resolution offering use of room to Davenport Art Association.....	166
A review of the published statements regarding the Mounds at Payson, Utah; with an account of their structure and origin. DR. E. PALMER.....	167
Inscribed Rocks in Cleona Township. REV. J. GASS.....	172
Report on a Mound in Jackson County. REV. J. GASS.....	173
Exercises at the laying of the Corner Stone of the Academy Building, October 4th, 1877....	173
Address by Rev. S. S. Hunting.....	174
Address by Hon. Z. C. Luce.....	177
Ode on laying the Corner-Stone. DR. C. C. PARRY.....	178
Articles deposited in Corner-Stone. W. H. PRATT.....	179
Address by T. S. Parvin.....	180
Resolution offering use of Room to Scott County Medical Society.....	185, 204
On the prevalence of Left-handedness in the City Schools. W. H. PRATT.....	186
A new California Lilly. DR. C. C. PARRY. Illustrated.....	188
Habits of a Singing Mouse. W. H. PRATT	190
List of the Lepidoptera of Muscatine County, Iowa. MISS ALICE B. WALTON.....	191
Reminiscences of the Early History of the Academy. W. H. PRATT	193
Amendments to the Articles of Incorporation.....	203
Annual Meeting, January 2d and 25th, 1878.....	204, 206
On the Growth of Paleontology as a Science. S. A. MILLER.....	206
President's Annual Address, Jan. 25th, 1878. REV. S. S. HUNTING..	207
Corresponding Secretary's Report. J. D. PUTNAM.....	211
Recording Secretary's Report. C. E. HARRISON.....	212
Treasurer's Report. DR. M. B. COCHRAN.....	212
Librarian's Report. DR. E. H. HAZEN	213
Curator's Report. W. H. PRATT.....	213
Report of the Publication Committee. J. D. PUTNAM.....	215
Report of the Historical Section.....	218
Report of the Biological Section.....	218
Election of Officers for 1878.....	218
Standing Committees for 1878.....	218
Mound Explorations in Jackson County, Iowa. REV. J. GASS	219
On the Synonymy of two Species of <i>Spirifera</i> . S. A. MILLER.....	220
Exploration of Mound No. 11, Cook's Farm Group, and Discovery of an Inscribed Tablet of Limestone. C. E. HARRISON. Illustrated.....	221
Opening of Academy Building, Feb. 23d, 1878.....	221
Notes of personal investigation among the Shell Mounds of Florida. W. W. CALKINS..	225
Post-mortem Examination of a Boa-Constrictor. DR. R. J. FARQUHARSON.....	230
Catalogue of the Marine Shells of Florida, with notes and descriptions of several new species. W. W. CALKINS. Illustrated.....	232
Curious Relic from the Cook Farm. W. H. PRATT. Illustrated.....	256
On the East Davenport Mounds. A. D. CHURCHILL.....	257
Resolutions on the Death of Prof. Joseph Henry	258
Contributions to the Flora of Iowa, No. III. J. C. ARTHUR.....	258
The Local Geology of Davenport and vicinity. REV. W. H. BARRIS.....	261
Resolution regarding the "Botanical Room".....	270
Descriptions of some species and varieties of North American Heteroceres, mostly new. HERMAN STRECKER. Illustrated.....	270
On some Hybrids between <i>Callimorpha lecontei</i> and <i>C. interrupto-marginata</i> . HERMAN STRECKER. Illustrated	275
The Larva of <i>Samia Gloneri</i> . HERMAN STRECKER.....	276
The Parry Botanical Collection. DR. C. C. PARRY.....	279
New Fossils from the Corniferous Formation at Davenport. REV. W. H. BARRIS. Illustrated.....	283

	PAGE
Exploration of a Mound near Moline, Illinois. Rev. J. GASS and Dr. R. J. FARQUHARSON.	289
Report of Exploration of Indian Graves. Rev. J. GASS.	291
Biological and other notes on <i>Coccida</i> . J. D. PUTNAM. Illustrated.	293
Elephant and Bear Pipes exhibited. Illustrated	348
Formation of Ground Ice in the Rapids of the Mississippi. Dr. R. J. FARQUHARSON. Illustrated.	349
Exploration of six Indian Burial Grounds. Rev. J. GASS.	354
Annual Address of the President, Jan. 7th, 1874. Dr. C. C. PARRY. [Omitted from Vol. I, page 55.]	355
Errata.	357

RECORD OF PROCEEDINGS OF REGULAR AND TRUSTEES MEETINGS, FROM JANUARY 5TH, 1876 TO DEC. 28TH, 1878, inserted in their Chronological Order.

BIOLOGICAL SECTION MEETINGS: 7, 8, 13, 17, 19, 21, 25, 34, 37, 120, 149, 142, 202, 205, 230, 252, 253, 254, 258, 270.

HISTORICAL SECTION MEETINGS: 8, 11, 14, 19, 20, 79, 119, 134, 150, 154, 165, 183, 193, 205, 231, 253, 254, 269.

ARCHAEOLOGICAL AND GEOLOGICAL SECTION MEETINGS. 11, 15, 24, 137, 154, 219.

ENTOMOLOGICAL NOTES: 7, 8, 10, 14, 17, 19, 22, 26, 35, 48, 123, 129, 142, 143, 148, 151, 184, 190, 205, 209, 252, 253, 255, 270.

BOTANICAL NOTES: 8, 10, 17, 20, 22, 28, 34, 37, 48, 119, 121, 129, 134, 202, 214, 252, 253, 255, 269, 278, 279, 291.

ZOOLOGICAL NOTES: 17, 18, 19, 20, 22, 30, 35, 48, 80, 85, 111, 121, 190, 205, 214, 254, 256.

GEOLOGICAL NOTES: 24, 48, 87, 89, 98, 116, 137, 138, 145, 150, 184, 209.

ARCHAEOLOGICAL NOTES: 6, 21, 24, 26, 38, 48, 81, 82, 85, 86, 87, 92, 115, 127, 129, 137, 138, 146, 147, 153, 154, 156, 214, 219, 221, 254, 348.

CONCHOLOGICAL NOTES: 10, 13, 14, 18, 19, 21, 22, 26, 48, 122, 129, 143, 202.

LIST OF ILLUSTRATIONS.

PLATES.

PLATE I. Upper surface of Inscribed Tablet found in Mound No. 3, Cook Farm, about two fifths of the natural size. Pages 96, 109.

PLATE II. Lower surface of same Tablet. Pages 96, 111.

PLATE III. Upper surface of another Inscribed Tablet from the same mound, about one-half of the natural size. Pages 96, 108. [The round spots at the right hand corners of the figure are holes pierced through the slab apparently for the purpose of suspending it. This edge should have been printed at the top.]

[Plates I, II, III were prepared by the Albertype process by Mr. E. Bierstadt, New York, from Photographs taken at the Smithsonian Institution under the direction of Prof. Spencer F. Baird, and give a very good idea of the tablets. It should be mentioned however that the photographs were obtained by throwing a light obliquely across the stones from above, which has caused the horizontal lines to appear stronger than the vertical lines.]

PLATE IV. Figs. 1, 2, *Caloptenus picticornis*, Thomas, ♂ ♀. Page 125. Figs. 2, 3, *Cicada Putnami* Uhler, ♂ ♀. Bulletin U. S. Geological and Geographical Survey, Vol. III, page 455. Figs. 5, 6, 7, Hybrids of *Callimorpha*. Page 275. [Drawn and engraved on stone by Herman Strecker.]

PLATES V, VI. *Lilium Parryi* Watson. Page 189. [Drawn from Nature and etched on steel by W. O. Gronen.]

PLATE VII. Inscribed Tablet from Mound No. 11, Cook Farm. One-half of the Natural size. [Artotype by Harroun & Bierstadt, New York, from negative by Hastings, White & Fisher, Davenport.]

PLATE VIII. Figs. 1, 2. *Triton veliei* Calkins. Page 235. Fig. 3, *Odostomia alba* Calkins. Page 239; Figs. 4, 5, *Cancellaria stimpsonii* Calkins. Page 250. [Drawn from nature and etched on steel by J. D. Putnam.]

PLATE IX. New North American Heteroceres. Pages 270-274. [Drawn and engraved by Herman Strecker.]

PLATE X. *Gyroceras Pratti* Barris. One-half natural size. Page 287. [Drawn from Nature and etched on steel by W. H. Pratt.]

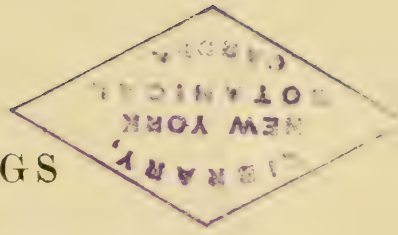
PLATE XI. New Corniferous Fossils. Natural size. Pages 382-287. [Etched on steel from Nature by J. D. Putnam.]

PLATES XII, XIII. *Pulvinaria innumerabils*. See Page 343. [Etched on steel from Nature by J. D. Putnam.]

[Plates V and VI were originally drawn by Mr. Gronen, with lithographic crayon on prepared paper, and transferred to stone, but after a few hundred impressions the figures became so blurred as to be useless. Plates VII, VIII, X, XI were carefully and beautifully drawn from nature by Mr. A. D. Churchill, directly on lithographic stone, but were spoiled by the printer before 200 impressions had been taken. The steel plates were printed by the Franklin Bank Note Co., New York.]

WOOD-CUTS.

- FIG. 1. *Galeodes pallipes* Say. Page 36. Drawn by J. D. Putnam.
 FIGS. 2-6. Shell beads, etc. Pages 39-45. Drawn by W. H. Pratt.
 FIG. 7. Copper crescent. Page 83. Drawn by W. H. Pratt.
 FIG. 8. Section of Mound No. 3, Cook Farm. Page 92. Drawn by W. H. Pratt.
 FIG. 9. Plan of Mound No. 3, Cook Farm. Page 93. Drawn by W. H. Pratt.
 FIG. 10. Dighton Rock Inscription. Page 105. Drawn by W. H. Pratt.
 FIGS. 11, 12. Grave Creek Inscription. Page 106. Drawn by W. H. Pratt.
 FIGS. 13, 14. Characters from Davenport Tablet. Page 110. Drawn by W. H. Pratt.
 FIG. 15. Section of Mound No. 10, Cook Farm. Page 141. Drawn by W. H. Pratt.
 FIG. 16. Section of Shell bed on Rock Island. Page 157. Drawn by W. H. Pratt. Engraved by John Graham.
 FIG. 17. Section of Mound No. 11, Cook's Farm. Page 222. Drawn and Engraved by C. E. Harrison.
 FIGS. 18, 19. Relic from Cook Farm. Page 256. Drawn by W. H. Pratt. Engraved by C. E. Harrison.
 FIG. 20. Diagram of *Stereocrinus*. Page 283. Sketched by Rev. W. H. Barris. Engraved by J. D. Putnam and John Graham.
 FIG. 21. Section of Mound near Moline. Page 289. Drawn by Dr. R. J. Farquharson and W. H. Pratt. Engraved by John Graham.
 FIG. 22. Bear Pipe. Page 348. Drawn by W. H. Pratt. Engraved by John Graham.
 FIG. 23. Elephant Pipe. Page 348. Drawn by W. H. Pratt. Engraved by John Graham.
 FIG. 24. Section of Rapids of Mississippi. Page 352. Drawn by W. O. Gronen. Engraved by John Graham.
 Brass die on cover of bound volume. Elephant pipe. Engraved by John Graham.



PROCEEDINGS
OF THE
DAVENPORT ACADEMY
OF
NATURAL SCIENCES.

VOLUME II.

RECORD OF PROCEEDINGS.

JANUARY 5TH, 1876.—ANNUAL MEETING.

Dr. E. H. Hazen, President, in the chair.

Twenty-three members present.

The reports of the Treasurer, Librarian, and Curator, were presented, and the retiring President, Dr. E. H. Hazen, delivered his Annual Address.*

The following officers were elected to serve during the ensuing year:

President—REV. W. H. BARRIS.

Vice-President—GEO. H. FRENCH.

Recording Secretary—DR. C. H. PRESTON.

Corresponding Secretary—MRS. M. A. MCGONEGAL.

Treasurer—JOHN HUME.

Librarian—DR. R. J. FARQUHARSON.

Curator—W. H. PRATT.

Trustees—WM. RIEPE, CHAS. E. PUTNAM, PROF. D. S. SHEL-

DON.

*Printed in Proc., Vol. 1, pages 83-86.

JANUARY 14TH, 1876.—TRUSTEES' MEETING.

Prof. W. H. Barris, President, in the chair.

Seven members present.

On motion of Mr. C. E. Putnam, the Abstract of Records, as prepared by the Publishing Committee, subject to such minor corrections as may be necessary, was accepted for publication.

The Secretary read a communication from the Women's Centennial Association, regarding the printing of the proceedings.

On motion of Mr. French, the Secretary was directed to insert the name of John Rowe in the list of regular members, his name having been accidentally overlooked at the last regular meeting.

The Treasurer was authorized to pay bills for ordinary current expenses, as presented.

JANUARY 22D, 1876.—TRUSTEES' MEETING.

Prof. W. H. Barris, President, in the chair.

Eight members present.

No business being ready, after an informal discussion, the Board adjourned.

JANUARY 28TH, 1876.—TRUSTEES' MEETING.

Prof. W. H. Barris, President, in the chair.

Eight members present.

A number of papers presented for publication in the Proceedings were accepted.

C. E. Putnam, chairman of the committee on proposed amendments to the Constitution and By-Laws, presented a codification of the Constitution to agree with the Articles of Incorporation, but making no change not necessary for such agreement. On motion the new form was adopted as the Constitution of the Academy.* Several amendments to the By-Laws were also proposed and approved, to be acted on at the next meeting.

*Printed in Vol. I, page 236.

A list of papers prepared by J. D. Putnam was read and referred to the Committee on Publication.

JANUARY 28TH, 1876.—REGULAR MEETING.

Rev. W. H. Barris, President, in the chair.

Eight members present.

Dr. Preston, of the Auditing Committee, reported that the Treasurer's report had been examined and found correct. The report was accepted and the committee discharged.

A letter was read from the Scientific Association of Richmond, Ind., acknowledging the receipt of photographs of pipes and axes.

The following persons were elected regular members: D. H. Twomey, E. P. Hopkins, Chester L. Pratt, C. E. Bronson, Mrs. M. Fisher, Mrs. Ebenezer Cook and Miss Frankie Pratt. The names of fourteen persons were proposed for membership.

FEBRUARY 19TH, 1876.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Seven members present.

Several amendments to the By-Laws, proposed at the last meeting, were unanimously adopted.*

A long list of papers, presented to the Academy at different times, was read, and on motion it was voted to publish all but one or two in the first volume of the Proceedings of the Academy. It was further voted to place the papers *together* in the volume, and to include the minutes of the last annual meeting in the published proceedings.

The Curator was authorized to use his discretion in allowing the removal of articles from the museum for exhibition at the art gallery established by the Bric-a-Brac Club on Second and Main Streets.

*By-Laws, as amended, Vol. I, page 238.

FEBRUARY 25TH, 1876.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Eight members present.

On motion of Dr. Preston, a Committee on Insurance, consisting of Messrs. C. E. Putnam, John Hume and W. H. Pratt, was appointed, with power to act.

Mr. Pratt gave notice of a proposed amendment to the By-Laws (Art. 2, § 2), changing the life membership fee from \$100 to \$50.

FEBRUARY 25TH, 1876.—REGULAR MEETING.

George H. French, Vice-President, in the chair.

Thirteen members present.

Mr. J. D. Putnam, on behalf of the Committee on Publication, reported that the printing of the "Proceedings" had been commenced, under a contract, made by the Women's Centennial Association, of Davenport, with C. E. Bronson, Levi Davis and Charles Fluke, printers residing in Davenport. It was expected to complete the work in from six to eight weeks.

The following persons were elected regular members: J. P. Stibolt, D. N. Richardson, F. I. Jervis, E. C. Chapin, George Wing, Richard Smetham, G. H. Parker, J. A. Crandall, Mrs. J. P. Stibolt, Mrs. D. N. Richardson, Mrs. F. I. Jervis, Mrs. E. C. Chapin, Mrs. W. B. Sherman, and Mrs. Ed. Russell. The names of four persons were proposed for membership.

The following resolutions, offered by J. D. Putnam, were unanimously adopted:

WHEREAS. In their generous and earnest efforts in behalf of the Academy of Sciences, the ladies of the Centennial Society have met with a great calamity, and incurred serious loss by the fire of the 23d inst.; therefore, be it

Resolved, That our warm thanks be tendered them for the endeavor they have made to publish our proceedings, but in view of the heavy responsibility the calamity has devolved upon them, we recommend that arrangements be made with the publishers to postpone the publication indefinitely, and that the proceeds of the entertainment intended therefor be devoted to the payment of losses incurred.

Resolved, That the members of this Academy will render to the ladies

of the Centennial Society all the assistance in their power to make good the loss incurred in its behalf.

Resolved, That to the young ladies of the "Bric-a-Brac" especial praise is due for the creditable art gallery they have improvised in our midst, as well as for their excellent management and eminent success; and that they be requested, if possible, to continue their entertainments during part of the following week, and to devote the funds realized to the payment of losses incurred.

The following papers were read and referred to the Committee on Publication:

"Mound Explorations in 1875," by A. S. Tiffany.

"Mound Explorations in 1875," by Clarence Lindley.

"Summer Botanizing in the Wasatch Mountains, Utah Territory; a letter addressed to Prof. Asa Gray," by C. C. Parry.

A communication was read from James Terry, of San Bernardino, Cal., requesting an exchange of copper axes, etc., for relics and specimens in his possession.

A few donations were reported, for which the thanks of the Academy were returned.

MARCH 31ST, 1876.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Seven members present.

Mr. C. E. Putnam reported, on behalf of the Committee on Insurance, that the property of the Academy had been insured to the amount of \$2,000, distributed as follows: Museum, \$750; library, \$750; furniture, \$100; cabinet cases, \$300; telescope, \$100.

An amendment to the By-Laws, Art. 2, § 2, changing the fee for life membership from \$100 to \$50, was adopted.

Mr. W. H. Pratt gave notice that he would, at the next meeting propose a new by-law, providing for the formation of working sections in the Academy. Messrs. W. H. Pratt, J. D. Putnam and C. H. Preston were appointed a committee to prepare such a by-law.

The President announced the following standing committees to serve during the year:

PUBLICATION.—W. H. Pratt, J. D. Putnam, C. H. Preston, R. J. Farquharson and G. H. French.

LIBRARY.—R. J. Farquharson, C. H. Preston and Mrs. S. R. Millar.

MUSEUM.—W. H. Pratt, *Curator*; R. J. Farquharson, *Archæological Department*; J. G. Haupt, *Botanical Department*; J. D. Putnam, *Zoological Department*; A. S. Tiffany, *Geological Department*; John Hume, *Historical and Mechanical Department*.

FINANCE.—Chas. E. Putnam, John Hume and George H. French.

FURNITURE AND ROOMS.—John Hume, Mrs. C. E. Putnam and Mrs. M. A. Sanders.

The Library Committee were requested to prepare rules and regulations for the use of the Library.

On motion of Mrs. M. A. McGonegal it was

Resolved, That that portion of Dr. Hazen's Valedictory Address, relating to the history and progress of the Association, and all parts of scientific interest, be inserted in the publication of the Proceedings of the Academy.

MARCH 31ST, 1876.—REGULAR MEETING.

Rev. W. H. Barris, President, in the chair.

Eleven members present.

Mr. J. D. Putnam, on behalf of the Committee on Publication, reported sixty-four pages of the Proceedings and twenty lithographic plates printed.

Letters were read from Mr. James Terry, of San Bernardino, Cal., offering exchanges, and from Mrs. Mary P. Haines, Richmond, Ind., acknowledging the receipt of photographs of axes and pipes, and advising of valuable donations in return.

A large number of donations were reported by the Curator.

The following persons were elected regular members: J. E. Carmichael, M. J. Rohlfs, Dr. P. H. Worley and Mrs. G. W. Fitch. The names of four persons were proposed for membership.

A very neatly and carefully executed pen drawing, showing the texture of the Mound Builders' Cloth, was exhibited by Mr. W. H. Pratt. Each cord of the warp is composed of two doubled and twisted cords, and the woof of one, which passes between the two parts of the warp, the latter being twisted at each change, allowing the cords to be brought close together, so as to cover the woof almost completely.

On behalf of the author, Mr. J. D. Putnam presented the following paper for publication in the Proceedings:

“List of Hymenoptera collected by J. Duncan Putnam, of Davenport, Iowa, with descriptions of two new species,” by E. T. Cresson, Philadelphia.

Mr. Putnam exhibited a portion of the above collection which he had made during the past four years in Iowa, Colorado, Wyoming and Utah. Of the two new species described, *Nomada Putnami* was found quite common at Spring Lake Villa, in Utah, July, 1875, and *Anthophora albata* was collected in June, 1872, near Denver, Colorado. The latter were noticed very abundantly, flying swiftly in a circular manner, close to the ground, which was sandy, beneath some cottonwood trees.

Mr. Putnam also exhibited some specimens of a ferocious-looking spider-like animal, a species of *Phrynus* from Mazatlan, Mexico, and also two specimens of the so-called Tarantula (*Mygale Hentzii*) from Canon City, Col., and from Spring Lake, Utah. None but males were found. These were wandering solitarily about the country, along the roads and in dry ravines.

APRIL 7TH, 1876.—BIOLOGICAL SECTION.

Pursuant to a notice published in the daily papers a meeting was held this evening for the purpose of organizing a Section of Botany and Zoology. Ten persons were present.

Mr. J. G. Haupt was called to the chair, and W. H. Pratt was appointed Secretary.

The Chairman stated the objects of the meeting: To form a working section of those members of the Academy specially interested in Botany and Zoology, holding more frequent meetings for the purpose of listening to and discussing the reports of observations and collections in these departments, made by the members. The Secretary then read the amendment to the By-Laws regarding sections proposed at the last meeting of the Trustees.

An application for the organization of such a section was drawn up and signed by the following eight members of the

Academy: J. D. Putnam, J. J. Nagel, J. G. Haupt, John Hume, Mrs. M. A. Sanders, W. E. Crosby, Mrs. C. E. Putnam, W. H. Pratt.

Messrs. J. D. Putnam, W. H. Pratt and J. G. Haupt were appointed a committee to draft a plan of organization and a programme of work for the section, and to report at the next meeting.

Mrs. Sanders exhibited a beautiful collection of plants collected by her husband, the late Alfred Sanders, illustrating the Flora of Iowa nearly thirty years ago, and which she has mounted in a handsome volume for exhibition at the Centennial, afterwards to be placed in the Herbarium of this Academy.

Messrs. Nagel and Haupt reported that they had noticed the white maple (*Acer dasycarpum*) in blossom March 10th, some three weeks earlier than usual. The weather has since been so severe that, with the exception of a few club mosses, no plants have been collected.

Mr. Putnam stated that insects were beginning to become lively and plentiful.

APRIL 14TH, 1876.—HISTORICAL SECTION.

Pursuant to notice a meeting was held this evening for the preliminary organization of an Historical Section of the Academy. Ten members were present.

Mr. J. A. Crandall was called to the chair and W. H. Pratt was appointed Secretary.

An application for the formation of the Historical Section was drawn up and signed by the following persons: Mrs. C. E. Putnam, Messrs. J. A. Crandall, C. C. Leslie, C. T. Lindley, J. G. Haupt, W. Riepe, W. C. Putnam, H. S. Putnam, W. H. Pratt, and John Hume.

Messrs. C. C. Leslie and W. C. Putnam were appointed a committee to draft a plan for the organization and working of the Section, to be presented at the next meeting.

Messrs. W. H. Pratt and J. G. Haupt were appointed a committee to obtain additional names to the application for organizing the Section.

APRIL 15TH, 1876.—BIOLOGICAL SECTION.

Eleven members present.

Mr. J. G. Haupt called the meeting to order, and W. H. Pratt was appointed Secretary.

Mr. J. D. Putnam, of the Committee on Organization, reported the following code of rules, which, after some discussion, were unanimously adopted, subject to the action of the Board of Trustees.

Standing Rules of the Biological Section.

1. This Section shall be known as the BIOLOGICAL SECTION of the Davenport Academy of Natural Sciences.
2. It shall have for its object the collection of all facts and specimens illustrating the Botany and Zoölogy of this region in particular and of the world in general.
3. There shall be one executive officer, styled DIRECTOR, who may appoint such deputies or assistants as he may deem necessary.
4. The meetings shall be held every alternate Saturday at such time and place as the members may from time to time determine.
5. Field meetings and excursions for the collection of specimens shall be held as often as practicable.
6. One or more members shall be appointed to assist the Curator in labeling and caring for the collections in each of the following departments: Phænogamic Botany, Cryptogamic Botany, Medical (or Applied) Botany, Mammalogy, Ornithology, Hereptology, Ichthyology, Entomology, Articulata, Conchology, Radiata, Infusoria.
7. Any person who shall fail to attend any of the meetings of the Section for three consecutive months shall cease to be a member of the Section, unless such non-attendance is caused by sickness, absence from the city, or some other good reason.

In accordance with these rules, Mr. J. D. Putnam was elected Director, and took the chair.

The business being over, the next thing in order was the reports of observations and collections made during the week.

Messrs. Nagel and Haupt reported that the following plants had blossomed since the last meeting:

- Corylus Americana* Walt. Hazel nut. April 13.
Thalictrum anemonoides Mx. Rue anemone. April 13.
Ulmus Americana L. American Elm. April 13.
Claytonia Virginica L. Spring beauty. April 14.

Capsella Bursa-pastoris. Mench. Shepherd's purse. April 14th.

Hepatica acutiloba, DC. Sharp lobed Hepatica. April 15.

Ranunculus fascicularis Muhl. Early crowfoot. April 15.

The table was adorned with a large number of living examples of the above plants. Mr. Nagel reported that several club mosses had fruited, but he could not give the names. He was unable to gain access to any work describing the mosses of this country.

Mr. W. H. Pratt reported that last Saturday (April 8th) he visited HORSE ISLAND, a few miles below town, for the purpose of collecting *Helix profunda* Say, a species usually abundant on that Island, though rare elsewhere in this vicinity. He found them still in a state of hibernation, and easily gathered a large number. Without exception they were all found with the spire down and the umbilicus up. Among the specimens collected there is a great range of variation in color. Several are entirely without brown bands, while others are entirely covered with reddish brown, excepting a narrow clear line. The majority of specimens have one prominent broad reddish band, sometimes accompanied by several narrow ones. It is probable that the warm weather of Monday and Tuesday brought them to active life, and that they have now scattered so that they will be more difficult to collect. A few dead specimens of *Helix thyroides* Say, and of *H. concava* Say, were collected in the same locality. He also found several specimens of *Succinea obliqua* Say, a species which no recent collector has before been able to find, though it is recorded in Tryon's List.*

Mr. Putnam stated that the present warm weather was bringing the insects into active life quite rapidly, but he had been too unwell to collect much. On April 7th and 10th the following species were collected, mostly from under stones, pieces of wood, etc.: COLEOPTERA: *Amara fallax* Lec., *Selenophorus pedicularius* Dej., *Stenolophus conjunctus* Say, *Agonoderus pallipes* Fab., *Tachys*, 2 species, *Orchestris striolata* Ill., and about a dozen undetermined species; also under some dead turtles were *Silpha marginalis* Fab., *S. inequalis* Fab., *Ips quadrisig-*

*Journal of Conchology, Vol. I, p. —. Philadelphia, 1867.

natus Say, *Hister americanus* Payk, *Platysoma Lecontei* Mars, and an undetermined species of *Nitidulidæ*. A large colony of white ants, *Termes flavipes* Koller, was found under the bark of an old cherry log. Specimens of the wingless cricket, *Ceuthophilus maculatus*, and of the chinch bug, *Rhyparochromus leucopterus* Say, were also collected.

APRIL 19TH, 1876.—HISTORICAL SECTION.

George H. French in the chair.

Mr. C. C. Leslie, of the committee appointed at the last meeting, presented the outline of a plan of organization, and asked that the committee be given longer time for perfecting details.

A letter was read from C. H. Eldridge, expressing his sympathy in the objects of the Section and making some valuable suggestions regarding the work to be done towards preserving the local history of Davenport and its institutions. Mr. E. states that he is "the oldest 'white boy' now living as a resident here, this making my fortieth year of continuous residence in the city of Davenport."

It was voted that this section be called the Historical Section of the Davenport Academy of Natural Sciences.

Messrs. W. H. Pratt, J. A. Crandall, C. C. Leslie and C. H. Eldridge were appointed a committee to present the objects of the Section to persons likely to be interested.

W. C. Putnam called the attention of the members to an erroneous statement in Wilkie's "Davenport, Past and Present," regarding the battle fought on Willow Island in August, 1814, between the Indians and Col. Zachary Taylor. The account given by Dr. Parry in his lecture on the "History of the Mississippi Valley," is probably the correct one.

APRIL 21ST, 1876.—GEOLOGICAL AND ARCHÆOLOGICAL SECTION.

Pursuant to notice a meeting was held this evening for the purpose of taking preliminary action toward the formation of a Section of Geology and Archæology. Seven members were present.

An application for organization of such a Section was drawn up and signed by those present.

Dr. E. H. Hazen and W. H. Pratt were appointed a committee to draft a plan of organization and operation of said section.

MAY 5TH, 1876.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Six members present.

A committee, consisting of Messrs. Hume, Pratt and Riepe, were appointed to confer with Mr. James Renwick concerning the suitability of certain rooms he proposed to rent to the Academy.

The committees on new By-Laws, concerning the use of the Library and formation of Sections, made their reports, which were laid over until the next meeting for action. Mr. Hume gave notice of a proposed By-Law setting aside life-membership fees as a building fund.

MAY 5TH, 1876.—REGULAR MEETING.

Rev. W. H. Barris, President, in the chair.

Eleven members present.

The correspondence during the month was read, and a number of valuable additions to the Library and Museum were reported.

The following resolutions were unanimously adopted:

WHEREAS, Our friend and associate, Mr. A. U. Barler, has passed to the higher life:

Resolved, That in the death of Mr. Barler the Academy and the community have sustained a loss which is deeply to be regretted, he having been one of the founders of our Association, and its first Vice-President, occupying that position for several years until his removal from the city; and, having been also an experienced teacher, remarkably earnest and successful in introducing and awakening an interest in the Natural Sciences in the public schools.

Resolved, That we deeply sympathize with his family in the loss of a kind husband and father, and with the members of the various associations with which he was connected, in the departure of an earnest fellow-worker.

Resolved, That these resolutions be published in the city papers, and copies thereof sent to the family and relations.

W. H. PRATT,
C. H. PRESTON,
JOHN HUME,
Committee.

Mrs. H. C. Marsh, Mrs. T. F. M. Curry, E. J. Babcock and W. C. Putnam were elected regular members.

The Secretary was authorized to procure a box and balls for more convenient balloting.

MAY 12TH, 1876.—TRUSTEES' MEETING.

George H. French, Vice-President, in the chair.

Six members present.

The following By-Laws were adopted: Article 8th on the Formation of Sections, and Article 9th on Library Regulations.*

The Committee on Rooms reported those offered by Mr. Renwick to have little, if any, advantage over those at present occupied. Messrs. C. E. Putnam, W. H. Pratt and George H. French were appointed a committee to make further investigations towards securing more commodious quarters.

A proposition from Mrs. Ebenezer Cook to bear the expense of a die for the cover of the published Proceedings of the Academy, was accepted with a vote of thanks.

MAY 13TH, 1876.—BIOLOGICAL SECTION.

J. D. Putnam in the chair.

Six members present.

Mr. Pratt stated that last Saturday (May 6th) he visited Rock Island in search of shells. In a small stream flowing into Sylvan Water, near the old railroad embankment, he collected *Bulinus hypnorum* Linn., *Planorbis parvus* Say, *Segmentina armigera* Say, and a species of *Sphaerium*. These were all quite plentiful in this place, though he himself had never found either of them in any other locality in this vicinity.

During the past week Mr. A. S. Tiffany made a very interesting collection of shells just above Milan, Rock Island County,

*See Vol. I, page 242.

Ill., near the junction of Rock River and Mill Creek. He found the following species :

<i>Hyalina arborea</i> , Say.	<i>Pupa fallax</i> , Say.
<i>Hyalina minuscula</i> , Binney.	<i>Pupa armifera</i> , Say.
<i>Hyalina lineata</i> , Say.	<i>Pupa contracta</i> , Say.
<i>Helix striatella</i> , Anthony.	<i>Succinea obliqua</i> , Say.
<i>Helix labyrinthica</i> , Say.	<i>Segmentina armigera</i> , Say.
<i>Helix monodon</i> , Rackett.	<i>Planorbis bicarinatus</i> , Say.
<i>Pomatiopsis lapidaria</i> , Say.	

Of these *Helix striatella* and *Pupa armifera* were not inserted by Mr. Pratt in his list of shells found in the vicinity of Davenport (just printed), as he knew of no authentic recent specimens being found, though they were both known to occur as fossils in the loess of the bluffs.

Prof. D. S. Sheldon exhibited a colored drawing of *Thysania zenobia* Cram., made by Mr. C. V. Riley from a specimen which Prof. Sheldon took on the roof of Griswold College in 1867. This large and beautiful moth has never been taken in a region so far north as this before, and is a remarkable instance of a tropical insect being drifted north, probably with one of the severe thunder storms which so frequently visit the Mississippi Valley during early summer. The specimen from which this drawing was made is preserved in the cabinet of Mr. Riley in St. Louis.

Mr. Putnam reported but few insects collected. There was an unusual scarcity of all insects, and particularly of butterflies.

MAY 16TH, 1876.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Five members present.

W. C. Putnam, of the Committee on Organization, reported a series of rules, which, with some amendments, were unanimously adopted, as follows :

Standing Rules of the Historical Section.

1. The name of this Section shall be the HISTORICAL SECTION of the Davenport Academy of Natural Sciences.
2. The object of this Section is the collection and recording for future

reference of all such facts and incidents as relate to the history of this locality in particular, and of all others in general.

3. The officers of the Section shall be a Chairman and a Secretary, who shall hold their offices during the pleasure of the Section.

4. The duty of the Secretary shall be to keep a record of the proceedings; to keep a scrap-book for newspaper cuttings, etc.; to keep an album for photographs, autographs, etc.; to preserve and take charge of all papers, memoirs, and other written communications that may be presented.

5. The regular meetings shall be held on the second Friday of each month.

6. Any person who is a member of the Academy may become a member of the Section upon the written request of two members at a regular meeting of the Section, and election at a subsequent meeting by three-fourths of the members present.

7. Any member failing to attend any of the meetings for three consecutive months shall cease to be a member of the Section, unless such absence is caused by sickness, absence from the city, or some other good reason.

8. There shall be standing committees appointed by the Section on Membership, Local History; Books and Authorities; Numismatics and Philatrics; Geography, Charts, etc.; Statistics, Records and Publications; Museum and Library.

9. These rules may be altered or amended by a two-thirds vote at any regular meeting, notice of such alteration or amendment having been given at a preceding regular meeting.

Mr. J. A. Crandall was elected permanent Chairman, and W. C. Putnam was elected Secretary.

The following committees were appointed:

Local History.—J. A. Crandall.

Numismatics and Philatrics.—J. G. Haupt.

Records and Publications.—W. C. Putnam.

Museum and Library.—W. H. Pratt.

Mr. Crandall stated that he had obtained promises from a number of persons to write up various portions of the local history of Davenport and vicinity.

MAY 19TH, 1876.—GEOLOGICAL AND ARCHEOLOGICAL SECTION.

Dr. E. H. Hazen in the chair.

Seven members present.

The Committee on Rules reported a series of By-Laws, which were adopted subject to the approval of the Board of Trustees.

By-Laws of the Section of Geology and Archæology.

1. This Section shall be known as the SECTION OF GEOLOGY AND ARCHEOLOGY of the Davenport Academy of Natural Sciences.
2. Its object shall be the study of local Geology, and of Geology in general, including Palæontology and Mineralogy, and the study of the history, habits and conditions of pre-historic races, exploration of ancient mounds, and collection of articles for the Academy.
3. Candidates for membership may be elected by a vote of three-fourths of the members present at any regular meeting, having been proposed at a previous regular meeting.
4. Any member who shall be absent from the meetings for six consecutive months, except in case of absence from the city, sickness or other reasonable excuse, shall be dropped from the roll of membership.
5. The officers shall be a President and a Secretary, and shall be elected semi-annually at the regular meetings in July and January.
6. The regular meetings of the Section shall be held on the third Friday in every month.
7. These By-Laws may be amended in the same manner as is provided for amendments of the By-Laws of the Academy.

MAY 26TH, 1876.—REGULAR MEETING.

George H. French, Vice-President, in the chair.

Twelve members present.

The list of donations for May was read, and the thanks of the Academy voted to the donors. A special vote of thanks was offered to Mrs. Mary P. Haines, of Richmond, Ind., for a very valuable contribution.

Mr. Gustav Carstens was elected a regular member.

Mr. J. D. Putnam reported the organization of a "Biological Section," of which three meetings have been held. Mr. J. A. Crandall reported the organization of an "Historical Section," and Dr. E. H. Hazen that of a "Geological and Archæological Section." It is proposed in these Sections to meet frequently for the discussion of appropriate topics, and to gather up all facts relating in any way to the natural and civil history of our own locality.

The Secretary was instructed to procure a bulletin board on which to post notices of meetings, etc.

MAY 27TH, 1876.—BIOLOGICAL SECTION.

J. D. Putnam in the chair.

Eleven members present.

On motion of Dr. C. H. Preston, it was voted to hold the regular meeting of the Section on the first Saturday evening of each month.

A letter was read from Mrs. Mary P. Haines, of Richmond, Indiana, inquiring if any of our members were interested in the study of the mosses, etc. The subject of mosses and lichens, and the books relating to them, were discussed to some extent. Mr. J. G. Haupt was appointed to make further investigations.

Mr. Haupt reported a list of sixty species of plants which had been collected in flower since the last report, April 15th. One of these, a species of *Erysimum*, is new to this locality. An abundance of all the wild plants now in flower was on hand, and a number of those present, under the leadership of Mr. Haupt, organized a class, and spent some time in analyzing plants.

Dr. Preston exhibited some large tadpoles, which he was keeping under observation in a vase during the interesting process of development to the adult batrachian state.

Mr. Putnam brought a living horned toad (*Phrynosoma cornutum*) from Texas, given by Mrs. Col. Mandeville, and a fine living specimen of a tree toad (*Hyla versicolor*, Lec.) from Jacksonville, Ill. Also a specimen of *Samia cecropia*, recently emerged from a cocoon in one of the cabinets of the Academy.

Mr. Putnam reported a continued scarcity of butterflies, probably owing to the severe cold weather of March and April. The following species were observed during the month of May: *Papilio asterias*, *P. troilus*, *Colias philodice*, *Pieris protodice*, *Danaus errippus*, *Pyrameis cardui*, *P. atalanta*, *Lycæna* sp., *Hesperia* sp., *Deilephila lineata*, *Arctia nais*, *Samia cecropia*, and others. A considerable number of beetles, including several not before recorded from this locality, were collected, but have not yet been identified.

A living specimen of a large black spider, a species of *Lycosa*, bearing a large globular cocoon filled with eggs, was shown by

Mr. Pratt. He found it, with others, under an old log on Rock Island.

Mr. Pratt exhibited large numbers of small bivalve crustaceans (related to *Limnæa* and *Estheria*) which he had collected during the past week (since May 20th) in a pool of stagnant water on Rock Island. There seem to be two or more species, differing in size and in other ways. The smaller variety is now much more abundant than at first, thus giving rise to the idea that they may be the young of the larger species, but this is doubtful, for no intermediate stage is noticed. These animals are very lively, and may frequently be seen in pairs, thus showing them to be full grown. Associated with these crustaceans in the same pool are found *Limnæa caperata*, *Planorbis parvus*, etc. The late Mr. A. U. Barler found a single specimen of a larger species several years ago, in the river on the south shore of Rock Island. Prof. Sheldon has had specimens of the dry shells of probably two species in his collection for some years, but did not know what they were.

During the past week Mr. A. S. Tiffany collected two specimens of *Helix perspectiva* Say in a ravine near Rockingham. One of these he has presented to the Academy. This makes the third species added to the fauna of Davenport by Mr. Tiffany since the publication of Mr. Pratt's list.

Mr. Pratt visited the slough back of Rock Island City on May 14th and 21st. Here he collected *Limnæa reflexa* and *Physa heterostropha* in large numbers. This is the best locality for these species he knows of in this vicinity. He also found many specimens of *Planorbis* (*Menetus*) *exacutus*—a species which he had not previously collected, though it was included in the list on Prof. Sheldon's authority. Associated with these were *Planorbis parvus*, *Segmentina armigera*, etc. Also one young specimen of *Vivipara intertexta*, thus showing that this species still inhabits this station though it had not before been collected there since 1870. This morning (May 27th) he again visited the Island (Rock Island), and collected a few land shells—among them several specimens of *Helix clausa*, a species he had not found for several years, and never in any other locality.

Mr. Pratt noticed a peculiarity in the habits of *Bulinus hyp-*

norum. When adhering to stones, sticks, etc., beneath the surface of the water, as is its custom, it will, on being disturbed, rise immediately to the surface.

Living specimens of upwards of fourteen species of land and fresh water shells were on exhibition.

MAY 27TH, 1876.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Six members present.

J. G. Haupt reported a number of additions to the collection of coins. The collection has been neatly arranged on cards.

An interesting discussion was had on the history of the schools of Davenport, and various other topics of local interest. Mr. DeArmond was requested to read a sketch of the famous chief Blackhawk at the next meeting.

JUNE 3D, 1876.—BIOLOGICAL SECTION.

J. D. Putnam in the chair.

Nine members present.

Mr. Pratt made some further remarks on the small bivalve crustaceans noticed at the last meeting, and exhibited a number of drawings he had made. He continues of the opinion that there are certainly two and probably more species, but he has not succeeded in finding any descriptions of them in any books accessible. On May 28th he found a lot of dry and dead shells of a similar, but much larger species, in the slough back of Rock Island City. He has put up a large number of specimens in different media—alcohol, glycerine, turpentine, etc.

Mr. Putnam reported but little of interest in regard to the insects. *Limenitis ursula* and *Euptychia eurytus* were noticed during the past week for the first time this season. A specimen of *Alaus oculatus* was found by Mr. Shaefer. Quite a number of beetles, new to this locality, were collected but have not yet been identified. Among some insects received from Prof. Sheldon are several interesting additions to the list of Coleoptera and Lepidoptera, recently published. Among the former is a fine specimen of *Plectrodera scalator* Fab. The new Lepidoptera

are *Vanessa J-album* and *Ceratocampa regalis*. A specimen of this beautiful moth was raised from a larva found by Willie Allen on his father's farm several years ago. In this specimen the left wings are undeveloped.

Mrs. C. E. Putnam presented a specimen of a small snake about six inches long which had died while engaged in shedding its skin. The shed skin is turned back, inside out, for about one-third of the length of the snake. Every scale, including those of the head, is perfectly preserved. The snake had evidently been killed while thus engaged, and being in a hot, dry place, it is perfectly hard and dry, thus making a much more perfect specimen than could have been obtained artificially. Another living horned toad (*Phrynosoma cornutum*) was received during the week.

Mr. Haupt reported a list of twenty-one species of plants collected in flower to-day, among them three new to the list:—*Ptelea trifoliata* L., *Spiræa opulifolia* L., and *Rhus toxicodendron* L. He also found a single plant of the scarlet painted cup (*Castilleja coccinea*), a species once common here, but not observed for several years.

JUNE 5TH, 1876.—TRUSTEES' MEETING.

W. H. Pratt in the chair.

Five members present.

Mr. Hume presented a new By-Law, Article X, relating to an Endowment Fund, which was duly adopted.*

JUNE 9TH, 1876.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Six members present.

The following donations were reported:

A photograph of Homer Henderson's picture of old Fort Armstrong as it appeared in 1840, from *D. P. McGown, of Rock Island*.

Six City Directories of Davenport, Rock Island and Moline, bearing respectively the dates 1858-59, 1859, 1863, 1866, 1869,

*See Proceedings, Vol. 1, page 243.

1873, and an old almanac of the State of Iowa for 1850, from James M. Dalzell.

The various committees reported progress in their respective departments. Several additional reports had been promised on various branches of Local History.

The Committee on Museum reported that the collection of historical relics had been arranged in a case especially set apart for the purpose.

An interesting discussion ensued upon old Fort Armstrong as it appeared in early days.

JUNE 30TH, 1876.—REGULAR MEETING.

Dr. E. H. Hazen in the chair.

Nine members present.

The chairmen of the different Sections reported progress and considerable work done, especially in the Biological and Historical Sections.

A long list of valuable donations was reported.

Judge Wm. Cook was elected a regular member. The names of a number of persons were presented for corresponding membership.

It was voted that the Academy Rooms be kept open on the 4th of July.

The special thanks of the Academy were tendered to Capt. W. P. Hall for his extensive donation of stone and flint implements; to Hastings, White & Fisher, for pictures donated, and to Mr. Theo. Nissen, of Rock Island, for a valuable collection of pressed plants from the Alps of Europe.

JULY 8TH, 1876.—BIOLOGICAL SECTION.

J. D. Putnam in the chair.

Seven members present.

Mr. Pratt stated that he had visited HORSE ISLAND again yesterday (July 7th), and collected a few shells. *Succinea obliqua* was common. The young of *Helix profunda* were very abundant,—crawling over everything. *Helix multilinea* was quite

plentiful on the lower part of the Island. Mosquitoes were very troublesome. At the time he last visited Rock Island (July 3d), the small shelled crustaceans had almost entirely disappeared. He had gathered a lot of turtle eggs which he was going to try to hatch.

Several weeks ago August Stuhr brought to the Academy an immense bull frog (*Rana Catesbiana*, Schaw.) measuring when stretched out, fourteen inches from the head to the tip of the feet. To-day he presented a specimen of fishing duck (*Mergus Merganser*).

A cigar-box containing four horned toads, alive and in good condition, was received by mail a few days ago, having been sent from San Bernardino, Cal., by Mrs. Dr. C. C. Parry. They are of the species *Phrynosoma coronatum* Blain.

Mr. Putnam stated that he had lately examined the specimens of *Phrynosoma* contained in the collection. They can all probably be referred to the following three species:

Phrynosoma coronatum Blain. Four living specimens in different stages of growth, recently received from Mrs. Parry, San Bernardino, Cal. This is by far the most handsome species of the genus we have seen.

Phrynosoma cornutum Gray. Two living specimens lately received from Texas (from Mrs. Col. Mandeville and Mr. Martin), and one specimen in alcohol.

Phrynosoma douglasii Gray. This species seems very generally distributed on the high table lands of the Rocky Mountains. I have observed it in greater or less abundance in different parts of Colorado, Wyoming and Utah, though it seems more plentiful in the sage brush regions, and was not noticed in the mountains. In the collection of the Academy there is a fine series of this species in all stages of growth, collected at Spring Lake Villa, Utah, last summer. There are also a number of specimens from Denver and Valmont, Col., and from the neighborhood of South Pass, Wyoming.

Mr. J. G. Haupt reported that he had made collections of plants lately along the river bank to Gilbert, and for some distance up Duck Creek; in various localities to the west of the city; and to a distance of four miles south of Rock Island. He found a rare cliff-brake (*Pellaea atropurpurea*) on rocks along the river. *Cystopteris fragilis* is another new species collected in the same locality. Pond lilies (*Nuphar advena*) were found

growing in Duck Creek. In and about Chippiannock Cemetery, south of Rock Island, he found great numbers of ferns, among them several rare species. In company with J. D. Putnam he had made a trip to Walcott on June 10th, and collected several new plants, but was not prepared to report to-night.

Mr. J. D. Putnam reported a considerable number of insects collected during the month, among them several not before recorded from this locality. A very pretty myriapod with remarkably long legs and appendages (*Cermatia foreeps* Raff.) has been several times brought in, but it does not appear to be common. The large, uncouth insect, known as the helligramite fly (*Corydalus cornutus* Linn) seems to be particularly abundant this year, and a large number of specimens have been brought to the rooms by various persons. A small collection of insects was made at Walcott, Iowa, June 10th, while on a visit there in company with Mr. Haupt and Dr. Byrnes. Besides the insects a few small fishes, tadpoles, a crawfish, and a number of specimens of *Succinea avara*. These latter were attached to the decaying stems of weeds and rushes partly immersed in the water. A single dead shell of *Planorbis trivolvis* was noticed in the same slough. Butterflies continue to be remarkably scarce this year, and during the entire trip to Walcott and back—twenty miles—scarcely a dozen were seen.

Mr. J. D. Putnam also made the following remarks :

On the Young of a Species of *Lycosa*.

At the meeting of this Section, May 27th, Mr. Pratt brought in a tin baking powder box containing a number of living land snails, and also a large, dark-colored spider of the genus *Lycosa*, which was carrying about a large cocoon filled with eggs. The cocoon was fully five-eighths of an inch in diameter, and was attached to the abdomen by the spinnerets. He found it that morning, in company with others, while looking for shells under a log on Rock Island. I took the box home, but did not look into it again until about June 15th. The eggs had then all hatched, and the young spiders had crawled upon the back of the mother, and made her appear two or three times as large as natural. It remained in this condition for upwards of a week. I did not disturb the box again until June 22d, when it was noticed that a considerable number of the young spiders had crawled out of a small hole in the top of the can, and had begun to spin webs from the top of the can to the table on which it stood. The spiders were somewhat larger than when I first saw them,

but not a great deal. When the box was opened a few days later, everything in the shape of a spider had disappeared. Can it be that the mother spider was eaten by her own progeny?

JULY 21ST, 1876.—GEOLOGICAL AND ARCHÆOLOGICAL SECTION.

Prof. W. H. Barris in the chair.

Four members present.

The Section proceeded to elect permanent officers, resulting in the choice of Prof. W. H. Barris as President, and W. H. Pratt as Secretary.

Messrs. Barris and Pratt reported the collection of a considerable variety of fossils from the quarries in the neighborhood, and proposed to continue the research, and report at a future meeting.

Clarence Lindley stated that he had recently been on an exploring trip to Pine Creek and Toolesboro, during which he had examined several mounds, and would prepare a report for the Academy.

JULY 28TH, 1876.—TRUSTEES' MEETING.

George H. French, Vice-President, in the chair.

Six members present.

But five members having been present at the last meeting of the Trustees, the actions of that meeting were ratified.

The following communication was read:

To the Honorable Board of Trustees of the Davenport Academy of Natural Sciences:

The undersigned proposes to and does hereby donate to the Academy the collection of fossil and mineralogical specimens now on deposit in the Academy rooms, and numbered from five thousand and one (5001) to six thousand three hundred and fifty (6350) inclusive, if accepted by the Trustees with the following conditions, and the acceptance endorsed hereon, and this paper recorded in the minutes.

Condition 1st. In case of the dissolution of the Academy or its being merged in any other institution, or in any other way losing its separate and independent existence, this collection shall revert to the donor or his heirs; and

Second. This collection shall not be disposed of or parted with by the Academy, except that duplicate specimens may be used in exchanges;

provided, that the specimens received in exchange therefor shall be numbered the same as the specimens given, and be subject to the same conditions.

Respectfully,

Davenport, July 28th, 1876.

W. H. PRATT.

On motion of Dr. Preston the donation was accepted with the conditions proposed, and with the thanks of the Academy.

JULY 28TH, 1876.—REGULAR MEETING.

Rev. W. H. Barris, President, in the chair.

Thirteen members present.

Mr. J. D. Putnam reported on behalf of the Publication Committee that the printers were now at work on the last sheet of the first volume of Proceedings, which, it was expected, would soon be ready for distribution.

A number of donations were reported and a vote of thanks extended to the donors.

A communication was read from James Terry, of Terryville, Conn., recently returned from San Bernardino, Cal., requesting again to exchange for copper relics.

Mrs. Walker Adams was elected a regular member, and the following persons were elected corresponding members: Dr. Geo. Engelmann, St. Louis, Mo.; Henry Ulke, Washington, D. C.; Herman Strecker, Reading, Pa.; E. T. Cresson, Philadelphia, Pa.; Dr. H. A. Hagen, Cambridge, Mass.; F. W. Putnam, Salem, Mass.; S. H. Peabody, E. W. Blatchford, Dr. J. W. Velie, Dr. H. A. Johnson, Chicago, Ills.; Henry Edwards, R. H. Stretch, Dr. Herman Behr, Dr. A. Kellogg, W. G. W. Harford, San Francisco, Cal.; Dr. Cyrus Thomas, Carbondale, Ills.; Jos. L. Barfoot, Salt Lake City, Utah; G. C. Broadhead, State Geologist of Missouri; Dr. James Lewis, Mohawk, N. Y.; John Wolf, Canton, Ills.

AUGUST 7TH, 1876.—BIOLOGICAL SECTION.

To-day a number of the members of the Section joined the members of the County Teachers' Institute in an excursion and picnic to OFFERMANN'S OR CREDIT ISLAND. Eight members of the Section were present, besides about fifty persons not members.

The party assembled at the foot of Brady Street, and about nine o'clock A. M. started down the river on board of Mr. Offermann's horse power boat, "River Horse." After a pleasant trip of an hour, the party was landed near the head of CREDIT ISLAND, about three miles below town. The weather was delightful, and the place beautifully adapted for a picnic. Everyone seemed to thoroughly enjoy the day, and it was seven o'clock P. M. when the boat started on the return trip.

A large number of cattle are now pastured on the Island, so that the collecting is not as good as formerly. A considerable number of interesting insects were picked up, embracing about a dozen species of beetles not before known from this locality. A single immature mole cricket (*Gryllotalpa borealis*) was found under a stick of wood in a moist place. We know of but one other specimen, which Prof. Sheldon found near French & Davies' saw mill several years ago. The only shells collected were some immature specimens of *Physa heterostropha* and a few young *Helices*. A few years ago there was an abundance of *Helix multilineata* on this Island, but the presence of cattle has rendered them scarce. A large number of frogs (*Rana halecina* Kalm.) were noticed high up on dry land. No plants of any special interest were noted.

AUGUST 25TH, 1876.—REGULAR MEETING.

Dr. M. B. Cochran in the chair.

Thirteen members present. Baron C. R. Osten Sacken was present as a visitor.

The list of donations for August was read, and the thanks of the Academy extended to the donors.

Mr. W. R. Smith was duly elected a regular member. Permission was granted to Dr. R. J. Farquharson to take from the Museum articles of interest to be exhibited at the International Archæological Convention, meeting at Philadelphia, September 4th.

Mr. Pratt gave an account of a recent trip to Peoria, and the collection near that place of some 600 specimens of a fresh water shell (*Vivipera lineata*), not found in this vicinity; also

specimens of building stone and potter's clay. He had transplanted some of the living shells into Sylvan Water.

Mr. J. D. Putnam reported that the first volume of the Proceedings was now in the hands of the binders, and would soon be ready for distribution. He also made some remarks on the recent visit to the Academy (August 15) of Dr. Geo. J. Engelmann, of St. Louis, who is much interested in archæological researches respecting the so-called mound builders.

Baron Osten Sacken, upon solicitation, made a few brief but interesting remarks upon the Swiss Lake Dwellings near Zurich, which he visited while the excavations were being made.

SEPTEMBER 28TH, 1876.—REGULAR MEETING.

Rev. W. H. Barris, President, in the chair.

Thirteen members present.

A large number of donations and exchanges were reported.

George W. Parker was elected a regular member and Baron C. R. Osten Sacken a corresponding member.

The Corresponding Secretary of the Academy having been absent for some months, Mr. J. D. Putnam was appointed to fill the office *pro tem.*, with W. H. Pratt to act in his absence.

The publication of the first volume of Proceedings has been completed, and 180 copies have been distributed to societies, besides a number sold.

OCTOBER 14TH, 1876.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Six members present.

The following communication was read :

DAVENPORT, October 11, 1876.

Dr. Preston, Secretary of the Academy of Natural Sciences :

DEAR SIR:—The Publishing Committee of the "Ladies Centennial Society" have been directed by said Society to inform you that the work entitled "Proceedings of the Davenport Academy of Natural Sciences," and published by them, is now completed, and placed at the disposal of the Academy.

Respectfully yours,

MRS. THOMAS McCULLOUGH,
Secretary pro tem.

On motion of Dr. Preston the publication was accepted from the hands of the Centennial Society, with earnest thanks for their generous labor in accomplishing the work.

The purchase of an additional case for botanical specimens was authorized.

A proposition from Prof. W. D. Gunning, of Boston, to deliver a course of six scientific lectures before the Academy was accepted.

OCTOBER 27TH, 1876.—REGULAR MEETING.

Rev. W. H. Barris, President, in the chair.

Thirteen members present.

The Corresponding Secretary reported numerous communications—none requiring action.

A large number of donations and exchanges were reported.

J. H. Southwell, of Port Byron, and Jay Goldsbury, of this city, were elected regular members.

Mrs. M. A. McGonegal, Corresponding Secretary, being about to remove from the city, offered her resignation which was accepted.

Messrs. Hume, Pratt and Preston were appointed a committee on Prof. Gunning's lectures.

Dr. Parry read some interesting letters from a correspondent in Utah, Miss Julia J. Wirt, describing the recent

Exploration of a Mound near Utah Lake, Utah.

The mound, which is situated on the farm of Mr. Amasa Potter, near Payson, was about fifty feet long and twelve feet deep. At about the general level, or five feet below the surface of the mound, was found a skeleton, six feet seven inches in length, with its head toward the center, and a stone pipe weighing five ounces between its teeth. Disposed about it were numerous articles of pottery, some of them beautifully ornamented with pictures of flowers and different animals. There were also a number of smaller human bones near the skeleton not nearly so well preserved. In a later and more thorough investigation, an air-tight stone box, encased in mortar or potter's clay, and containing another stone box of about two quarts capacity, was found at the head of where the skeleton had lain. The second box contained on opening about a quart of light, mouldy wheat, a few of the best grains of which were

planted and grew, producing ears somewhat similar to Chilian club wheat. The presence of wheat argues against the very great antiquity of the mound, since, according to Humboldt and others, wheat was first introduced into this country about 300 years ago.

There are six other mounds near the one opened, all encircled and connected by graveled walks. Two of them are circular; the others elongated. They are composed of earth similar to the adjacent alluvial soil, which is interspersed with gravel. Some of the local Indians (Utes) attribute these mounds to the Navajoes; others to the whites. Besides the articles already mentioned, there have been found charred corn with a small indented kernel, sun-flower seeds, pieces of red cedar, grinding stones, mineral paint, and amongst numerous pieces of pottery, one having painted upon it a quite recognizable sketch of a range of mountains visible from the locality of the mounds.

Unfortunately the greater part of the articles exhumed have been scattered beyond recovery, but it is hoped other mounds of the group may be equally instructive and rich in relics.

[The discovery of wheat above mentioned has been found to be a fraud. The wheat was taken from a mouse nest. See Proceedings, Jan. 26th, 1877.]

Dr. Parry then read the following:

Notice of the late I. A. Lapham, LL. D.,

Corresponding Member of the Davenport Academy of Natural Sciences.

BY DR. C. C. PARRY.

A little more than a year ago, viz: September 14th, 1875, Dr. I. A. Lapham was found dead in a small fishing boat on Lake Oconomowoc, Wisconsin, where, after concluding some scientific work in reference to the adaptability of that charming lake district for the propagation of fish, he had taken a solitary row for recreation. As a corresponding member of this Academy, and a worthy representative of scientific progress in the Western country, it would seem proper that some special notice in reference to the subject should appear on our records. Having been for many years in frequent friendly correspondence with Mr. Lapham and enjoying his personal friendship, I therefore submit the following, which may be regarded as a tribute from the Academy. More full details may be gathered from a complete biographical sketch, published by his intimate personal friend, S. S. Sherman, of Milwaukee.

Mr. Lapham was a genuine western man. Early identified, since 1836, with the growth and progress of Wisconsin, and especially its chief town, Milwaukee. He carefully, from the first, preserved all historical records, including regular series of newspapers, and was the author of several of the earliest works on Wisconsin, including maps and popular descriptions of the country. He was actively connected, as surveyor and engineer, with some of the earlier projects of inland navigation, including a canal to connect the head waters of Rock River with Lake Michigan. He took

an early and deep interest in the study and examination of the pre-historic mounds of his district, and was among the first to detect and publish the fact that many of the mounds represented in outline various animal figures. A full account of these, with actual measurements and figures, was published in early numbers of the Smithsonian Contributions. Among his other active labors as a surveyor, he made some of the earliest collections of plants in Wisconsin, and also published at different times in Agricultural Reports, lists of the native grasses of Wisconsin and Northern Illinois.

Mr. Lapham was always foremost in every enterprise to cultivate a taste for scientific investigations, was one of the original founders of the Wisconsin Historical Society, and later of the Wisconsin Academy of Science. He assisted largely in carrying on the Geological Survey of the State, at one time holding the position of Chief Geologist. He kept a continuous meteorological record at Milwaukee during the whole period of his residence, and was the first to suggest in practical form the organization of the Signal Service Bureau. In his later years he was especially interested in fish propagation, and with a view to master its details, he moved to Oconomowoc, living on the borders of that beautiful lake.

In his scientific character, Mr. Lapham was laborious, patient, conscientious and unpretentious; he was ever regardful of the claims of his associates, and always free to communicate information. He was also naturally deeply interested in educational progress. Some of his latest views on botanical classification seem worthy more attention than they have yet received.

Socially, Mr. Lapham was genial, affable and unostentatiously hospitable. His retired house in Milwaukee was specially attractive in a very select library and carefully arranged museum, to which was added the charm of a most intelligent and refined family.

Mr. Lapham is botanically commemorated in a well-marked genus, of southwestern plants, *Laphamia*, dedicated to him several years ago by his life-long friend, Prof. Asa Gray. This genus now comprises several well-marked species, of which the *Laphamia Stansburii* (here exhibited) was first discovered in Stansbury's exploration of Salt Lake, and then named and figured by Dr. Torrey as *Monothrix Stansburii*.

The loss of Mr. Lapham at the present time, when special interest is being directed to investigations in which he was a pioneer and earnest laborer, is a matter of sincere regret.

NOVEMBER 23D, 1876.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Seven members present.

Mr. Pratt stated that a fine golden eagle, presented to the Academy, had been stuffed and mounted at an expense of \$10, which

sum was now due the taxidermist. On motion it was voted to pay the bill as soon as the funds in the treasury would allow.

The committee having Prof. Gunning's lectures in charge, reported a very satisfactory course of six lectures delivered, three in the Unitarian, and one each in the Congregational, Methodist and Christian churches. The receipts were \$125.50, and expenses \$129.20, including a bill for advertising in the *Gazette*, not yet paid.

Dr. Parry was appointed a committee to make some definite arrangements with the newspapers of the city for notices and reports of lectures, etc.

The thanks of the Academy were voted to the editors of the *Democrat* for generous gratuitous advertising.

NOVEMBER 23D, 1876.—REGULAR MEETING.

Dr. C. C. Parry in the chair.

Eleven members present.

A large list of donations received during November was read, and the thanks of the Academy returned to the donors.

An extensive correspondence regarding the publication of Proceedings, etc., was reported.

Mr. J. D. Putnam was unanimously elected to the office of Corresponding Secretary, made vacant by the resignation of Mrs. M. A. McGonegal.

Israel Hall, of Davenport, was elected a regular member, and Miss Julia J. Wirt, of Payson, Utah, and Mr. J. C. Arthur, of Charles City, Iowa, were elected corresponding members. Five names were proposed for membership.

The following resolution was offered by Dr. C. C. Parry:

Resolved, That a committee of three be appointed to take into consideration the feasibility of establishing a monthly publication in the interest of this Academy, to contain its regular proceedings, and also such other matter of local or scientific interest especially pertaining to this western region as may commend it to the patronage of the community at large; with estimated cost of the same, and probable sources of revenue, and to report at the next regular meeting.

The resolution was adopted, and Messrs. Parry, J. D. Putnam and Preston were appointed on the committee.

The Secretary stated that he had been unable to procure the publication of Dr. Parry's memorial of Dr. Lapham, the event not being sufficiently recent.

The following paper was then read, and referred to the Publication Committee.

Manufacture of Pottery by Mojave Indian Women.

BY DR. EDWARD PALMER.

At the landing of Europeans on the American continent, they found the native Indians in possession of pottery, the excellence of which was praised by the strangers. The manufacture of pottery seems to have been carried on all over the American continent, that of Chili and Peru being of superior quality to that of any other section. The pottery gradually assumes an inferior quality northward, and becomes especially so in the northern and eastern mounds.

There seems to be two divisions of the American Indians, the Toltecs and Aztecs, both of whom are found to be makers of pottery, but of very different qualities. The Toltecs are makers of the superior pottery, and are represented by the Pimo Indians of Arizona, the Moqui and Rio Grande Indians of New Mexico. This division is distinguished from the other, not only by their pottery, but also by their superior dwellings and the manner of disposing of the dead, by burying instead of burning, as is practised by the Aztecs. The pottery of the Aztecs is very inferior to that of the Toltecs in quality, decoration and glazing; in fact, it is of a rudeness that would almost warrant the conclusion that they had borrowed the art from their neighbors, and had just completed their first lesson—that of making a plain, rough pot.

Both these divisions of Indians existed at the discovery of America. The women have always been superior to the men in their knowledge and successful prosecution of the domestic arts and manufactures, and have always been the sole pottery makers. If a man or his children depended upon *him* to make a pot to cook or eat from, they would starve before they would have one. As the female artists of both divisions use the same means of constructing pottery, it may be interesting to many to know how pottery is made by the native women of our continent.

Last summer I visited the Mojave Indian reservation on the Colorado River, Arizona, for the purpose of making a collection of their native foods, manufactures, etc. Wishing a set of dishes of their make, I engaged the services of a native woman. She was instructed to bring whatever was necessary to make the pottery to the agency so that I could see the process.

The next day she appeared, as desired, accompanied by an assistant.

They were somewhat aged, approaching to four score years, and possessed of many wrinkles. Their hair was cut off straight in front, just above the eyes, the remainder reaching down to the shoulders, where it too was evenly trimmed all round. On the head was a round, rather conical hat, made of split twigs, and water tight. Around the waist was suspended the only article of dress, a skirt reaching to the knees, made of strips of willow bark, intermingled with strips of old blankets, pants, and various colored calicos obtained from the whites. This mixture of various colored strips was fastened to a belt of the same materials. The jewelry, worn by one consisted of a number of white pearl buttons, strung and hung around her neck. The other wore a string of small sea shells with a larger one in the center. Thus attired they were ready for work.

One of the women laid down a quantity of clay, some paint, several round flat stones of different sizes, and two wooden paddles. The other took her hat from her head, went to the well and filled it with water. They both squatted down on the bare ground, and commenced by sprinkling water from the hat on the clay, using their hands to work the clay to a consistency like that used in manufacturing bricks. After being told the kinds and sizes of pots required, each selected one of the round flat stones upon which to form the bottom of the contemplated pot, using the stones according to the size of the article to be made. Pieces of clay were taken and laid upon the stones. A wooden paddle was used by the right hand to form the mud on the stones into the bottom of the future pot. The ground near by was smoothed off, and these bottoms carefully placed on it. The next thing was to build upon these bottoms. As much clay was taken as was considered necessary, and rolled out in the hand until it was of the same thickness, and long enough to go round the bottom. This was then applied to the bottom and pinched together by the thumb and fingers of the right hand as white ladies do pie crust. The flat stone was now removed from the bottom, and held in the left hand on the inside of the embryo pot, close against the attachment of the addition to the bottom, while the paddle in the right hand patted the outside, nearly obliterating all traces of the joint, while the stone served the same purpose to the inside.

As piece by piece the pots were built up, and the seams nearly obliterated by the stone and paddle, the hands were dipped in water and rubbed over the vessels, inside and out, until a smooth and even surface was produced, thus making the union perfect, and hiding all appearance of the pots having been built up. When the pots had been completed to the desired height, the rim was formed by holding the round stone under the last piece built on, and gently tapping as the stone was moved around the edge. If it was to be ornamented by indentations, a stick was suitably pointed, and the designs executed therewith. In the course of a few hours seven pieces of pottery of various sizes, and designed for different purposes, all even in thickness and smoothness of surface, were produced. The great difficulty was in regulating the quantity of clay for each addi-

tion, as the circumference increased or diminished, but they successfully accomplished the task, so that they are justly entitled to the reputation of skilled workers in clay.

All the pottery completed, a smooth piece of ground was selected, exposed to the direct rays of the sun, to which the vessels were removed to dry. As the drying proceeded any crack that appeared was filled up by dipping the fingers in thick, muddy water. The pottery was repeatedly turned so as to dry evenly. All defects that showed themselves were corrected before the burning. Some of the vessels were to be ornamented with paint. This was done during the process of drying, so that it might dry evenly with the clay. The artist mixed her paint with water on a flat stone, and made a brush by twisting a piece of cloth from one of the strips of her skirt. The decorations were now applied, consisting of parallel lines and dots, neatly and regularly made. The painting and drying completed, the next thing was the burning.

A quantity of wood of even sizes was selected, and laid in two piles and ignited. They arranged the pottery tops downward, so that fire could be put all around and on the tops, causing the heat to be uniform all over. A sharp watch was kept over the burning, so that an even degree of heat was applied to all parts of the same vessel at the same time. The potters repeatedly examined the vessels by removing the fire with long sticks in order to see that an even burning was being effected. As soon as the pottery was sufficiently burned, the fire was removed and the pots allowed to remain and cool. Vessels made for cooking and for holding water were not glazed, but those to be used for other purposes were. The glazing was done by rubbing salt water over the vessels while warm, and reburning them to set the glazing.

These artists, though homely and plainly clad and besmeared with dirt, had performed their work well. Judging them by their works, it must be acknowledged they had done as well as most men and women of the paler and better-to-do race could have done with like materials. Dire necessity and compulsion would be necessary to compel most of us to attempt the task. Considering the beauty of the pottery, its symmetry of form, quality of workmanship, the rude tools, the kind of materials used, and also that necessity had been their only teacher, these female artists, though Indians, had, by their works, proven themselves heroines in domestic art, challenging competition by either sex of Americans under like conditions. Credit must be given to the female for her good works, let her be of whatsoever race or color.

DECEMBER 2D, 1876.—BIOLOGICAL SECTION.

J. D. Putnam in the chair.

Six members present.

In answer to a question from Dr. Parry, Mr. Haupt stated that he had found *Sarracenia purpurea* L. growing in a bog on

the Iowa shore of the river, somewhere between Dubuque and Davenport, while on his way down the river in 1871. He thought it was in Scott county, but could not be positive. It was decided that this species should be dropped from the list until better evidence is secured. A variety of other plants were discussed.

Mr. W. H. Pratt exhibited a glass of cistern water containing a number of very small and active crustaceans, a species of *Cyclops*. Several of these were placed under a microscope and examined with interest by the members present. Mr. Putnam stated that he had frequently noticed these crustaceans in the well water at his residence in the west part of town. Their presence in the water should be regarded as rather a favorable sign. They probably act as scavengers in destroying organic matter that might otherwise be injurious.

Mr. J. D. Putnam exhibited several specimens of a curious spider-like animal, belonging to the *Solpugida*, a family of Arachnids allied to the scorpions, and made the following remarks on

Galeodes pallipes, Say.

The specimens here exhibited, five in number, were collected at different times in 1872 and 1874, under stones and dried dung in dry places, near Denver, Valmont or Cañon City, Colorado. They were always found single and alone. As near as I can recollect I have never noticed any other living thing under the same stone with them. They appear to be quite pugnacious, but their habits were not as carefully observed as they should have been.

This species was first collected over fifty years ago by the celebrated naturalist of Philadelphia, Thomas Say, at the base of the Rocky Mountains, not far from the site of the present city of Denver, and was described by him in a foot-note in the Report of Long's Expedition to the Rocky Mountains in 1819-20, under the name of *Galeodes pallipes*. In the same place Mr. Say describes another species—*G. subulata*. Of this latter species but one specimen is known to have been since collected—by Capt. Marey on his expedition to Red River in 1852, and is redescribed by Girard in the report of that expedition. This specimen is still preserved in the museum of the Academy of Natural Sciences in Philadelphia, and although only hastily examined I am satisfied it is quite distinct from my Colorado specimens. Dr. Packard in his Guide to the Study of Insects mentions that *Solpuga* (*Galeodes*) *Americana* Say, occurs in the Southern States, but no authority is given, nor can I find any other reference to such a species. At the meeting of the Philadelphia Academy of Natural Sciences Nov. 7th, 1876, Prof. Cope exhibited

a specimen of *Galeodes* (probably *G. pallipes* Say) from Denver, Colorado, with some remarks on its habits. This is the only other record of the occurrence of this species I have been able to find.

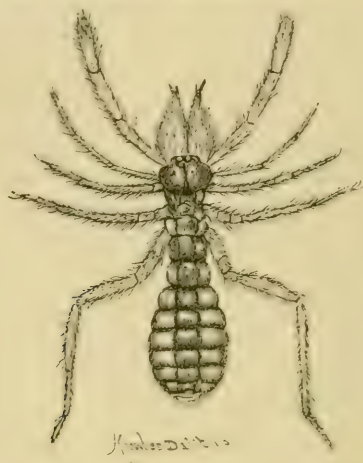


FIG. 1. GALEODES PALLIPES, Say
[Twice natural size.]

Mr. Butler, of the British Museum, has published in the Transactions of the Entomological Society of London for 1873, a "List of the species of *Galeodides*," in which fifty-two species are enumerated, under five genera, but not a species from the United States. Of the eighteen species of *Galeodes* proper not one is from the American continent, but it is not improbable that our species may prove to belong to the genus *Gluvia*, of which several species are recorded from Mexico and the West Indies. Say's descriptions have been entirely overlooked.

It is probable that, besides these two, there are three or four other species found in this country, as specimens seen from Florida, California, and Arizona, in the Museum of Comparative Zoology at Cambridge, and in that of the Boston Society of Natural History would seem to indicate. I hope sometime to give a more detailed account of this interesting group of animals.

[Since making the above remarks, I have had an opportunity of examining other specimens of both species, contained in the collection of the Philadelphia Academy of Natural Sciences and have received from Rev. H. C. McCook, a specimen of *G. subulata*, collected by Capt. Burt, in Wyoming. Although bearing some superficial resemblance to each other, these two species must probably be referred to different genera — *G. pallipes* being a true *Galeodes*, and *G. subulata* probably a species of *Gluvia*. A more detailed description, with illustrations, is in preparation for publication in these Proceedings. The accompanying woodcut of *Galeodes pallipes* Say, (enlarged to twice the natural size,) will serve to give an idea of the general appearance of these peculiar animals. *J. D. P.*, March 15th, 1877.]

It was decided to hold the meetings of the Section every Saturday afternoon during the winter, whenever practicable.

DECEMBER 4TH, 1876.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Six members present.

It was decided to exhibit a selection from the collection of the Academy, including the cloth covered copper axes, at the Turners' Fair, to be held December 8th, 9th, and 10th. Messrs. Hume, Riepe, and Farquharson were appointed a committee to make the selection and attend to the exhibition.

DECEMBER 23D, 1876.—BIOLOGICAL SECTION.

Met in Dr. Parry's Herbarium.

J. D. Putnam in the chair.

Three members present.

Dr. Parry exhibited a collection of walnuts from various parts of the country—*Juglans cinerea* L, our common white walnut or butternut, *J. nigra* L, the black walnut, *J. regia* L, the smooth shelled English walnut, *J. californica* Watson, from the Pacific coast, and *J. rupestris* Engl., from Texas. Some time was spent in examining early botanical publications.

DECEMBER 29TH, 1876.—TRUSTEES' MEETING.

G. H. French, Vice-President, in the chair.

Eight members present.

Dr. Parry stated that the editors of the *Gazette* and *Democrat* both expressed a friendly feeling toward the Academy, and their willingness to publish notices of the meetings gratuitously, and to advertise paying lectures, etc., at a fair reduction from regular rates: also desiring to be furnished with condensed reports of proceedings for prompt publication.

Mr. J. D. Putnam reported, on behalf of the Publication Committee, that the first volume of Proceedings had been completed and paid for, with a small balance on hand in the publication fund. Nine hundred and ninety complete copies were received from the printers, besides a number of copies lacking some of the plates. Of these 250 copies had been delivered to subscribers and sold, and 456 copies distributed to scientific

societies, editors and others, leaving 288 copies on hand. On motion the action of the committee was approved.

Drs. Preston, Parry and Cochran were appointed a committee to draft resolutions in acknowledgement of the generous action of the ladies of the Centennial and Bric-a-Brac societies on behalf of the publication.

DECEMBER 29TH, 1876.—REGULAR MEETING.

G. H. French, Vice-President, in the chair.

Thirteen members present.

The Corresponding Secretary reported a large correspondence in regard to the Proceedings, etc. A communication from Prof. Richards proposing to deliver a course of lectures upon chemistry was referred to a special committee, consisting of Messrs. Parry, Hume and Pratt.

The list of donations for December was read, and the thanks of the Academy returned to the donors.

Dr. Edward Palmer, Cambridge, Mass.; Dr. L. N. Dimmock, Santa Barbara, Cal.; J. G. Lemmon, Sierra Valley, Cal.; W. G. Wright, San Bernardino, Cal.; and Dr. J. D. B. Stillman, of San Francisco, Cal., were elected corresponding members of the Academy.

A fine specimen of stone carving by the Hydah Indians, of Queen Charlotte's Island, was exhibited by Dr. C. C. Parry, with brief explanatory remarks. The following paper was then read:

SHELL MONEY and Other Primitive Currencies.

BY W. H. PRATT.

Having recently received, among other articles collected from mounds in Calhoun County, Ills., by Capt. W. P. Hall, a quantity of small univalve shells, all of which have been uniformly ground off in a peculiar manner, and different from any specimens that we have seen or heard of before, and which have evidently been buried a long time, it becomes a matter of considerable interest to determine, if possible, for what purpose or use they were intended. (Fig. 2.)

They are from half an inch, or somewhat less, to three-quarters of an inch in diameter, with very low spire, and were supposed to be of some marine species, though we were unable to find any to which they could be referred. Within a few days, however, I have identified the species

without a doubt to be a *variety* of *Anculosa prerosa*, one of several species I have received from the rivers of Alabama and East Tennessee. I have ground down one of these shells to correspond with the ancient specimens, and it does correspond perfectly.



It is easy to see that they must have had something else than their beauty to recommend them, and they are exceedingly undesirable as ornaments. In the same rivers are found many far handsomer shells, and certainly none less so than these. Upon examination it is quite evident that they were not beautified by polishing. The shell in its natural condition is too thin to admit of that. Of course it is not improbable that several species of the same genus, or of closely allied genera, may have been used in this way, but they are all thin, and the differences among the specimens we



FIG. 2.—Natural Size.

have (some 200 in number) are so small as to render it highly probable that these, at least, are all of the same species. Many of them are considerably decayed and broken, yet they generally retain the principal portion of the shell not much injured.

What were they for ?

PRIMITIVE CURRENCIES.

As soon as a people become sufficiently advanced to adopt a system, however crude, of "division of labor," each doing chiefly that for which he has a particular taste or capacity, and exchanging his commodities for those which he cannot so easily produce with his own hands, the inconvenience of the direct exchange and transfer of articles in bulk will become apparent to them, and as a matter of fact, it has been found that they soon, even while in a very barbarous condition, will adopt some article of more or less, or even of *no intrinsic value*, as a *representative* of value, which article, or perhaps several of them of different kinds, they will, by common consent, give and receive in exchange for articles of comfort or necessity.

A great variety of very dissimilar things have been made to serve the purposes of a currency among the different nations and tribes of the world. In the East India Islands and many parts of Africa, the small "cowry"—as it is commonly called, the *Cypræa moneta* (the specific name "moneta" relates to this fact)—which is abundant in the waters of that region, is extensively used, and doubtless has been for ages, as a circulating medium. Baird's Dictionary of Natural History states that many tons of these shells are imported into Great Britain, and exported for barter with the native tribes of Western Africa. It is said that as many as sixty tons were brought in 1848, and nearly 300 tons in 1849 to Liverpool alone. They are called "Guinea money" (referring to the African coast where they are used), and are, or have been used in the slave trade.

According to Chamber's Encyclopædia, "In Central Africa purchases are made and debts paid by strings of beads or coils of brass wire."

Jóhnson's Cyclopædia says :

"Anything which has value may be used as money. Tin was thus employed in ancient Syracuse and Britain, iron in Sparta, cattle in Rome and Germany, a preparation of leather among the Carthaginians, platinum in Russia, lead in Burmah, nails in Scotland, pieces of silks among the Chinese, cubes of pressed tea in Tartary, salt in Abyssinia, cowry shells on the coast of Africa, slaves among the Anglo-Saxons [a bad pre-eminence for the Anglo-Saxons, surely], tobacco in Virginia, codfish in Newfoundland, bullets and wampum in the early history of Massachusetts, logwood in Campeachy, sugar in the West Indies, soap in Mexico, etc."

He says "anything that has value," but here are named the cowry shell, wampum, etc., which have no intrinsic value, unless their possible use as ornaments might be so considered, and even that would hardly apply to the cowry, which is probably seldom used as an ornament.

Prof. Jevons says, in the volume entitled "Money and the Mechanism of Exchange," of the International Series, "In India the current rate of these cowry shells used to be about 5,000 shells for one rupee, at which rate each shell is worth about 1-200 of a penny;" and he says, "among the Fijians *whale's teeth* served in the place of cowries, and white teeth were exchanged for red teeth somewhat in the ratio of shillings to sovereigns." Among other articles of ornament or of special value as currency, he mentions yellow amber, engraved stones, such as the Egyptian scarabæi, and tusks of ivory. He further says that while various manufactured commodities, such as, for example, pieces of cotton cloth, might very naturally be used as a currency, as was the case in several countries, such cloth having an actual value, it is not so easy to understand the origin of the curious straw money which circulated until 1694 in Portugal, and which consisted of small mats, called libongos, woven out of rice straw, and worth about 1½ pence each. These mats must originally, he thinks, have had some use apart from that as a currency.

He speaks also of the not improbable suggestion of Boucher de Perthes, one of the early explorers and collectors of flint implements in the gravel beds of the Valley of the Somme in Switzerland, that, "perhaps, after all, the finely worked stone implements now so frequently discovered, were among the earliest mediums of exchange. Some of them are certainly made of jade, nephrite, or other hard stones, only found in distant countries, so that an active traffic in such implements must have existed in times of which we have no records whatever."

Prof. Jevons also refers to "some obscure allusions in classical authors to a wooden money circulating among the Byzantines, and to a wooden talent used at Antioch and Alexandria," but says that, "in the absence of fuller information as to their nature, it is impossible to do more than mention them."

In the American Encyclopædia I read that "of the aboriginal money of the American continent, from the mounds in and adjacent to the Valley of the Mississippi, specimens have been obtained, composed of lignite, coal, bone, shell, terra-cotta, mica, pearl, carnelian, chalcedony,

agate, jasper, native gold, silver, copper, lead and iron, which were fashioned into forms evincing a skill and art to which the descendants of the aborigines, now surviving, are strangers.”

Two of these statements I think we should now be inclined to call in question, namely: First, the finding of *iron* relics in the *ancient* mounds, or, at least, in the *ancient portion* of any mound, and the work of any ancient people in this country, and also its use as a currency here; and second, that their form evinces greater skill than is now possessed by the descendants of those “aborigines.”

Their descendants, if any are still living in North America, are probably those tribes which certainly do possess a skill quite equal to that shown by the workmanship of the ancient relics found in and about the Mississippi Valley.

It is there further stated that “wampum, as is well known, was used by the Indians as a currency, and consisted originally of strings of small spiral fresh-water shells.”

This is the only mention I can find of the use of small, spiral univalves as a currency, and these are said to have been fresh-water shells.

It is stated by early New England writers that one of the most common shells of that coast—*Venus Mercenaria* or “quahog”—was much used for this purpose by the Indians of those times, and from the dark-colored portion they made their purple money or “black money,” and from the axis of a species of *Pyrula*, and from other shells, the “white money,” which was rated at one-half the value of the black money or purple shell.*

It seems usually to have been made in the form of beads or buttons, as in any other form it would be liable to rapid wear and breakage, and would be ill-suited for ornaments, and more likely to be lost.

In a very interesting article on this subject, by Mr. Robert E. C. Stearns, of San Francisco, published in the *Overland Monthly*, and also in the Proceedings of the California Academy of Sciences, he says:

“As to whether the interior tribes of the continent made use of money, and whether it was different from, or the same as that of the coastwise tribes, we can only conjecture, as we have been unable to obtain satisfactory data on this point. It is, however, highly probable that the money used by them was received from the maritime or coast tribes in return for such articles as are peculiar to interior positions, for it is reasonable to suppose that the matter of habitat would naturally affect and cause certain differences, as between each other, in the manners and customs of tribes occupying exterior and interior stations. The proximity of the coast tribes to the sources whence the material was procured from

*In those days when business was not very lively, and money doubtless rather scarce, and inflation not much dreaded, some of the perhaps rather dreary winter hours might no doubt be profitably employed by the colonists in the manufacture, which was free to all, of this kind of money, and I observe that Mr. Chas. Rau, in a recently published description of the archeological collection of the United States National Museum, mentions that the early settlers did adopt the Indian practice of making the wampum for circulation.

“In the intercourse of the colonists among themselves,” he says, “wampum served at certain periods instead of the common currency, and the court issued, from time to time, regulations for fixing the value of this shell money.”

In large amounts it was counted by the “fathom,” a string of six feet in length.

which their money was made, would at once give to the latter superior commercial advantages, and it is quite likely that they were liberal purchasers from the interior communities."

On the northwestern coast of North America it appears that a very different form of shell has been used as money, and is still so used to some extent, though its use has rapidly diminished since the introduction of blankets by the Hudson Bay Company, as blankets while on hand, would not be dead capital, but could be used.

This shell is the *Dentalium*, and Mr. J. K. Lord, formerly connected with the British North American Boundary Commission, states that the current value of the shell depends much upon its length, the longest representing the greatest value, and when strung together end to end, twenty-five shells should form a string one fathom, *i. e.*, six feet in length. Such a string was called a *Hi-qua*. It is stated in the Proceedings of the Zoölogical Society of London, 1864, that at one time a *hi-qua* would purchase a male slave, equal in value to fifty blankets or £50.

"It would seem as if there might be some mistake about this length of shell," says Mr. Stearns, "as they are seldom found even as much as *two inches* in length." Foreign species of this genus have been largely imported, and are sometimes displayed for sale in the fancy stores of San Francisco.

Mr. Stephen Powers, in a valuable article in the *Overland Monthly*, states that the Cahrocs, a tribe of Northern California Indians, make use of the red scalps of wood-peckers, which are valued at \$5 each (and surely these have no intrinsic value). They also use the *Dentalium*, which they polish and arrange on strings, the shortest being valued at twenty-five cents, and the longest at \$2, the value increasing in geometrical ratio with the length, or as the square of the length. When the Americans (meaning the whites), first arrived there, an Indian would give from \$40 to \$50 for a string of the length of a man's arm, containing a certain number of the longer shells below the elbow, and of the shorter ones above. "Among the interior Indians," he says, "all the dwellers on the plains, and as far up on the mountains as the cedar line, bought all their bows and the most of their arrows, from the upper mountaineers. An Indian is about ten days in making a bow, and it costs from \$3 to \$5, according to the workmanship, and an arrow 12½ cents." Three kinds of money were employed in this traffic, *viz*: white shell beads or buttons, pierced in the middle, \$5 a yard; the Periwinkles, \$1, and fancy marine shells at various prices, from \$3 to \$10, or even \$15, according to their beauty.

The Yocuts, another tribe of Californians, use the usual shell buttons, a string, reaching from the point of the middle finger to the elbow, being valued at twenty-five cents. A section of bone, very white and polished, about two and a half inches long, is sometimes on the string, and rates at a "bit" (twelve and a half cents).

Dr. Edward Palmer states that some years since he was witness to a trade where a horse was purchased of one Indian by another, the price paid being a single *Haliotis rufescens* ("Aulone shell").

Mr. Harford, of the Coast Survey, has discovered in some Indian graves on one of the islands off the southerly coast of this State (California), beads or money of a different character from any heretofore observed. These were made by grinding off the spire and the lower portion of the univalve shell, *Olivella biplicata*, so as to form small, flat, button-shaped disks, with a single central hole. These much resemble in form some of the wampum of the New England tribes.

H. H. Bancroft, in his description of the native races, says that "the circulating medium of the Southern Californians consisted of small round pieces of the white mussel shell." He also mentions the cacao beans used in Central America even now.

It appears then, that in many cases articles of no intrinsic value have been used as a circulating medium, as we use paper money, which possesses no value in itself, but, like the wampum, had a *representative* value, and each individual would accept it in exchange for useful articles, or for labor, because he knew that others would accept it from him in the same way. It was not, of course, like our paper money, a promise to pay, but was received from a reliance upon the custom of the country, which really is just what our government money, bonds, etc., depend upon after all.

Actual intrinsic value, then, is not absolutely essential, but one *indispensable* requisite to the currency of such an article, or of any article, is that it *must cost something*.

The successful hunter would not give the half of the deer he had killed, or the arrow-maker the product of a day's labor for a certain limited number of shells, if he could in a short time gather large quantities just like them himself. If, however, it was one which could only be procured at a great distance, that would give it this requisite of value, and whether from a distance or not, if a certain amount of labor had been bestowed upon it, as in the case of beads and polished bones of certain forms, etc., it would possess this value of *having cost something*.

Stevens, in the volume entitled "Flint Chips," says of the Aulone shell, or *Haliotis rufescens*: "The Indians converted them into buttons, and strung them in numbers from 100 to 200 on deer's sinews. A string of them was of great value, for they were produced with immense labor. It took an Indian twelve months to make a string of them."

Here the value of them was merely as a medium of exchange, and was just simply the representative and equivalent of the labor expended, and not an intrinsic value at all. If by any means the people could learn to make them twice as fast, they would at once become exchangeable for but half the amount of labor, or of any useful article.

WORKED SHELLS FROM ANCIENT MOUNDS.

The shells before us (Fig. 2,) certainly carry with them the evidence of this *value of cost*, and the *amount* of labor which has been invested is very definitely determined. I ground one of the *Anculosa* down like the ancient specimens, using a hard sandstone for the purpose. It took three-quarters of an hour, and as it was a small one, I do not believe that they were done in less time on an average by the ancient manufacturers.

They could not be counterfeited without the actual amount of labor which would make them genuine, the counterfeits *would be* genuine. It could not be said, as of the American continental currency, "to counterfeit is death," but "to counterfeit is *very hard work*," would be true.

We see that each shell has been ground on the lower side next the aperture, until the plane surface thus formed, at an angle of from thirty to forty degrees with the axis of the shell, cuts the outer lip, and also cuts through into the cavity of the next whorl. This is a very exact measure of the work done, and could not be slighted without entirely changing the appearance of the specimen, nor cheapened, except by mechanical processes, of which all were alike ignorant. One man or woman could make a certain number in a day, and no more, and not a *very great* number.

That they were estimated by count, and not by length, unless by laying in a row, if used as a currency, seems altogether probable, as they are not adapted for stringing. It is true that a string *could* be put through, but equally true and apparent that it *was not* done to any considerable extent, as the thin edge about the hole in the side of the shell would be very easily worn and broken, which does not appear to have happened. Besides it is to be observed that they would not slide upon a string except with much difficulty.* Doubtless it is and was common to string the shells or beads of which the currency was composed, but it was by no means always done, for the cowries are not described as having been perforated at all, and until recently I had seen no intimation that they were ever so perforated, but in the Iowa College Museum at Grinnell I have lately seen a string of cowries, drilled through and strung on a cord.

I also found there two other kinds of *wampum* or shell ornaments. One is a string of marine univalves, drilled through above the aperture. The other is a small *Natica*, and is drilled through and attached to a hoop of wood, forming doubtless a circlet or head band. These were not ground down at all, and the work of preparing them is ten or twenty times less labor than to grind them.

One other use for these shells suggests itself as possible, viz: as ornaments being attached to a belt or flat surface of some kind, not by a string (for the effects of a string would, as before remarked, be easily seen), but possibly by some kind of cement. In that case, no indication of the cement is now to be seen, and their use as currency seems the more probable one. If used as ornaments and cemented, it would scarcely seem necessary to grind them all down to just a uniform depth, nor to grind off as much as has been done, or even to grind them at all,

*In the work by Mr. Rau, already referred to, he gives (Page 69) a description and figure of a marine shell, *Strombus pugilis*, which is perforated so as to be readily strung upon a cord.

To drill these shells in a similar manner would be not one-twentieth, perhaps not one-hundredth of the labor required to grind them; they would be strung much more conveniently, would slide more freely and would make a much better appearance, being central on the string instead of hanging to one side and irregularly, as they would do when ground in this way. Hence, I conclude that these are not so prepared to be used specially as beads, though doubtless they might sometimes be so used. Especially it would seem probable that when buried with the deceased owner, they would be placed upon strings for that purpose.

while for a currency it *would* be needful in order to determine the value by the cost of labor which they exhibit. And beside, we see by the recent specimens before us of the same species, that they are very far from being ornamental in their appearance.

SHELL BEADS.

We have here a quantity of beads exhumed from a mound at Toolesboro, Iowa, last year, which are not only shell beads, but they are *pearl* beads, that is they are made of either detached or attached pearls, found, possibly, in the bivalve shells of the Mississippi. Such pearls are, however, rare in our river shells, and these are, without much doubt, marine. I have here one or two very small pearls I found detached and lying loose (having apparently grown so), in the *Unio rectus*. Many of these from the Toolesboro mound were apparently attached, *i. e.*, were excrescences or protuberances, resulting from injuries to the shells, and of fine pearly texture upon one side only. Two of these pearls, very fine ones, were used as the eyes of one of the bird pipes found in the same mound. The most of these beads were found within and around one of the skulls.

We have here also a small quantity of shell beads, found last year by Mr. Tiffany in one of the mounds at Albany, Ills. These beads are probably made from marine shells, and are of three varieties: First, of a discoidal form, about four-tenths of an inch in diameter, and two-tenths of an inch thick in the middle, edges very much rounded, and a rather large hole drilled through in the direction of longest diameter, and considerably tapered from each end of the hole to the middle. (Fig. 3.) Second, a cylindrical form, about one-quarter of an inch in diameter, and somewhat less



FIG. 3.—Natural Size.

in length, (Fig. 4); and third, cylindrical like the second form, but about twice as long, (Fig. 5). The first and second forms were found at the neck of



FIG. 4.



FIG. 5.

FIG. 6. a skeleton, and the third (long cylindrical) at the ankle, as described by Mr. Tiffany.

We received some time since, from Mrs. Haines, of Richmond, Ind., some button-shaped shell beads, being flat disks three-tenths of an inch in diameter, and one-tenth in thickness, perforated in the middle. (Fig. 6.)

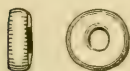


FIG. 6.

These were found in a mound in Florida, on the St. John's River, eight miles from the mouth. This mound, which was explored by Mr. Eli Haworth, contained the skeleton of one of those thick-skulled gentlemen who inhabited that region during the early centuries. The skeleton, as described by Mr. Haworth, was in a sitting position, facing the river, and nearly covered with the beads, of which there were probably five bushels. If this was money, this party, when he left, took his fortune with him, part way, at least. Perhaps he was a manufacturer of the articles, and then it might well have been said: "He rests from his labors, and his works do follow him." At his feet was a drinking cup, formed from a

large conch shell, probably the same species from which the beads were made. I have recently received from Mrs. Haines, for the Academy, a portion of the frontal bone, which is half an inch or more in thickness; also a piece of the lower jaw. These are from the same skeleton above mentioned.

COPPER BEADS.

In this connection we must not forget the copper beads found with the infant bones in the mound on Mrs. Cook's land here at Davenport, and which still contain pieces of the cord upon which they were strung ages ago. These have heretofore been fully described.*

The descriptions to which I have referred, and some other considerations suggest a possible use of the copper relics, axes so called, as a medium of exchange, and representing, no doubt, if so used, very high values. As they have apparently not been used as tools, not being adapted for actual service, being too soft, and showing no signs of wear, perhaps we might look upon them as copper coins, fashioned into the form of some of the stone implements, and made for the especial purposes of exchange and commercial transactions. If made for such a purpose they must have *some* definite form, and perhaps some useful article in everyday life would be as likely to furnish the model form which would be adopted, as any other object or idea.

Prof. Jevons says: "Some of the most extraordinary specimens of money ever used are the large plates of pure copper which circulated in Sweden in the eighteenth century. They were about three-eighths of an inch in thickness, and varied in size, the one-half daler being three and a half inches square, and the two daler seven and one-half inches square, and three and one-half pounds weight.

Mr. Bancroft says: "Ornaments are in the form of rings, gorgets, medals, bracelets and beads, with a variety of small articles of unknown use, some of them probably used as money. Very small models of larger implements like axes are often found, and were doubtless worn as ornaments. Mr. Dickeson speaks confidently of gold, silver, copper and galena money left by the mound builders. He further says that "According to Cogolludo, copper bells and rattles of different sizes, red shells in strings, precious stones and copper hatchets often served as money, especially in foreign trade. Doubtless many other articles, valuable and of compact form, were used in the same way."

That all of these articles, copper axes, beads and awls, and stone pipes, etc., would sometimes be exchanged between individuals or tribes for various kinds of property, value for value, is, of course, not to be doubted, but to what extent this was a custom in the case of each of these objects, is as yet little more than a mere speculation.

These ground shells seem to be more adapted to that purpose and less suited to any other than any other article we have found, excepting, perhaps, the shell beads so common in many mounds.

*See these Proceedings, Vol. I, page 134, plate VI.

JANUARY 3D, 1877.—TRUSTEES' MEETING.

Rev. W. H. Barris, President, in the chair.

Six members present.

On motion the reading of regular annual reports of officers for the past year was left to the annual meeting of the Academy.

JANUARY 3D, 1877.—ANNUAL MEETING.

Rev. W. H. Barris, President, in the chair.

Twenty members present.

In the absence of Dr. Preston, Dr. C. C. Parry was chosen Secretary *pro tem*.

The reports of the different officers were then read, as follows:

TREASURER'S REPORT.

To the President and Members of the Academy:

The undersigned would beg leave to make the following report :

RECEIPTS.

Balance on hand January 1, 1876.....	\$ 42.30
Initiation fees.....	115.00
Annual dues.....	188.00
Rent of rooms.....	21.05
Contributions, etc.....	10.75
Proceeds from Prof. Gunning's lectures.....	125.50
	\$502.60

EXPENDITURES.

Rent of rooms.....	\$125.00
Gas and fuel.....	57.45
Insurance.....	30.00
Janitor.....	29.25
Two wall cabinet cases.....	27.50
Stationery, postage, express and miscellaneous... ..	76.50
Prof. Gunning's lectures.....	\$100.00
Use of halls for the same, etc.....	16.00
Advertising in <i>Gazette</i>	9.50—\$125.50—\$471.20
	\$ 31.40

ENDOWMENT FUND.

Received from J. D. Putnam, life membership... ..	\$ 50.00
Deposited in Davenport Savings Bank.....	\$ 50.00
Accrued interest.....	1.76

Subject to order of the Finance Committee.

All of which is respectfully submitted.

JOHN HUME,

Treasurer of the Davenport Academy of Natural Sciences.

January 1st, 1877.

The report was received and referred to an Auditing Committee, consisting of George H. French, W. H. Pratt and C. E. Putnam.

CURATOR'S REPORT.

Gentlemen and Ladies of the Academy :

Regarding the CONDITION OF THE MUSEUM I beg leave to present the following report :

The increase in the collection during the past year having been, as in the preceding year, very considerable, has rather more than kept pace with the increase of space and facilities for their proper arrangement. As a consequence the arrangement is still rather imperfect and incomplete. In several of the cases the specimens are too much crowded to make a good appearance ; in some others is a miscellaneous collection, placed there temporarily for safe keeping, but which should be separately arranged, and the unsettled appearance of some is still far from what we should desire, while many good specimens are packed away for want of room. The want of space and of labels, and a sufficient quantity and variety of specimen boxes, greatly obstructs and increases the labor of arrangement.

On the whole, however, something has doubtless been gained during the year in this respect.

Almost the whole of the articles on deposit last year have since been donated to the Museum, including one entire case (6x7 feet) of fossil corals, nearly the whole of one case of coal plants, and the greater part of one case of fossil shells, about 1,500 specimens in all.

Two wall cases, 6 by 7 feet, and one botanical case have been added.

Very little has been done in Archæological explorations, but the number of ancient stone implements has been about doubled.

In Mineralogy, Geology and Palæontology, the collection is gradually and steadily increasing.

In Botany, some valuable contributions have been received and collections made by members.

In Zoölogy, the acquisitions consist of a number of skins of South American birds, with a few specimens of local species, mounted, and eggs of a number of species ; the skulls of some mammals ; several bottles of reptiles in alcohol ; a few fishes stuffed, and several hundred species of recent shells, mostly foreign.

Some of the above have been received in exchange for specimens from our collections. and some in exchange for our Proceedings, but mostly by donation.

Considerable collections have been made by members, which collections are not reported among the donations, including several species of recent and fossil shells, not before noted as being found here.

The following is an approximate list of the collection as it now stands :

MOUND RELICS.

Copper axes, 20; copper awls, 13; copper beads, about 200; carved stone pipes, 14; horn and bone implements, 20; marine shells (drinking vessels), 4; shell and pearl beads, 6 forms; pottery, two vessels entire, several others nearly so, and large quantities of fragments; flint implements, specimens of galena, mica, obsidian, horn, etc.; mound builders' skulls, 21, beside fragments of several from different parts of the country.

Of ancient implements, not from mounds, there are stone axes, fleshing stones, hammer stones, discoidal stones, and grinding stones to the number of 460, and flint (including quartz) arrows, spear heads, hoes, scrapers, awls, etc., to the number of 1,580.

The collection of modern Indian implements, bows, arrows, pipes, etc., is extensive.

GEOLOGICAL.

Fossil shells, 250 species; fossil corals, 100 species; fossil crinoids, 50 species; fossil coal plants, 75 species; primitive rocks, minerals, ores, crystals, 3 cases.

NATURAL HISTORY.

Plants, 2500 species; marine shells, 350 species; corals, sponges and algæ, 50 species; crabs, 8 species; turtle shells, 8 species; land and fresh water shells (local), 110 species; land and fresh water shells (foreign), 400 species; birds, mounted, 90 specimens; birds' eggs, 30 species; mammals, 16 specimens; skulls of mammals, 22 specimens.

SPECIMENS IN ALCOHOL.

Reptiles, 40 bottles; other specimens, 40 bottles.

MISCELLANEOUS.

Mechanical models from the Patent Office, about 200.

Historical relics and foreign curiosities, coins, etc., 1 case.

Among the immediate needs for the Museum I would mention: One large case for birds; five wall cases, viz: one each for Natural History, Comparative Anatomy, Mound Relics, Systematic Geology, and Local Geology. A case of drawers for such specimens as cannot be otherwise conveniently arranged. A quantity of boxes suitable for specimens in cases and labels for specimens, and a quantity of alcohol and bottles of the several suitable sizes.

For the work of the ensuing year in this direction, I will venture to call the attention of the Academy to the especial importance of systematic effort in two directions, viz: A somewhat extensive exploration of mounds, and a collection of the most complete possible series of the fishes and reptiles of the locality.

All of which is respectfully submitted.

W. H. PRATT, *Curator.*

Additions to the Museum During the Year 1876.

- Adams, Joseph, Hampton, Ills. Ancient stone axe.
 Alston, Edwin. Favosites from Iowa City.
 Anderson, Jess M., Anderson Post Office, Pike Co., Mo. Stone skin-
 ning knife.
 Arthur, J. C., Charles City, Iowa. Specimens of Iowa plants.
 Barber, Albros, Port Byron, Ills. Four stone implements.
 Barber, George, Port Byron, Ills. Ancient stone axe.
 Barber, John F., Port Byron, Ills. Twenty-six flint arrow heads.
 Barler, A. C., Chicago, Ills. Birds' eggs, 30 species.
 Barler, A. U. Skeleton of owl and collection of skulls of small animals.
 One sturgeon, one gar pike, stuffed.
 Barnes, Joseph D., Port Byron, Ills. Ancient stone axe.
 Barris, Prof. W. H. A collection of 50 species of fossils from the Nia-
 gara, Lower Helderburg, Oriskany sandstone and Hamilton Groups,
 of New York.
 Barrows, Miss Sarah. Old account book, Rockingham, 1837.
 Baxter, John, P., Port Byron, Ills. Ancient stone axe.
 Bergstrom, Edward, Watertown, Ills. Two arrow heads.
 Bergstrom, Nelson, Watertown, Ills. Ancient stone axe.
 Berry, Geo. W., Somerville, Ala. Several stone and flint implements.
 Bickle, Ferdinand, Le Claire, Iowa. Stone axe and flint arrow.
 Blyle, Benjamin, Canton, Mo. Ancient stone implement.
 Blackman, Elmer. Two arrow heads.
 Börsch, Hugo. Ancient stone implement.
 Boyd, R. M. Stone axe, arrow head, and one fossil from Crestline, O.
 Brock, Frank, Deer Plain, Ills. Three arrow heads.
 Brock, Richard, Deer Plain, Ills. One arrow head.
 Brous, Harry A., Manhattan, Kan. Specimen of *Amblychila cylindri-
 formis*.
 Buck. Body of a monkey.
 Chamberlain, Levi, Princeton, Iowa. Ancient stone axe, broken.
 Chamberlain, Mrs. M., Princeton, Iowa. Flint arrow head.
 Clark, Calvin, Le Claire, Iowa. Stone hatchet and six arrow heads.
 Coffey, John R., Fackler, Ala. Ancient stone implement.
 Cole, George, Illinois City, Ills. One hammer stone.
 Cole, Leonard, Illinois City, Ills. Flint arrow head.
 Collamer, Neil. Fan coral and collection of specimens from Colorado.
 Collins, Cornelius, Port Byron, Ills. Ancient stone axe.
 Comelian, Garrett, Watertown, Ills. Two arrow heads.
 Cook, Wm. Mineral specimens collected in Colorado.
 Coyle, S. E., Canton, Mo. Hammer stone.
 Criswell, Robert, Princeton, Iowa. Two arrow heads.
 Cross, J. P. Ancient stone axe.
 Dalin, Josephine, Nauvoo, Ills. Flint arrow head.
 Dillin, Wm. T., Green River, Ills. Copper awl.
 Doolittle, Amasa, Appanoose, Ills. Ancient stone axe.

- Dugald, Robert, Port Byron, Ills. Flint arrow heads, etc.
- Earle, Benj. C. Bottle of reptiles from Colorado.
- Evans, Fannie M. White flint arrow head.
- Evans, John, Pleasant Valley, Iowa. Ancient stone axe.
- Fangmeier, Fritz. Fossil shells, casts.
- Figley, Josiah, Dixon, Iowa. Head of wolf.
- Frahm, Henry. Specimen of Devonian coral of Davenport.
- Frank, Mrs. Mary, Rapids City, Ills. An ancient stone implement, "fleshing stone," found at Port Byron thirty years ago. Given to the Academy in her will.
- Freeland, Felix, Rapids City, Ills. Ancient stone axe.
- French, Geo. H. Specimens of seed oysters attached to a clam shell.
- Gates, Frederick, Pleasant Valley, Iowa. Flint arrow head.
- Geisler, Louis. Lump of copper ploughed up at Blue Grass in 1860.
- Gilman, S. F. Skull of prairie dog.
- Ginung, Mrs. Tennie, Rapids City, Ills. White flint arrow head.
- Goldsbury, Jay. Radiated Tourmaline, Franklin Co., Mass.
- Graham, David, Rapids City, Ills. Two arrow heads.
- Graham, James, Rapids City, Ills. Ancient stone axe.
- Gray, Wm. Head of a very large pike of the Mississippi River.
- Gronen, W. O. Skull of raccoon.
- Gundaker, Anna. Specimen of limestone—furrowed.
- Haines, Mrs. Mary P., Richmond, Ind. Eight Geodes, showing organic origin. Thirty-five cards of labelled specimens of fossil corals and polyzoa of Cincinnati group. Shell beads and pieces of skull from a Florida mound. Three photographs of fossil star-fish.
- Hall, Chauncey. Petrified moss from Minnesota.
- Hall, George, Gundrysville, Ala. Ancient stone implement.
- Hall, Miss Grace R. Ancient stone implement. Flint arrow. Stone implements from a mound, Henry Co., Ills.
- Hall, Capt. W. P. A large collection of flint and stone implements, fragments of pottery, minerals, woods, beaver gnawing, etc., from the Southern States. Bird's head, carved in stone or pottery, from a mound 30 feet high, Sandy River, Tenn. Ancient stone axe from Cook's Point, Davenport. Agate from Lake Pepin. A large lot of flint and stone implements, and of mound relics, consisting of pottery, shell money, specimens of paint stone (*Hematite*), etc., from Calhoun Co., Ills., and vicinity.
- Hanks, Hattie, Princeton, Iowa. Two arrow heads.
- Hanks, Leonard, Princeton, Iowa. Four arrow heads.
- Hanks, Samuel, Princeton, Iowa. Three arrow heads.
- Hannawacker, Chas., Hampton, Ills. Flint arrow heads.
- Hanson, H., Durant, Iowa. Bone found ten feet below the surface.
- Harrison, C. E. Several specimens of marble polished. Three glass-covered specimen boxes.
- Harrison & Holman. A mass of melted bottles, relic of the Brady street fire of Feb. 22d, 1876.
- Harrison, I. W. Specimen of long-legged myriapod (*Cermatia forceps*).
- Hathaway, W. W. Coal plant impressions in clay shales.

Haupt, J. G. Collection of coins, 14 specimens. Specimens of plants, etc.

Haviland, Adam, Valley City, Iowa. Three arrow heads.

Heath, S. A. Body of rat—dried.

Hennessy, Charles, Hampton, Ills. Flint arrow head.

Hennessy, Mary, Hampton, Ills. Flint implement.

Heschmeier, Mary, Deer Plain, Ills. Two arrows. One scraper.

Higgin, John, Bay Post Office, Ills. Flint arrow head.

Hill, E. L., Green River, Ills. Two flint spear heads.

Holmes, John Wilson, Albany, Ills. Ancient stone implement.

Houghton, David, Montrose, Iowa. Large stone axe and arrow.

Hughes, Mr. Shell of *Limulus*, very large. Specimens of sea-weeds and shells from Cape May.

Hume, John. Fossil shells, casts. *Megalomus Canadensis* and *Spirifer orthis* from Canada.

Hunting, Rev. S. S. Specimens of granite from New Hampshire; asbestos and mica from Georgia; shell marl from Georgia; palm leaf from Kew Gardens, London. Fragments of human skull from a mound in Wisconsin.

Jay, Charles, Bay Post Office, Ills. Ancient stone axe.

Jay, E. J., Bay Post Office, Ills. One flint shovel or hoe. Two flint scrapers.

Jay, John R., Bay Post Office, Ills. Discoidal stone.

Jay, Mary J., Bay Post Office, Ills. Ancient flint knife.

Johnson, Finley, Montrose, Iowa. Two arrow heads. One crystal.

Johnson, Robert, Andalusia, Ills. One arrow head.

Kauffman, John, Rock Island, Ills. Indian skull from the Island.

Keating, Edward. Ancient stone implement, etc.

Keely, Ambrose, Port Byron, Ills. Indian shell ornament.

Keely, Henry, Port Byron, Ills. Ten arrow heads.

Keely, Miss Nonie, Port Byron, Ills. Ancient stone axe.

Keely, Wm., Port Byron, Ills. Two arrow heads.

Kellogg, ———, Chicago, Ills. Head of Texas ox.

Kelley, Dennis, Port Byron, Ills. Ancient stone axe.

Kendall, John, Sonora, Ills. Ancient stone axe.

Kendall, Kate L., Sonora, Ills. One flint shovel.

Kendall, Mary, Sonora, Ills. Two specimens coral (*Lithostrotion Canadense*).

Kirby, Mrs. M. S. Cocoons of tiger moth.

Lamb, L. D., Port Byron, Ills. Ancient stone axe.

Lane, Emma. Flint arrow head.

Lane, Hattie M. Flint arrow head.

Lane, Nettie. Flint arrow head.

Lesslie, C. C. Copper coins, 19 specimens.

Lindley, C. T. A very large snake.

Littig, Augustus N. Two stone axes.

Livergood, Geo. O., Watertown, Ills. Very small stone axe and two arrow heads.

- Long, Matt. Flint arrow head.
- Lorenzen, Martin. Specimen of volcanic scoria, found in Arkansas.
- Lorton, ———. Five arrow heads, etc.
- Lyter, Mrs. J. M. Tusks of the walrus. Pair Chinese shoes. Bouquet of skeleton leaves.
- McCabe, Emeret, Deer Plain, Ills. Small stone axe.
- McCullough, Frank. Chinese Joss tapers and Southern pitch pine.
- McGonegal, Mrs. M. A. Collection of Geodes.
- McKown, D. P. Photographic view of Fort Armstrong as in 1840.
- McTier, John, Hamburg, Ills. Copper awl.
- Mahan, Matthew, Somerville, Ala. Flint arrow head.
- Malarky, John, Port Byron, Ills. Ancient stone axe.
- Mallet, Mr. Ancient stone axe, found in a coffer dam.
- Mandeville, Mrs. Col. Horned toad from Texas.
- Martin, Mr. Horned toad from Texas.
- Mason, Wm., M. D., Stevenson, Ala. Ancient stone implement.
- Matthews, J. C. Ancient stone axe.
- Maxwell, Dr. A. S. Tennessee ores from the Centennial Exposition. Palm leaves from Florida.
- Mead, Hon. J. R., Wichita, Kan. Silver bearing galena.
- Miclot, Joseph. Polished specimen of Buffalo encrinal limestone.
- Moeller, Adolphus. Ancient implement of brown hematite and seven arrow heads.
- Moore, J. W. Flint implements from Kaskaskia battle ground, Illinois.
- Myers, Dr. R. D. Casts of the carved stone pipes in the Museum. Alligator tooth.
- Nagel, Chas., Rockingham, Iowa. One stone axe,—broken.
- Nagel, J. J., and Haupt, J. G. Collection of plants of this vicinity of 1875.
- Newcomb, Mrs. D. T. A lot of shells collected by Dr. W. Newcomb. California.
- Newton, Mr., Dixon, Iowa. Five heads of mink, squirrel and skunk.
- Niel, Wm., Hamburg, Ills. Three arrow heads.
- Nissen, Theodore, Rock Island, Ills. Herbarium of 248 species of Alpine plants collected in Switzerland in 1828.
- Northcraft, H. H., Bay Post Office, Ills. Discoidal stone and stone axe.
- Northcraft, Margaret, Bay Post Office, Ills. Ancient stone implement.
- O'Brien, Michael, Watertown, Ills. Two arrow heads.
- O'Brien, Thomas, Watertown, Ills. Two arrow heads.
- Palmer, Dr. Edward. A collection of California plants. Mojave pipe. Specimen of Mezquite bread, made by the Coahuilla Indians of South-eastern California.
- Parry, Dr. C. C. Photograph of stone plate, carved by Hydah Indians, and found in Colorado Desert, California. String of pine nuts, California.
- Parry, Mrs. Dr. C. C. Four living horned toads from San Bernardino, Cal.

- Peck, Mrs. E. Mineral specimens from Grave Creek, Iowa.
- Peters, Wm. E., Gundrysville, Ala. Three flint implements.
- Pickering, C. E. Skull of mole.
- Pickering, Miss H. E. Ancient stone axe and head of gar pike.
- Pleasantina, Antonio, Bay Post Office, Ills. Ancient stone axe.
- Pleasantina, Mary, Bay Post Office, Ills. Fossil crinoid.
- Polk, Martin, Hamburg, Ills. Flint arrow head.
- Pollock, Hugh, Le Claire, Iowa. Flint arrow head.
- Port Byron Lime Co. Fossil shell cast.
- Post, Oliver, Hamburg, Ills. Two arrow heads.
- Pratt, C. L. Arrow head found on High School hill.
- Pratt, W. H. 1,350 specimens of fossil corals, coal plants and shells, numbered from 5,001 to 6,350, inclusive. Also, 550 species of recent foreign land, fresh water and marine shells. Numerous specimens of fossils, shells, etc.
- Preston, Dr. C. H. Specimens of frogs in alcohol.
- Prince, Mrs. Eliza M., Cordova, Ills. Two stone axes.
- Proctor, N. J., Gundrysville, Ala. Two arrow heads.
- Putnam, H. S. and W. C. Cartridge shell fired over the grave of Gen. Rodman, on Rock Island, 1871. Chicago Exposition medal, and Spanish copper coin.
- Putnam, J. D. Collection of fresh water and land shells. Tree toad (*Hyla arborea*), living specimen. Trilobite from Illinois.
- Putnam, Mrs. C. E. A small snake, killed while shedding its skin.
- Ranef, Wm., Appanoose, Ills. Two arrow heads.
- Reilly, Albert. Iron ore from Johnstown, Pa.
- Renard, S. B., New Grand Chain, Ills. Specimens of silver mica, etc.
- Rice, Mrs. Adeline, Gundrysville, Ala. Ancient stone implement.
- Riley, Chas., Port Byron, Ills. Ancient stone axe.
- Rook, Chas., Princeton, Iowa. Five arrow heads.
- Rosa, George, Hamburg, Ills. Flint arrow heads.
- Rowe, Mrs. Mary, Washington Territory. Moss agate.
- Rule, D., Hamburg, Ills. Flint hoe.
- Rule, J. D., Hamburg, Ills. Flint spear head.
- Sanders, Miss Julia E. Specimen of *Coquina* (shell rock), and a *Platycarcinum* (sea star) from Florida.
- Sanders, Mrs. M. A. A collection of pressed flowers, gathered in Iowa by the late Mr. Alfred Sanders, between 1845 and 1860, comprising about 300 species. Centennial Herbarium, 123 species.
- Sands, M. Acorns enclosed in leaves of apple trees.
- Schloeffel, Theresa, Princeton, Iowa. Small stone axe.
- Scott, Mrs. James, Montrose, Iowa. Ancient stone axe.
- Shaefer, Mr. Specimen of *Alaus oculatus*.
- Shannon, John, Illinois City, Ills. Flint arrow head.
- Sheldon, Prof. D. S. Shells from Ohio, 15 species, 74 specimens. Several species of shells collected in Griswold College grounds. A number of entomological specimens. Gypsum sand from New Mexico.
- Shelts, Godfrey, Dallas City, Ills. Ancient stone axe.

- Sheridan, Thos. Nauvoo, Ills. One discoidal stone. One fleshing stone (Hematite).
- Sibels, Frank, Watertown, Ills. Ancient stone axe.
- Simpson, Robert. Egg of skate, California.
- Smart, Gordon C., Haydon, Bear River, Col. Specimen of Baculite.
- Smith, Manuel, Hampton, Ills. Flint arrow head.
- Smith, Nathan, Watertown, Ills. Three arrow heads.
- Smith, Otto. Specimens of conglomerate.
- Smith, Otto, Jr. A golden eagle for mounting.
- Snow, Mrs. L. M., Watertown, Ills. Discoidal stone.
- Snyder, Byron, Rapids City, Ills. Ancient stone axe.
- Snyder, Mrs. Elizabeth, Port Byron, Ills. Piece of drift copper. Flint scraper.
- Snyder, Geo., Rapids City, Ills. Three arrow heads.
- Southwell, J. H., Port Byron, Ills. Several specimens of fossil coal plants, new species, found at Port Byron, and fossil coral and shell.
- Spencer, John, Illinois City, Ills. Flint arrow head.
- Stuhr, August. A very large bull-frog. Fishing duck (*Mergus merganser*), mounted. Skulls of birds and turtle. Birds' eggs. Skin of bat, etc.
- Suiter, James, Princeton, Iowa. Fossil shells and seven arrow heads.
- Suiter, Wm. A., Le Claire, Iowa. Flint arrow heads.
- Teele, Warren. Petrified wood found on Credit Island.
- Thompson, H. M., Long Grove. Specimens of crinoids.
- Thorington, Hon. James. Thirty-four skins of South American birds.
- Tiffany, A. S. Copper kettle found buried near Rock River. Specimen of quartzose limestone or calcareous sandstone, Davenport quarries. Lump of iron ore from Ripley street bluff. Specimens of land and fresh water shells.
- Vann, E. J., Madisonville, Fla. Four arrow heads and a quartz crystal.
- Wagoner, I. N., Sr., Hamilton, Ills. Ancient stone axe.
- Wagoner, I. N., Jr., Hamilton, Ills. Ancient stone axe.
- Wainwright, Geo., Rapids City, Ills. Two stone axes.
- Wallace, M. B., Marietta, Ga. Five quartz arrow heads.
- Wallendorf, Joseph, News Post Office, Ills. Flint arrow head.
- Walton, John, Muscatine, Iowa. Ancient stone implements.
- Welter, J. Two ancient stone implements.
- Wells, Albert, Hampton, Ills. Arrow head and mineral specimen.
- West, Benj. F., New Hope, Ala. Several ancient stone implements.
- Wheeler, H. Specimen of New Hampshire granite from New York State House. Gypsum from Harvey Co., Mo.
- Wilcox, Geo., Port Byron, Ills. Flint scraper.
- Wood, B. F., Princeton, Iowa. Two arrow heads.
- Woodbury, Miss Anna, Carbon Cliff, Ills. One arrow head. One shell.
- Woodbury, Miss Emma, Carbon Cliff, Ills. Three arrow heads and three shells.

RECORDING SECRETARY'S REPORT.

During the past year there have been held fifteen business meetings of the Trustees, and thirteen regular meetings of the Academy, including the annual meeting in January.* The average attendance of members at the regular meetings has been within a fraction of thirteen members. Thirty-six regular and twenty-eight corresponding members have been elected during the year.

Three papers† have been presented for publication, viz: 1. A Notice of the late Dr. I. A. Lapham, by Dr. C. C. Parry. 2. Modern Manufacture of Pottery in America by Females, by Dr. Edward Palmer. 3. A paper on "Shell Money," by Prof. W. H. Pratt.

Numerous and valuable donations have been reported each month.

In January a Codification of the Constitution to agree with the articles of Incorporation, was adopted.

In February it was resolved to recommend the indefinite postponement of the publication of the "Proceedings" on account of the loss sustained by fire on the night of the 22d and 23d, but thanks to the courage of the ladies of the Centennial and Bric-a-Brac Societies, and to the generosity of our citizens, the work went on, and has been brought to a satisfactory completion.

In March, insurance to the amount of \$2,000 was effected on the Museum, Library and furniture of the Academy; also the life membership fee was reduced from \$100 to \$50.

In May the organization of Working Sections was authorized, and since then the Biological, the Historical, and the Geological and Archaeological Sections have held frequent meetings. A By-Law regulating the use of the Library was also adopted in May.

A By-Law for the establishment of an Endowment Fund, was adopted in June.

In August the Academy authorized Dr. Farquharson to take mound builders' relics from the Museum for exhibition at the International Archaeological Convention, meeting at Philadelphia, Sept. 4th.

In October the completed first volume of "Proceedings" was gratefully accepted by the Academy from the hands of the Centennial Society.

During the latter part of October and the early part of November a course of six highly instructive popular lectures was delivered before the Academy by Prof. W. D. Gunning, of Boston.

In December the Academy contributed a collection of relics, etc., for exhibition at the Turners' Fair, held in this city.

The above are the principal matters of record, aside from current business, and some slight alterations of By-Laws, which appear as amended in Vol. I. Respectfully submitted.

Davenport, January 3d, 1877.

CHAS. H. PRESTON, Secretary.

*In addition to the above the *Biological Section* have held nine, the *Historical Section* five, and the *Geological and Archaeological Section* three meetings during the year.

†This does not include a number of papers presented during the early part of the year, and included in the first volume of Proceedings. The preparation of that volume necessarily kept the few active members of the Academy pretty busy for several months.

LIBRARIAN'S REPORT.

MR. PRESIDENT:—As Librarian, I would beg leave to make the following report, viz :

The number of books, according to the last annual report, was..	362
Since then there has been received by exchange of complete volumes	121
By exchange of pamphlets and parts of volumes.....	351 — 472
By gifts of complete volumes.....	90
By gifts of pamphlets and parts of volumes	36 — 126
Total volumes.....	960

For the proper preservation of this comparatively small, yet very valuable Library, one or two additional book cases are required.

R. J. FARQUHARSON,

Davenport, Iowa, Jan. 3d, 1877.

Librarian.

Additions to the Library during 1876.

I. FROM INDIVIDUALS.

- Barler, A. U.* Patent Office Report, 1859.
- Barris, Prof. W. H.* Reports on the New York State Cabinet of Natural History for the years 1868, '69, '70, '71, '72, '73—6 vols.
- Brous, Harry A.; Manhattan, Kan.* Habits of *Amblychila cylindriformis*.
- Campbell, Alva E.* Correlation of Forces.
- Dalzell, Jas. M.* Davenport City Directory, 1858-59; Twin Cities Directory, 1859-60; Davenport City Directory, 1863; Davenport Directory, 1866; Davenport City Directory, 1868-69; Davenport, Rock Island and Moline Directory, 1873; Iowa State Almanac, 1860.
- Dana, Jas. D.; New Haven, Conn.* On Cephalization, Part V.
- Davis & Fluke.* A large quantity of extra sheets from the 1st vol. of Proceedings D. A. N. S., etc.
- Eads, Luther T.* Resources of the State of Arkansas.
- Farquharson, Dr. R. J.* Proc. Acad. Nat. Sci., Phila., 1875, Part I; Catalogue of the British Section of Philadelphia International Exposition; Catalogue of Collections from the India Museum; Photographic likeness.
- Fulton, H.* U. S. Postal Guide, 1874.
- Gentry, Thos. G.; Germantown, Pa.* Life History of Birds, Vol. I. [*Ex.*]
- Gunning, Prof. W. D.* Our Planet, its Life History.
- Haines, Mrs. M. P., Richmond, Ind.* Fifth Annual Report of the Geological Survey of Indiana.
- Harrison, Chas. E.* A package of the *Scientific American*.
- Hastings, White & Fisher.* Photographs of copper axes; photographic portraits of Dr. Farquharson and J. D. Putnam.
- Hunting, Rev. S. S.* Annual of Scientific Discovery, 1857; Annual Report of Commissioner of Agriculture of Georgia; Report of Progress of Physical Survey of Georgia; Chemical Analysis of Georgia; Man-

- ual of Sheep Husbandry in Georgia; Annual Reports of Smith. Inst. 1857, '59, '60; Patent Office Agricultural Report. 1857; Fourth Annual Report Mass. Board of Agriculture; Abstract of Returns of Agricultural Societies of Massachusetts, 1856; First Annual Report of Inspectors of Detroit House of Correction; Report of Operations of the Sanitary Commission, &c., 1861; Report on Treatment of Ophthalmia, by *Hildreth*; Despotism in America: The Exiles of Florida, *Giddings*; The Impending Crises, *Helper*; Slavery and Anti-Slavery, *Goodell*; Miscellaneous Writings on Slavery, *Jay*; N. P. Roger's Writings.
- Ingersol, Ernest*; *New York*. Special Report on the Recent Mollusca of Colorado; Mollusks of the Rocky Mountains; Forrest and Stream.
- Jarvis, Frank I.* White's Geology of Iowa, 2 vols.; Dictionary of Weights and Measures, *Alexander*; Weights, Measures and Money of all Nations, *Clark*; Monopolies and the People, *Cloud*; Philadelphia and its Manufactories, *Freedley*; Iowa Horticultural Report, 1875; Hayden's Geological Survey of the Territories, 1872.
- Lapham, S. G.*; *Milwaukee, Wis.* Biographical Sketch of Dr. Increase A. Lapham.
- Lindsay, W. K.* Indian Tribes by Kenney and Hall, Nos. 9 and 16.
- Magoon, Rev. Geo. F.*; *Grinnell, Iowa*. Statistical Atlas of the United States, Part 3, vital statistics.
- McGonegal, Mrs. M. A.* Davenport Directory 1876.
- McNeil, O. S.* Iowa Agricultural Reports, 1874-75.
- Marsh, Prof. O. C.*; *New Haven, Conn.* Six pamphlets on Extinct Vertebrate remains.
- Olshausen, Dr. J.* History of St. Louis; German emigration pamphlets, descriptive of Iowa and Missouri.
- Packard, Dr. A. S.*; *Salem, Mass.* Record of American Entomology, 1868-73; First, Second and Third Reports on the Injurious Insects of Massachusetts; The Ancestry of Insects; Glacial Phenomena of New England and Europe; On the Cave Fauna of Indiana; Thysanura of Essex County; Notice of New Phyllopora; five papers on the Phalænidæ and Pyralidæ.
- Palmer, Dr. Edward.* Exploration of a mound in Utah; Papers on Coleoptera, by *Dr. Horn*; Ornithology of Guadaloup Island.
- Parvin, Prof. T. S.*; *Iowa City*. U. S. Coast Survey Reports, 1851-1865 inclusive, 16 vols.
- Perkins, Prof. Geo. H.*; *Vermont*. Insects Injurious to the Potato and Apple; Ancient Burial Ground at Swanton, Vt.; Molluscan Fauna of New Haven; Hygiene of House Plants; Vegetation of the Illinois Lowlands.
- Pratt, Miss Lucy.* Photographic likeness.
- Pratt, W. II.* Perke's Geography, 1793; Davenport's Gazetteer; Guyot's Earth and Man; Foster's Pre-historic Races of the United States. [*Ex.*]
- Preston, Dr. C. H.* Photographic likeness.
- Putnam, Chas. E.* Binding of 36 vols. Proceedings Phila. Acad. Nat. Sciences, etc. Letter Press, Letter copy book, etc.

- Puinam, J. D.* Report on Climate and Resources of San Bernardino County, Cal.; photographic likeness.
- Robertson, Col. D. A., St. Paul, Minn.* Journal of Am. Geog. Soc., Vol. V, 1874.
- Russell, Edward.* U. S. Postal Guide, Oct., 1876.
- Scudder, S. H.; Cambridge, Mass.* Historical Sketch of the generic names proposed for butterflies; Entomological notes (from Proc. Bost. Soc. Nat. Hist.) III, IV, V; Papers from Buff. Soc. Nat. Sci., and from Bulletin U. S. Geological Survey of the Territories.
- Thompson & Carmichael.* Davenport Past and Present, *Wilkie*; Iowa Hand Book, 1860.
- Thompson, James.* Photographic likeness.
- True, Mrs. D. S.* Pacific R. R. Survey, 8 vols.; U. S. Coast Survey Reports, 2 vols.
- Watson, Sereno; Cambridge, Mass.* Geological Survey of California, Botany, Vol. I; Contributions to American Botany, Nos. 1, 2, 3, 4, 5, 6.
- Whittlesey, Col. Chas.; Cleveland, Ohio.* Fugitive Essays, Selection No. 1.

II. FROM SOCIETIES AND INSTITUTIONS.

California.

- California Academy of Science.* Proceedings, Vols. I, III, IV, V, complete; Memoirs, Vol. I, Nos. 1, 2.
- California State University.* Bulletin, Nos. 1-25; Statement of Progress and Condition, 1875; Report on Water Supply; Petition of John Le Conte, President; Circular regarding Pacific Coast Fisheries; Report of Joint Committee; Lecture on Cotton Culture.
- San Diego Society of Natural History.* Fungus, on Orange and Olive Trees, in Southern California. (*D. Cleveland.*)
- Santa Barbara College.* Forest Culture, and the Eucalytus Tree, by Ellwood Cooper. Two different editions.

Connecticut.

- New Haven Colony Historical Society.* Papers of the New Haven Colony Historical Society, Vol. I.
- Connecticut Academy of Arts and Sciences.* Transactions, Vols. I and II, complete; Vol. III, part I.

District of Columbia.

- Department of Agriculture.* Annual Reports, 1874 and 1875.
- Department of the Interior.* Annual Report of U. S. Geological and Geographical Survey of Colorado, 1873; Birds of the Northwest, (*Dr. Coues*); Synopsis of the Flora of Colorado, (*Porter & Coulter*); Synopsis of the Acrididæ of North America, (*Thomas*); Report on Extinct Vertebrate Fauna, of Western Territories, (*Leidy*); Report on Cretaceous Vertebrata, (*Cope*); Monograph of the Geometrid Moths, (*Packard*); Geology of the Uintah Mts., Maj. Powell's Survey with an Atlas; Report on the exploration of the Colorado River, (*Powell*).

- U. S. Geological and Geographical Survey of the Territories.* F. V. Hayden. Letter from Secretary of the Interior, Jan. 27, 1873; Report of Congressional Committee, May 26, 1874; Supplement to Fifth Annual Report, for 1871; Catalogue of Publications of the Survey. Miscellaneous Publications: No. 1, List of Elevations; No. 2, Meteorological Observations, in 1872; No. 5, Catalogue of Photographs: Bulletin Vol. I, First Series, No. 2, Second Series, Nos. 4, 5, 6; Bulletin, Vol. II, Nos. 1, 2, 3, 4.
- U. S. Coast Survey.* Report for 1873.
- Surgeon General's Office.* Circular No. 1, Report on Epidemic Cholera and Yellow Fever; Circular No. 2, Excisions of the Head of the Femur, for Gunshot Wounds; Circular No. 8, Hygiene of the U. S. Army and Military Posts; Medical Statistics of Provost Marshal's Bureau, 2 vols.; List of Skeletons and Crania in the U. S. Medical Museum; List of Preparations and Objects of Human Anatomy.
- Signal Service Office, U. S. A.* Daily Weather Bulletin, September, 1872 to November, 1873, 15 vols.; Practical Use of Meteorological Reports and Weather Maps; Instructions to Observer Sergeants.
- Engineer Office, U. S. A.* Report of Lieut. G. C. Doane, Yellowstone Expedition, 1870; Report of Expedition up Yellowstone River, 1875. (*Forsyth & Grant*); Report of Explorations in Nebraska and Dakotah, 1855, '56, '57, (*Warren*); Explorations Across the Great Basin of Utah, 1859; (*Simpson*); Expedition from Santa Fe to Junction of Grand and Green Rivers. (*Maccomb*), Geological Report, by Prof. Newbury; Exploration of the Black Hills of Dakotah, 1874, (*Ludlow*). Explorations West of One Hundredth Meridian, (*Lieut. Wheeler*): Progress Report, 1872; Annual Report, 1875; Final Report, Vol. III. Geology, Vol. V. Zoology: Preliminary Report on Invertebrate Fossils, (*White*): Systematic Catalogue of Vertebrata of New Mexico, (*Cope*).
- Bureau of Education, Department of the Interior.* Public Libraries of the United States, Part I; Part II.
- Smithsonian Institution.* List of Foreign Correspondents, 4th edition; Check List of Publications, July, 1874; Archaeological Collection of U. S. National Museum, in charge of the Smithsonian Institution, by *Charles Rau*.
- U. S. Naval Observatory.* Reports of Foreign Societies on Medals to American Arctic Explorers; Instruments and Publications of the U. S. Naval Observatory, 1845-1876.
- Field and Forest.* Vol. I, complete; Vol. II, Nos. 1, 2, 3, 4, 5, 6.

Georgia.

- Historical Society of Georgia, Savannah.* Constitution and By-Laws; Description of Hodgson Hall, Savannah; Miscellanies of Georgia, (*Chappel*), Parts 1, 2; Wilde's Summer Rose.

Illinois.

- Illinois State Microscopical Society, Chicago.* The Lens, Vols. I, II, complete.

- Ottawa Academy of Natural Sciences.* Origin of the Prairies, by J. D. Caton; American Cervis, by J. D. Caton; Land and Fresh Water Shells of La Salle Co., Illinois, by W. W. Calkins.
- Scientific Association of Peoria.* Constitution and By-Laws.
- Geological Survey of Illinois*; A. H. Worthen. Report, Vol. I, Geology; Vol. II, Paleontology.
- Rantoul Literary Society.* Reports, etc.
- Illinois Wesleyan University.* Nineteenth Catalogue, 1876-77: The Alumni Journal, Vol. VI, No. 9. Sept. 1876.

Indiana.

- Geological Survey of Indiana.* E. T. Cox. Annual Report for 1875.
- Richmond Scientific Association.* Transactions No. 1, June, 1875.
- Botanical Bulletin*, J. M. Coulter, Editor, Vol. I, No. 12; Vol. II, Nos. 1, 2.

Iowa.

- Davenport Library Association.* Finding List, 1876; Pacific Railroad Surveys, Vols. I, III and IV.
- Davenport Women's Centennial Association.* Proceedings of the Davenport Academy of Natural Sciences, Vol. I, 1867-76; 750 or more complete copies.
- Iowa State Library; Des Moines.* Census of Iowa, 1856, '59, '63, '67, '69, '73,—6 vols. Adjutant General's Report, 1864, '65, '66, '67, '68, '73, '74, '75, '76,—9 vols.
- Iowa College; Grinnell.* Catalogues 1876-77.

Kansas.

- University of Kansas.* Tenth Annual Catalogue 1875-76.
- Kansas Academy of Science.* Transactions, 1873, 1874, and Vol. IV, 1875. (2 copies); Catalogue of the Birds of Kansas, (Snow), third edition.

Kentucky.

- Kentucky University and State Agricultural College.* Catalogue, 1874; Treasurer's Report, 1871; Report of Board of Visitors, 1873; Report of J. B. Borman, 1869.

Louisiana.

- New Orleans Academy of Science.* Philosophy of the University of France (*Sarah A. Dorsey*); The Aryan Philosophy (*Sarah A. Dorsey*); The Entities and Thoughts on Development, &c. (*Forshey*); Lecture on Friends of Horticulture (*Kohn*); Lecture on Formation of Language (*King*); Geological Reconnaissance of Louisiana, 1869 (*Hilgard*); Report on Improvement of Mouth of the Mississippi by Jetties; Report of the Commissioner of Louisiana at the Paris Exposition; Louisiana as It Is, 1876 (*Dennett*).

Maryland.

- Maryland Academy of Science*; Baltimore. Constitution. Charter. and List of Members; Address at Dedication of the Hall.

Massachusetts.

- Boston Society of Natural History.* Proceedings, Vol. XVIII, Nos. 1, 2 :
Report on the Geological Map of Massachusetts, 1876.
- Cambridge Entomological Club.* Psyche, Vol. I, Nos. 1-31.
- Nuttall Ornithological Club.* Bulletin, Vol. I, Nos. 1, 2, 3, 4.
- Museum of Comparative Zoology.* Annual Report for 1875 : Bulletin,
Vol. III, Nos. 11-14, and Nos. 15, 16.
- Peabody Museum of American Archaeology and Ethnology.* Seventh and
Eighth Annual Reports.
- Bussey Institute, Jamaica Plain.* Bulletin, Nos. 2, 3, 4, 5. (No. 1, out
of print).
- Essex Institute, Salem.* Bulletin, Vol. VII, 1875, complete : Bulletin.
Vol. VIII, 1876, Nos. 1, 2.
- Peabody Academy of Science, Salem.* Annual Reports. 1, 2, 3, 4, 5, 6 :
Memoirs, Nos. 2, 3, 4.
- American Association for the Advancement of Science.* Proceedings of
the Detroit Meeting, 1875.
- Worcester Lyceum of Natural History.* Centennial Pamphlet : Officers
and Constitution : Catalogue of the John M. Earle Collection of
Shells.

Minnesota.

- Minnesota Academy of Natural Sciences, Minneapolis.* Constitution, etc.,
1873 : Bulletin, 1874, 1875 ; Geological, and Natural History Survey
of Minnesota, Second Annual Report.

Missouri.

- Historical Society of Missouri.* Address at the International Expositi-
tion, (*Allen*) ; History of St. Louis and Missouri.
- St. Louis Academy of Science.* Transactions, Vol. I, Nos. 2, 3, (No. 1
out of Print) ; Vol. II, complete ; Vol. III, Nos. 1, 2, 3.

New Hampshire.

- New Hampshire Historical Society.* Collections, Vol. VIII.

New Jersey.

- Stevens' Institute of Technology.* Annual Annoucement, 1876 ; Strength
of Materials of Machine Construction, (*Thurston*) ; Methods of
detecting phases of vibration in sound ; Method of measuring
wave lengths, etc., of sound in gases ; History of Young's discov-
ery of his Theory of Colors ; Effects of Magnetism on Dimensions
of Iron, etc. : Researches in Acoustics, Papers Nos. 5, 6, 7 ; Method
of fixing and photographing magnetic spectra ; Determination of
Constants of the law connecting the pitch of a sound, with dura-
tion, etc., (*Mayer*).
- Passaic Historical Society, Paterson.* Newspaper Report.

New York.

- Albany Institute.* Transactions, Vol. VIII.
- New York State Museum of Natural History.* Reports 20, 21, 23, 24, 25,
26, 27.

- New York State Library.* State Cabinet Reports, 8; 9, 10, 11, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27.
- Cornell University, Ithaca.* Warfare of Science. (*White*): Register and Catalogue, 1875-76.
- American Geographical and Statistical Society.* Transactions and Journal, Vols. 2, 3, 4, 6. Vol. 1 out of print.
- Columbia College.* Catalogue of the Library; Report of the Librarian, 1875.
- Torrey Botanical Club.* Bulletin, Vols. 1, 2, 3, 4, 5, 6, complete; Vol. 7, Nos. 1-10; Constitution and By-Laws.
- American Museum of Natural History.* Annual Reports, Nos. 5, 6, 7.
- The Nation.* Nos. 588-600.
- Poughkeepsie Society of Natural Sciences.* Proceedings, Vol. I., Part 1, 1875.
- Union College, Schenectady.* Catalogue. 1876, 81st year: Historical Sketch.

Ohio.

- Cincinnati Observatory.* Catalogue of New Double Stars.
- Cincinnati Society of Natural History.* Constitution and By-Laws; Proceedings No. 1, Jan., 1876. Cincinnati Quarterly Journal of Science, Vols. 1, 2, complete.
- Western Reserve and Northern Ohio Historical Society.* Tracts 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32.
- Cleveland Academy of Natural Sciences.* Proceedings 1845-1859.
- Toledo Society of Natural Sciences.* Organization and Constitution 1876: Scientific Monthly, Vol. I, No. 9.
- State Archaeological Association of Ohio.* Minutes of the Convention at Mansfield, Ohio, Sept., 1875; Circulars, etc.

Pennsylvania.

- Academy of Natural Sciences of Philadelphia.* Proceedings 1875. Parts 1, 2, 3.
- Historical Society of Pennsylvania.* Circular regarding Publication Fund.

South Carolina.

- South Carolina Historical Society.* Address on Twenty-first Anniversary (*Rivers*).

Vermont.

- University of Vermont.* Catalogue 1876-77; Address before O. B. K. Society (*C. K. Adams*); Transactions Vermont Dairyman's Association; Featherstonhough's Geological Reconnaissance of the elevated country between the Missouri and Red Rivers; Featherstonhough's Geological Reconnaissance of the elevated country between the Missouri and St. Peter's Rivers.
- Vermont Historical Society.* Annual Address, Oct. 17, 1876 (*E. A. Soules*).
- Orleans County Society of Natural Sciences.* Archives of Science, and Transactions, O. C. S. N. S., Vol. I, complete.

Virginia.

University of Virginia. Catalogue, 1875-76; Semi-Centennial Ode, by D. B. Lucas; Alumni Address (*Hunter*); Economy of Higher Education (*Kean*).

Virginia Historical and Philosophical Society. Newspaper Report.

Wisconsin.

University of Wisconsin. Historical Sketch, 1849-1876.

Wisconsin Academy of Sciences, Arts, and Letters. Transactions, Vol. I, 1870-72 Vol. II, 1873-74.

Wisconsin Historical Society. Collections, Vols. 1, 2, 3, 4, 5, 6, complete: Catalogue, 2 vols., and Supplement; Twenty-First and Twenty-Second Annual Reports; Pre-historic Wisconsin, *J. D. Butler*; Circulars.

Canada.—Province of Quebec.

Literary and Philosophical Society of Quebec. Transactions, 1873-4, 1874-5; Manuscripts Relating to the Early History of Canada, Fourth Series; Siege of Québec, on 31st of December, 1775, Centenary Fete, etc.

Le Naturaliste Canadienne. Vol. VIII, Nos. 1-10.

Province of Ontario.

Entomological Society of Ontario. Annual Report, for 1875; Canadian Entomologist, Vol. VIII, Nos. 1-10.

England.

Newman's Entomologist. Nos. 161, 162, 163.

CORRESPONDING SECRETARY'S REPORT.

To Rev. W. H. Barris, President of the Board of Trustees:

The publication of the "Proceedings" during the past year has caused a very considerable increase in the correspondence of the Academy. A letter or a postal card was written announcing each copy as it was mailed, and requesting a return of exchanges. In the absence of Mrs. McGonegal, this work was undertaken by the undersigned, and at the meeting of the Academy in November they did me the honor to elect me to the vacancy caused by her resignation. One hundred and eighty-three communications were written in September, and seventy-one during the months of October, November and December, making a total of two hundred and fifty-four. About thirty of these were by Mr. W. H. Pratt, and the remainder by myself. During this time two hundred and seventy-eight communications of various kinds have been received, most of them being in acknowledgement of our Proceedings. A large number of publications have been received, of which a detailed account will be found in the report of the Librarian. So far as is known but a small amount of correspondence was carried on previous to Sept. 15th, and of this there has been no record.

A copy book and letter-press were procured, and copies of all letters

written since Sept. 15th have been preserved, and may be readily referred to. The letters received have been filed in the order of receipt, and it is intended to prepare an index so that they can be easily referred to. A blank book has been used jointly by the Publication Committee and Corresponding Secretary, in which to keep their accounts and records.

Twenty-eight corresponding members have been elected during the past year, making a total of sixty-two. Owing to the pressure of other duties during the short time since my election, I have not been able to notify these members of their election.

It seems to me quite important that the Academy should have some suitable certificate of membership to send to its corresponding members. A seal is another of the important needs of the Academy, and I hope that steps will be taken to secure both at an early day.

Respectfully submitted.

Davenport, Jan. 2d, 1877.

J. DUNCAN PUTNAM,
Corresponding Secretary.

REPORT of the COMMITTEE of PUBLICATION.

To the President and Members of the Academy:

In the first Constitution of the Academy, adopted in December, 1867, its object was stated to be the "Increase and diffusion of a knowledge of the Natural Sciences, by a Museum, the reading and *publication of original papers*, and other suitable means." A Museum was soon commenced, lectures were delivered, and papers read before the Society. Occasionally reports of the meetings were published by the city newspapers, but they were usually hastily prepared, and not often preserved. The matter of publishing the Proceedings or Transactions of the Academy in a more permanent form, was ever and anon the subject of discussion, and Dr. Parry never failed to allude to the importance of such a publication to the Academy in his annual addresses as President. But nothing had been accomplished, when, on November 26th, 1875, the following resolutions were presented by J. D. Putnam:—

WHEREAS, The object of the Academy is the increase and diffusion of a knowledge of the Natural Sciences by the establishment of a Museum, the reading and publication of original papers, and all other suitable means; *and,*

WHEREAS, Many original investigations have already been made by our members, some of them being of general, as well as of scientific interest; *and,*

WHEREAS, The publication of our proceedings would be advantageous to the Academy in many particulars, *e. g.:*

1. It will preserve much material that might otherwise be lost.
2. It will furnish a greater incentive to our members to make original investigations.
3. It will increase the Library by means of exchanges with other societies and publishers.
4. It will place us on a creditable footing with the other societies of the world. *Therefore*

be it

Resolved, That the Academy begin the publication of its proceedings with the least possible delay; *and,*

Resolved, That a committee of five be appointed, of which Messrs. W. H. Pratt and J. D.

Putnam (ex-secretaries), and Dr. C. H. Preston (present secretary), shall be members, to decide as to the best form of publication, as to title, etc., and to prepare the records and make selections of reports, scientific papers, etc., and determine on the publication or non-publication of each.

This resolution was adopted, and Messrs. W. H. Pratt, J. D. Putnam, C. H. Preston, R. J. Farquharson, and Geo. H. French, were appointed a committee on publication of proceedings. No means were provided to pay for the work, nor, indeed, was there any very encouraging prospect that any would be forthcoming. In the meantime the committee set to work with a good heart to discuss the various plans for a publication and to prepare the records, but before getting fairly started, the greatest difficulty in the way of publication—a guarantee that it could possibly be paid for,—was removed in an unexpected manner by the

WOMEN'S CENTENNIAL ASSOCIATION.

This Society had been organized during the autumn by the ladies of Davenport for the purpose of having the city represented in the Women's Pavilion at the Centennial Exposition at Philadelphia. It was at first proposed to collect various specimens of women's handiwork, the best samples to be sent to Philadelphia for exhibition, and afterwards to be sold for the benefit of the Academy of Natural Sciences. Many of the ladies, however, felt that such articles would not fairly represent the work of women in Davenport, where they have done so much for the advancement of literature and science. So, when the publication of its proceedings was decided upon by the Academy, the ladies made a proposition to publish the Proceedings of the Davenport Academy of Natural Sciences from December 14th, 1867 to January 1st, 1876, and to exhibit the work at Philadelphia as the result of woman's enterprise.

At a meeting of the Board of Trustees, held December 20th, 1875, the following resolution was adopted :

WHEREAS, The Academy has received a proposition from the LADIES' CENTENNIAL ASSOCIATION, to publish the Proceedings of the Davenport Academy of Natural Sciences to January 1st, 1876,

Resolved, That the Board, on behalf of the Academy, accept the proposition, and tender our hearty thanks for this generous aid in furthering the interests of the Academy.

Resolved, That the committee appointed by the Academy, to whom was intrusted the preparation of the records and selections of reports, scientific papers, etc., be requested to furnish to this Board the matter designed for publication with as little delay as possible.

Mrs. Charles E. Putnam, Mrs. Thomas McCullough, Mrs. M. A. McGonegal, Mrs. M. A. Sanders and Mrs. S. B. R. Millar, were appointed a committee to attend to the details of the publication by the Centennial Association. Under this arrangement the Ladies' Committee attended to all financial matters connected with the publishing of the Proceedings. To them belongs all the credit of securing the necessary funds, and making the contracts for the execution of the work. In fact, they assumed the entire responsibility of raising the money and paying for the publication, while the preparation of the manuscript, correction of proofs, etc., was managed by the regular Publication Committee of the Academy.

Before undertaking this work, the Ladies' Centennial Association had

already given a "Centennial Tea Party," in November, of which the net proceeds were \$176.00; \$100.00 of this sum was now set aside for the publication, while the remainder was kept as a reserve fund, to be used in any manner the Association might find necessary or expedient. A subscription paper was prepared and circulated by the chairman of the Ladies' Committee, with such great success that the Committee felt no hesitancy in making the final contracts with the printers and engravers for the execution of the work. An estimate of the work to be done was sent to each of the printing establishments in Davenport, Rock Island and Moline, and bids were received from four offices. On the 8th of February, a contract was signed by Messrs. Bronson, Davis and Fluke, and the members of the Ladies' Committee individually, in which the former agreed to print 1,000 copies of the volume, consisting of 250 pages, 100 copies to be bound in cloth, and the remainder in paper covers, all to be done in a strictly first-class and acceptable manner, and the Ladies agreed to pay them the sum of \$419, and \$1.50 for each additional page, upon completion of the contract. They also made a contract the same day with Mr. L. Hagebøck to furnish 1,000 copies each of thirty-two lithographic plates, for which he was to receive \$223.64, and Mr. J. E. Rice was engaged to make a wood-cut of one of the copper axes.

The Academy committee had, in the meantime, been engaged in preparing and revising the records, and as soon as the printers were ready they were furnished with copy, and work was at once begun.

On the evening of the 22d of February the Ladies gave the first of what was to have been a series of Centennial entertainments for the benefit of the Publication Fund, in Olympic Hall. The exercises the first evening consisted of tableaux, supplemented by a "Martha Washington" Reception and Tea Party. Although the admittance fee was but ten cents, the Ladies cleared about \$121.00 that evening, and the prospect of success looked very bright. An Art Gallery had been projected in connection with the other entertainments. This part of the enterprise was undertaken by the "BRIC-A-BRAC CLUB," a literary society of young ladies, and was a great success in every point of view. The exhibitions of paintings, engravings and reliques, loaned by the various owners, far surpassed the expectations of any one.

But the Ladies were destined to a severe trial, for early on the morning of the 23d, Olympic Hall took fire and burned to the ground, together with the entire block in which it stood. As the entertainments were intended to extend over several days, a large quantity of valuable property had been left in the Hall—much of it borrowed of merchants and others who could ill afford the loss. At a meeting held on the morning of the fire, the ladies decided that though they might not be legally bound, yet they held themselves morally responsible to pay all losses to persons who had loaned articles for the entertainment. The entire amount of these losses was over \$1,500, about \$500 of which was generously remitted. They set to work with a wonderful energy to raise money with which to pay the balance, and in less than three weeks

every debt was paid. The Ladies of the Centennial Association were greatly aided in their efforts to raise the money by the *Bric-a-Brac Club*, the *Parlor Club*, and by the citizens generally. A party of ladies and gentlemen from Rock Island and Moline, gave a very successful entertainment in the Burtis Opera House for the benefit of the "Fire Debt Fund."

Fortunately the "Art Gallery," under the supervision of the *Bric-a-Brac Club* had been established in a vacant store in Davenport's old block, at a distance from Olympic Hall, and escaped the fire. It was kept open for one week, and was constantly thronged with appreciative visitors. The receipts were upwards of \$600. Of this sum \$250 was paid over to the Ladies' Publishing Committee, that amount being sufficient, in connection with funds already on hand and subscriptions promised, to pay all contracts for getting out the book. The remainder was appropriated to paying the fire debts. At a meeting of the Academy, February 25th, resolutions were passed sympathizing with the Ladies in their misfortune, and thanking them for their endeavors to publish our Proceedings, but suggesting its postponement until a more favorable time.*

The Ladies' Publishing Committee now had \$350 in their hands in addition to the amount of private subscriptions which had been promised, and the fire debt having been reduced to about \$150, they decided to loan that amount to the committee having in charge the settlement of these debts. This reduced the amount of funds on hand to \$200, but having already the promise of about \$300, subscribed by private individuals, with a prospect of further subscription, they decided to continue the publication, and trust to future efforts for the re-payment of the \$150.

Naturally enough, the ladies felt the need of rest after so great exertion, but the work of printing went steadily on, though on account of various delays the printers were unable to fully complete the work and deliver all the books before December 1st. By the terms of the contract they were to be paid in full upon its completion. The bill of Davis & Fluke was \$665.58—there having been fifty pages more printed than called for in the contract, besides other extras. Of this sum \$368.00 had already been paid by the Ladies, leaving \$287.58 still due. This sum was advanced by a member of the Academy, who was anxious to see the work a success.

During the month of May two incomplete copies were sent to Philadelphia for exhibition at the Centennial Exposition in the Women's Pavilion, and in the Iowa Educational Department. These were duly replaced by the completed volumes in October.

Early in December the Ladies decided to give a dinner in order to raise enough money to repay the \$150 used during the spring to pay the balance of fire debts, but the weather became suddenly very severe, and they concluded to raise the sum by subscriptions among themselves. In this they were entirely successful. The \$150 was all raised, and in addition the sum of \$30.35 balance remaining from the Centennial Fourth of July

*Ante, page 4.

celebration, was generously donated to the Ladies by the committee having the celebration in charge, making a total of \$189.35 with which to reimburse Mr. C. E. Putnam, who had so generously met the printers' bill when it became due. This has enabled the Association to close up their accounts with the close of the Centennial year, with a small balance on hand. The following synopsis of accounts will show from whence the funds have been received and how disbursed :

DR.	Cr.
To subscriptions for books.....\$ 304.50	By woodcuts, electrotypes, etc.....\$ 21.85
To sale of books..... 329.63	By lithographs (35 plates)..... 259.64
To special subscriptions..... 39.00	By insurance on plates..... 9.00
To author's extra sheets..... 18.45	By lithographs, plates 35-33..... 88.00
To Art Gallery by Bric-a-Brac Club.. 250.00	By printing and binding..... 632.38
To other entertainments, etc..... 115.20	By printing extra sheets..... 23.95
To balance from Fourth of July celebration..... 30 35	By expenses of distribution..... 48.05
	Total expenditures.....\$1,082.87
Total receipts.....\$1,087.13	Balance on hand.....\$ 4.26

In accordance with the original proposition of the Ladies to publish the Proceedings, it is expected by them that all proceeds from its sale shall continue in a special fund, to be devoted to future publications.

Having thus successfully completed their task, the Women's Centennial Society, on the 27th day of December, A. D. 1876, formally disbanded.

PREPARATION OF THE MANUSCRIPT.

The preparation of the manuscript devolved upon the regular Publication Committee of the Academy. This committee met frequently during the winter, often in connection with the Board of Trustees. It was decided to have the publication of Proceedings begin with the first organization, and thus give a complete history of the Academy. This involved the rearranging, copying and revising of the records of the Academy for over eight years, a very difficult piece of work, which was executed in a most commendable manner by Miss Lucy Pratt, with the direction and advice of members of the committee. The records, as thus prepared, were carefully revised and corrected by the committee, and were accepted by the Trustees.

During the early history of the Academy, but a comparatively small number of scientific papers were read at the meetings, and these were often of a very general nature. Many of these could not be found, and others containing no new facts, it was decided not to publish. It was also decided to omit all simply theoretical papers not supported by original observations. Fortunately for the committee, there was scarcely a paper presented which could not be accepted for publication. Several papers were rewritten and several were prepared especially for publication in this volume, and not read at the meetings. Each paper was carefully read and passed upon by the Committee and Board of Trustees. The

following papers, accepted for publication, have been printed in the first volume of Proceedings :

BY E. T. CRESSON, PHILADELPHIA, PA. :

1. List of Hymenoptera collected by J. Duncan Putnam, of Davenport, Iowa, with descriptions of two new species.

BY DR. R. J. FARQUHARSON:

1. A paper entitled, Do rifle balls, when striking the animal body, burn?
2. A study of skulls and long bones from mounds near Albany, Ills.
3. Recent Archeological Discoveries at Davenport, Iowa, of Copper Axes, Cloth, etc., supposed to have come down to us from Pre-historic People, called the Mound Builders.

BY DR. E. H. HAZEN :

1. President's Annual Address, January 5th, 1876.

BY J. G. HAUPT :

1. List of Phenogamous Plants collected in the vicinity of Davenport, Iowa, by J. J. Nagel and J. G. Haupt, during the years 1870 to 1875, inclusive.

BY CLARENCE LINDLEY:

1. Mound Explorations in 1875.

BY DR. C. C. PARRY:

1. President's Valedictory Address, March 12th, 1869.
2. Obituary Notice of Prof. John Torrey, M. D.
President's Annual Address, January 7th, 1874.*
3. President's Annual Address, January 9th, 1875.
4. Summer Botanizing on the Wasatch Mountains, Utah Territory.

BY W. H. PRATT:

1. Meteoric Shower, Nov. 13th, 1868.
2. Force and Motion. (Abstract.)
3. Report on a Geological Examination of the section of the Bluffs recently exposed by the C., R. I. & P. R. R.
4. Report of Explorations of the Ancient Mounds at Albany, Whiteside County, Ills.
5. Report of Explorations of the Ancient Mounds at Toolshoro, Louisa County, Iowa.
6. Report on the Condition of the Museum, January 5th, 1876.
7. List of Land and Freshwater Shells found at Davenport, Iowa.
8. Description of a Unio shell, found on the south bank of the Mississippi River, opposite the Rock Island Arsenal, in 1870.

BY DR. C. H. PRESTON:

1. Synopsis of a paper on Storms. The cold wave of Jan. 7th to Jan. 11th, 1875.

BY CHAS. E. PUTNAM:

Resolutions on the death of D. S. True.

BY J. DUNCAN PUTNAM:

1. The Maple Tree Bark Louse (*Lecanium acericola* W. & R.).
2. Hieroglyphics observed in Summit Canyon, Utah, and on Little Popo-agie River in Wyoming.
3. List of Coleoptera found in the vicinity of Davenport, Iowa.
4. Coleoptera collected at Monticello, Iowa, June 12th, 1872.
5. Coleoptera collected near Frederic, Monroe County, Iowa, August, 1869.
6. List of Lepidoptera collected in the vicinity of Davenport, Iowa.
7. List of Coleoptera collected in the Rocky Mountains of Colorado in 1872.
8. List of Lepidoptera collected in Colorado during the summer of 1872.
9. Report on the Insects collected by Capt. Jones' Expedition to Northwestern Wyoming in 1873. Indian Names for Insects.
10. Report on the Insects collected in the vicinity of Spring Lake Villa, Utah County, Utah, during the summer of 1875.
11. Notes on Dr. Thomas' paper on Orthoptera.

*A copy of this Address was not found until after the printing of the volume had been completed. It will be appended to this volume.

BY DR. CYRUS THOMAS:

A list of Orthoptera collected by J. Duncan Putnam, of Davenport, Iowa, during the summers of 1872, '73, '74, and '75, chiefly in Colorado, Utah and Wyoming Territories.

BY A. S. TIFFANY:

1. Discovery of Human Remains in a shell-bed on Rock Island.
2. On an ancient copper implement donated by E. B. Baldwin.
3. On a supposed Pre-historic Cremation Furnace.
4. Report on the results of the excursion to Albany, Ills., Nov. 7th and 8th, 1873.
5. Mound Explorations in 1875.

The other matter contained in this volume was prepared by the different members of the committee. * * *

In the published Proceedings the details of business matters have been greatly condensed, or even sometimes omitted, while occasionally remarks on new observations or discussions which were briefly mentioned in the minutes, have been slightly elaborated from notes preserved by the members. It is very unfortunate that many observations of real value have been so briefly recorded. The verbal remarks made before such a society as ours often contain information of both interest and value, and the RECORD OF PROCEEDINGS would be much more interesting if these loose observations were carefully reported. They should, of course, whenever possible, be revised by the authors before publication.

It would be impossible in printing such a book for the first time, to avoid having a considerable number of typographical errors. We always found Messrs. Davis & Fluke very obliging and accommodating. Considering the number of vexatious delays and other difficulties they deserve great credit. The printing was commenced February 14th, but owing to a variety of causes, for some of which the committee, and for others the printers themselves were responsible, it was not completed until the first week in August. The binding was done by R. Crampton, of Rock Island. The entire work was completed, and 990 copies of the volume were delivered at the Academy Rooms on and before December 1st. Messrs. Davis & Fluke very kindly donated a considerable number of over-sheets, including about sixteen complete volumes, for which there were not a sufficient number of plates. These sheets may hereafter be useful to the Academy, and it was thought best to preserve them.

ILLUSTRATIONS.

The very considerable number of interesting relics contained in the Archaeological collection of the Academy, and described by Dr. Farquharson in his paper on the Mound Builders, made it very desirable to have some of the more typical forms figured. When the Ladies undertook the work they decided that the book must be handsomely illustrated, and they would supply the necessary funds.

After considering the various methods of illustration, lithographs were decided upon as being the cheapest and best adapted for the purposes in view. Plates 1, 2 and 3 were drawn by Mr. W. O. Gronen, under the direction of Dr. Farquharson. They should be regarded as diagrams rather than actual sections. Plates 4-8, illustrating some of the many reliques

found in the mounds in this vicinity, were drawn by Mr. W. H. Pratt, either directly from the objects themselves, or from photographs, and then reduced with a pantagraph. A large number of the figures of flint and stone implements on Plates 9-19 were selected and originally drawn by Miss Alice French, and were afterwards transferred and prepared for the engraver by Mr. Pratt, who also made some additions. It is unfortunate that no description of these relics was prepared for the book. It should be stated here that these plates exhibit only a very small proportion of the forms to be found in the Academy's collection. The outlines of skulls on Plates 20-25 were all drawn by Mr. Pratt from the shadows, and reduced to one-fourth of natural size with a pantagraph. They give a very good idea of the different shapes of the skulls. Plate 26 was drawn by Mr. Putnam, the upper section from the description and a diagram by Mr. Tiffany, and the lower figure from an original sketch. Plates 27-30 are from original sketches made in Wyoming and Utah by J. D. Putnam, but the lithographing has been very roughly done. Plate 31 was drawn from nature by Mr. Pratt, and Plate 32 is from a survey of the cut of C., R. I. & P. R. R., made by Mr. Pratt some years ago. Plates 33-34 were received through the courtesy of Mr. F. W. Putnam, Permanent Secretary of the American Association for the Advancement of Science, in exchange for an equal number of Plates 2 and 3. Plates 5 and 6 were also published in the Proceedings A. A. S. Plates 35 and 36 were drawn and engraved from the original specimens by Herman Strecker, of Reading, Pa., and are accurate representations of the insects figured. In a limited edition these plates have been colored.

An electrotype of the map of the Albany Mounds was received from the Smithsonian Institution, having been used to illustrate an article by Mr. Pratt in the Report for 1873. A woodcut of one of the cloth-covered axes was engraved by Mr. J. E. Rice from a photograph.

Through the liberality of Mrs. Ebenezer Cook, a gilt stamp, representing one of the copper axes, has been placed on the covers of the bound volumes.

DISTRIBUTION.

Four copies of the book were first received at the Academy Rooms on August 28th, and the remainder in varying quantities at different dates, the last copies being received December 5th, making a total of 990 complete copies, besides sixteen copies, lacking the plates, and a large quantity of surplus sheets. Of this number there were :

309 copies bound in cloth with a gilt side stamp.

681 copies bound in paper covers.

787 copies were printed on white paper—154 bound.

203 copies were printed on tinted paper—155 bound.

In 72 copies Plates XXXV and XXXVI were colored.

These books were delivered at the Academy Rooms by order of the Ladies' Committee having the publication in charge. With the consent, and partly at the suggestion, of the Ladies, the distribution of the books

to other societies. in accordance with the original object of the publication, was commenced as soon as a list of societies* could be prepared, and 183 copies had been thus distributed, besides 212 copies sold or delivered to subscribers before the books were formally turned over to the Academy at the meeting October 10th. In accordance with the wishes of the Ladies, all proceeds arising from the sale of books have been applied to the payment of the printers. In December, 198 copies of the book were sent to the Smithsonian Institution for distribution to foreign countries. Of this number 172 were addressed to such societies as have sent exchanges during the past two years to other similar societies, as the St. Louis and Philadelphia Academies. This list was made out also by Mr. Putnam, with aid and advice from Dr. Parry and Mr. Pratt. The books were packed in a box and sent by express to Washington. It is confidently believed that a large number of valuable publications will be received in exchange for these.

The following statement shows the exact manner in which the books have been distributed. Accompanying this report is a list giving the name of each society or individual to whom books have been sent.

ENTIRE NUMBER OF BOOKS RECEIVED.....	990 COPIES.
Delivered to subscribers.....	103 "
Sold for cash.....	120 "
Distributed to scientific men, etc , for exchange	50 "
Distributed to editors for review and exchange.....	34 "
Distributed to societies in the United States and Canada.....	165 "
Sent to the Smithsonian Institution for foreign distribution.....	198 "
On hand.....	301 "
Unaccounted for.....	8 "
Total.....	990 "

RESULTS.

The publication of its "Proceedings" has proved of great benefit to the Academy in many ways. It has, to a great extent, opened to us our own resources, and has brought us into active communication with nearly all similar societies throughout the world. By means of exchanges, our Library has been greatly increased, already 121 complete volumes and 351 pamphlets and parts of volumes have been received, and it is but a few days over three months since the first books were distributed. These exchanges have been received from but 94 institutions and individuals, less than one-fourth of the number to whom books have been sent. Scarcely a day passes but some new book is received, and twelve or more periodicals are sent to the Academy regularly; among them *The Nation*, *The Canadian Entomologist*, *Le Naturaliste Canadien*, *Coulter's Botanical Gazette*, *Field and Forest*, *Psyche*, *Bulletin of the Essex Institute*, *Bulletin of the Torrey Botanical Club*, *Bulletin of the Nuttall Ornithological Club*, *Proceedings of the Boston Society of Natural History* and of the *Philadelphia Academy of Natural Sciences* and *Newman's Entomologist* (London).

*This list was made out and most of the labor of distribution was done by Mr. J. D. Putnam, with the advice and assistance of other members of the committee, Drs. Preston and Farquharson and Mr. Pratt.

It is very difficult to place a money valuation of the publications that have been received, for a large portion of them are not for sale at any price, and are very difficult to obtain. But a careful estimate shows that there has been already received works to the value of not less than \$300, and probably much more.

Numerous letters have been received from some of the leading naturalists in the country, congratulating the Academy upon the fine appearance of its first publication, and the energy of its lady members in being able to publish so creditable a volume. It is said to be the best *first publication* of a young society ever issued in this country. The appearance of such a publication from west of the Mississippi was entirely unlooked for, and it can scarcely be credited that we are a society almost without funds and without a library, and yet show such positive evidence of an enthusiastic membership. Very favorable notices of the PROCEEDINGS have appeared in *The Nation* for Oct. 5, *Field and Forest* for November, *Psyche* for October, *Harpers' Monthly* for December, the *American Naturalist* for December, *Popular Science Monthly* for January, the *Botanical Gazette* for November and again in December, the *American Journal of Science and Arts* for October, the *Common School* for December, the *San Bernardino (Cal.) Times*, the *Patterson (N. J.) Evening Bulletin*, the *Rock Island Argus*, the *Davenport Daily Democrat*, *Davenport Der Demokrat*, and probably others which we have not noticed. Not one unfavorable criticism has been made by anybody, either at home or abroad. These notices have given our little Academy a fame throughout the world, such as is possessed by but comparatively few older and more worthy institutions. The city of Davenport, too, comes in for its full share of the glory, and has already been designated more than once as being in a fair way to become the "Athens of the West."

Now, that our first publication has proved such a decided success, it is quite important we should not let our enthusiasm suddenly subside, but some means should be provided for the continuance of publication of the Proceedings. It would be better to print the Proceedings in parts, and issue them at regular intervals, and as soon after each meeting as possible. In this way, the work being extended over a longer time, the expenses might be more easily met. In printing another volume it is recommended that a slightly larger page and heavier paper be used, so as to render our Proceedings more uniform with those of other similar societies. The proof reading should be more carefully attended to.

A list of exchanges received, and some extracts from letters and notices of our work are herewith submitted.

There remains in the hands of the committee 301 complete copies of the Proceedings, Vol. I, besides sixteen copies without plates, and a quantity of surplus sheets. These should be placed in charge of such officer or officers of the Academy as the Board of Trustees may direct. The exchanges which have been received should be turned over to the Librarian to be incorporated in the Library.

In closing this report we desire to express our heartfelt thanks to the Women's Centennial Association for the important aid they have ren-

dered us in the publication of our Proceedings; to the printers for their uniformly accommodating manner upon all occasions, and to all others who have aided us, either by work performed or advice given.

Respectfully submitted.

W. H. PRATT,
J. DUNCAN PUTNAM,
R. J. FARQUHARSON,
C. H. PRESTON,

Davenport, Jan. 3d, 1877.

Committee.

The retiring President, Rev. W. H. Barris, then delivered his

ANNUAL ADDRESS.

Ladies and Gentlemen:

In compliance with custom, and carrying out the provisions of our by-laws, it becomes the duty of the retiring President to make a report on "the condition and progress of the Academy in all its departments." Such a paper must necessarily gather its material mainly from the reports of the other officers of the Society.

The report of the Treasurer shows our financial status to be sound. In one respect our Academy is a model. Our receipts for the year have been in excess of our expenditures.

From the report of the Recording Secretary we find that during the year there have been fifteen business meetings of the Trustees, and thirteen regular meetings of the Academy. The latter have averaged a fair attendance, though not as full as we could have desired, yet embracing those most devoted to our work.

The report of the Librarian shows the additions that are constantly being made to the Library. Every addition is a new argument for increased accommodations. Even at the beginning of the year our two cases were crowded to overflowing. Since that time the number of books have more than doubled; 360 volumes have grown to 900 volumes and pamphlets. The two or three cases modestly asked for by our Librarian are needed *now*. We have yet to hear from the vast mass of our foreign exchanges, and if they respond at all in proportion to their capability, we shall be in no condition properly to care for them.

The report of the Curator is in your possession. In Archæological remains, the number of stone and flint implements during the year has been doubled. In the departments of Mineralogy, Geology and Palæontology, the collection has steadily increased. In Botany, valuable contributions have been received. In Zoölogy the acquisitions have been quite extensive. With the recital of work done in this department, we are again confronted with the wants of the Academy. The Curator is ready, and has done his part in the proper identification and classification of the material under his hand, but as to its full arrangement and scientific presentation to the eye, such as shall make it subserve the highest purposes of education, in this he is sadly crippled.

Such result cannot possibly be looked for in our present condition, till

far greater facilities and spaces are afforded, so that whether we regard the wants of the cabinet or library, we are led in but one direction, and to but one result. We need a fire-proof building, which will not only preserve what we have in possession and in prospect, but become a permanent place of deposit for valuable libraries and cabinets scattered over the State, and which, even now, await our action.

The report of the Corresponding Secretary is suggestive of patient, quiet, persistent work. This post, whatever it may have been in past years, is now no sinecure. An immense amount of correspondence, foreign and domestic, now devolves on this officer. The number of letters written, though for the past three months averaging eighty per month, is no measure of head and brain work required for such a task. It could only be wrought by one whose heart is in his work, to which he is devoting the best energies of his life.

I suggest, with reference to the offices so far considered, that there be as little change as possible in the status of the present occupants. When men are well qualified for their respective positions, either by the possession of thorough scientific acquirements or acknowledged business habits, it is not wisdom to change. With the offices of President and Vice President it is different. More and greater good may, and no doubt will, accrue by change, bringing with it new accessions of interest and strength.

The report of the Publication Committee furnishes us with a full history of the Women's Centennial Association, their exposures, temptations, trials, battles, victory—of which victory they wear the crown; we reap the more substantial benefits. It contains, in addition, a complete account of the preparation of manuscripts, illustrations, publication and distribution of the Proceedings of the Academy to individuals as well as societies, the returns they have brought us, and the arrangement of the whole is so complete, that the merest item of detail can be turned to at once. Whatever disposition may be made of the paper, it deserves a prominent place in the archives of the Academy, not only valuable to us, but to those who come after us. The cost of publication and distribution up to date has been \$1082.87, the whole of which has been paid, with a small balance in our favor. By way of exchange for 92 numbers of the Proceedings, there have been received 120 complete volumes, 357 pamphlets, at a rough valuation worth over \$300. In addition, I may note that among the works already received are many that it is simply impossible to purchase.

In May last a new feature was introduced into the Academy—the organization of Sections. One of these was the Biological Section. There may be much in the nature of the subject, but more in the qualifications of the parties composing it, that has given it marked prominence. Not only has it been fully attended, but the interest has kept up since its organization. Many causes may have combined to interfere with the work of the other Sections. Whether they can be removed remains to be seen. Workers are comparatively few and limited as to the necessary knowledge with which to work to advantage.

I would suggest whether in each of the Sections, especially in those that

as yet have attempted little, there might not be founded schools of instruction, where especially the younger members might regularly secure such practical instruction from the lips of the living teacher as shall qualify them for efficient, practical work. In each Section might be found some one willing in this quiet way to further the interests of the Academy.

I would emphasize the recommendation of the Curator that especial attention be directed to the collection and study of the fishes and reptiles found in our vicinity. This department is full of interest, and to work it up faithfully would add greatly to the reputation of the Academy.

It is hoped that the present season may witness a further and fuller exploration of the mounds in our vicinity. Much of the interest awakened in the publication of our Proceedings is traceable to the fact that it abounds in illustration of these relics of the past. Men who are not particularly drawn out or interested in scientific studies and details, readily recognize the importance of such collection, and are ready to contribute to it. We have but to look around our cabinet, and in the array of stone implements deposited or given to the Academy, realize that the popular heart and hand has nobly responded to this department of our work. We are masters of the situation. There remains much land to be possessed.

The year just closed is, in many respects, the most auspicious year in our history. The publication of our Proceedings has given us a position we must not forfeit. Already three papers have been presented as material for the commencement of a new volume. They will rank favorably with papers published by any similar society. They present facts new to science, and most worthy a place in the archives of any of our sister societies. The same reasons exist for publication as before. There is the inherent value of the papers themselves. We have no right to hoard up such facts; we have no right to shut them up within the four walls of this society. It is our duty to disseminate the knowledge and light we gather to add to the wealth and stimulate other and distant workers in the various departments of science. That this is expected of us is fully proved by the pleas that come up from so many quarters for what we have already done. The wants of the Academy can alone be met by full publication. No society can work independently of others. Without their aid we may be toiling and plodding on problems which they solved years ago. With each fact new to science our own horizon expands. Facilities are offered by exchanges, enabling us to compare our best work with others—to do honest, permanent work.

I remind you that the returns already made are full of promise. We have even now the first fruits—the earnest of a full rich harvest.

The election of officers for the ensuing year was then held, with the following result:

President—REV. S. S. HUNTING.

Vice-President—DR. C. H. PRESTON.

Recording Secretary—DR. C. C. PARRY.

Corresponding Secretary—J. DUNCAN PUTNAM.

Treasurer—DR. M. B. COCHRAN.

Librarian—DR. E. H. HAZEN.

Curator—WM. H. PRATT.

Additional Trustees—REV. W. H. BARRIS, DR. R. J. FARQUHARSON, WM. RIEPE.

On motion of Dr. M. B. Cochran, the thanks of the Academy were tendered to the retiring officers for their faithful and efficient performance of duty.

The following persons, proposed at the last regular meeting, were duly elected honorary members of the Academy: Prof. Asa Gray, M. D., Cambridge, Mass.; Prof. Joseph Henry, Washington, D. C.; Dr. John L. Le Conte, Philadelphia, Pa.; Dr. J. P. Kirtland, Cleveland, Ohio; Dr. J. D. Hooker, Director Royal Gardens, Kew, England; Prof. Alphonse De Candolle, Geneva, Switzerland; Dr. Wm. B. Carpenter, London, England; Prof. J. O. Westwood, London, England.

The committee appointed at the last regular meeting to draft resolutions in acknowledgement of the services rendered by the Ladies of the Women's Centennial Association in providing means for publishing the first volume of Proceedings of the Academy, reported the following, which was unanimously adopted:

WHEREAS, During the past year (1876) an organization, known as the Women's Centennial Association, has generously volunteered and efficiently carried out a plan to supply the necessary funds for publishing Vol. I of the Proceedings of the Davenport Academy of Natural Sciences. In duly acknowledging the value of this timely gift, which has placed at the disposal of the Academy, free of all debt, the means of securing a large and constantly accumulating series of scientific exchanges to enrich its Library and Museum, we are not unmindful of the great labor involved in the undertaking, which, though securing liberal aid from other kindred associations of ladies, and always warmly seconded by the generous contributions of the community at large, has had to contend with serious losses by fire, and an unusual stringency in pecuniary affairs, yet still brought to a successful conclusion during the Centennial year just closed; therefore, be it

Resolved, That the most sincere thanks of the Davenport Academy of Natural Sciences is due, and is hereby tendered, to the Ladies, both individually and collectively, who have been instrumental in carrying out

this generous and laborious enterprise ; that, as a scientific society, we shall ever cherish a most grateful recollection of the valuable assistance thus rendered in promoting one of the principal objects of the Academy, and desire herewith to place on our permanent records this testimony to the great value of the services thus rendered to the cause of science by the ladies of Davenport.

Dr. C. C. Parry offered the following resolution, which was unanimously adopted :

Resolved, That the thanks of the Davenport Academy of Natural Sciences are hereby tendered to the PUBLICATION COMMITTEE for their efficient and faithful labors in superintending the publishing of their Proceedings ; while recognizing the trials and difficulties under which this duty has been performed, and the engrossing labor necessarily incurred, we are satisfied that their gratuitous efforts have been prompted solely by a desire to promote the best interests of the Academy, and we congratulate them at the conclusion of their labors on the abundant evidence furnished by disinterested and competent parties at home and abroad of the permanent value of their work.

In the same connection we would further express our appreciative thanks to the *Corresponding Secretary* of the Academy, who, in spite of bodily weakness, has accomplished so much mental labor in carrying on a constantly increasing correspondence, and has so judiciously and efficiently aided in the work of home and foreign exchanges.

JANUARY 18TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Five members present.

A number of donations to the Museum of the Section were announced—among others the journal of an old grocery store and lumber business in this city in 1837.

Mr. W. H. Pratt deposited in the Library of the Section a large collection of early New England Historical and Genealogical works, including nearly a full series of the New England Historical and Genealogical Register, besides many other books and pamphlets.

JANUARY 26TH, 1877.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President, in the chair.

Six members present.

Mr. J. D. Putnam reported proceeds from the sale of Proceedings to the amount of \$18.76, which was, on motion, appro-

priated towards paying the expenses of future publications of the Academy.

A proposition was received and accepted from J. D. Putnam to publish Vol. II of the Proceedings of the Academy at his own cost, and to furnish the Academy with 500 copies for distribution, free of expense, provided that 150 copies were subscribed for by members of the Academy and citizens of Davenport at \$3.00 per copy.

Permission was granted to Miss Dubois to use the rooms of the Academy for teaching a French class, three times a week, upon certain conditions.

JANUARY 26TH, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Twenty-four members present.

The President announced the following standing committees for the ensuing year :

PUBLICATION.—J. D. Putnam, C. H. Preston, R. J. Farquharson, C. C. Parry, C. E. Harrison.

MUSEUM.—W. H. Pratt, R. J. Farquharson, C. C. Parry, A. S. Tiffany, J. Gass, J. Hume.

LIBRARY.—E. H. Hazen, C. H. Preston, E. P. Lynch, J. G. Haupt, C. T. Lindley.

FINANCE.—M. B. Cochran, G. H. French, C. E. Putnam.

FURNITURE.—John Hume, W. H. Pratt, Mrs. C. E. Putnam, Mrs. M. A. Sanders.

The Corresponding Secretary reported a large number of letters received, and answered during the month, all of which had been filed and the answers copied.

The Curator reported a large list of donations to the Museum, including a fine series of Florida corals and shells from the Chicago Academy of Science, and a collection of bird's eggs from Dr. J. W. Velie. The thanks of the Academy were tendered the donors.

Mr. Pratt exhibited a photograph of a gray ground squirrel (*Spermophilus Franklinii*) rolled up into a perfect sphere, with the head completely out of sight. It was found, frozen solid, in the center of a hay stack, where it had probably gone for the

purpose of hibernating. It was brought to the Academy by Mr. W. R. Smith about a week ago.

The Librarian reported many valuable additions to the Library, received in exchange and by donation, and also the deposit by W. H. Pratt of a very valuable collection of Historical and Genealogical works.

The Committee appointed to audit the accounts of the late Treasurer, reported them correct. The report was accepted and the committee discharged.

Rev. J. S. Jenckes and Chas. M. Putnam were elected regular members of the Academy.

The following communication was received:

DAVENPORT, January 10th, 1877.

After receiving the final report of the Central Committee at the regular meeting on January 9th, it was resolved: That the DAVENPORT TURN VEREINDE deems it its duty to cordially thank the Academy of Natural Sciences for their assistance at our fair of December last; it was further resolved: that we are under special obligations to those members thereof whose untiring zeal and protracted manual labor in arranging specimens, made the display of the Academy so interesting and instructive.

For the Davenport Turn Gemeinde,

CHAS. N. VOSS,
First Secretary.

CHR. MÖLLER,
First Speaker.

To Academy of Natural Sciences, Davenport, Iowa.

A communication was read from the Rev. J. Gass, describing the discovery on the 10th inst. of two inscribed tablets, in a recent further excavation of the mound on Cook's farm near this city, heretofore described in these Proceedings (Vol. I, p. 119, and pl. I, fig. 3) as Mound No. 3, in which he was assisted by Messrs. L. H. Willrodt and H. S. Stoltzenau.* These tablets have been deposited in the Museum of the Academy on the same conditions with the former articles from this group of mounds. The tablets were on exhibition, and much interest was manifested in them by the members present. The larger one was broken by a spade, but is otherwise perfect, and is covered on both sides with a large number of hieroglyphics and

*This communication has been included in a more complete and corrected description of the exploration of this mound, which will be printed hereafter.

pictorial representations of animals, plants, etc. On the smaller tablet are inscribed four circles, nearly perfect, one of them divided into twelve equal parts, each marked with a peculiar sign, and another into four equal parts.

On motion of Dr. C. C. Parry the following resolution was unanimously adopted :

Resolved, That the thanks of the Academy be presented to Rev. J. Gass for his interesting paper, for the zeal and intelligence with which he has prosecuted his successful archæological researches, and that the tablets now on exhibition as the last result of his labors, be known and designated in the future publications of the Academy as the Gass tablets; and further, that the matter of permanent record and illustration be referred to the Publication Committee.

General remarks on the recent remarkable mound discoveries of the Rev. Mr. Gass were made by several members. It being considered important to continue the excavations, a subscription paper was put in circulation to raise funds for mound exploration, and \$45 was subscribed by members present.

Dr. Parry read a letter from Miss Julia J. Wirt, giving some further developments in regard to the mound opened near Payson, Utah, of which she had recently written.* One of the persons engaged in the opening of the mound had reluctantly confessed to her that the wheat was taken *from a mouse's nest*, two or three feet below the surface, and that the stone box was a myth. The other parties in the exploration still stoutly declare its genuineness, but there is little doubt that it is a fraud, gotten up in the interests of the Mormon church. The finding of the stone box accords very well with certain stories in the "Pearl of Great Price," and other works published by the Latter Day Saints.

On motion of Dr. C. C. Parry, Mr. A. S. Tiffany was requested to present to the Academy an illustrated paper on Devonian Fossils, which he has in preparation, with a view to its publication in the Proceedings of the Academy.

Clarence Lindley read the following paper on

*This volume, page 23.

Mound Explorations in Jackson County, Iowa.

BY C. T. LINDLEY.

In Iowa Township, Jackson County, Iowa, four miles below the mouth of the Maquoketa River and about half a mile from the Mississippi, is a group of nine mounds, situated on the farm of Thomas Boothby, near a locality known to the people of the neighborhood as "The Point." The land on which the mounds are situated rises very abruptly from the river. The sweeping view of the two rivers and the height of the elevation makes this a very commanding and beautiful locality, thus exhibiting another example of the taste displayed by these ancient people in selecting the sites of their works. The place is still a favorite resort for fishing parties and hunting excursions.

At my suggestion, Mr. G. W. Boothby, of Goose Lake, Clinton County, Iowa, examined four mounds of this group, and the following account has been prepared from his statements.

The mounds are nine in number, arranged in a single row. The first one examined was that farthest up the river, and may be designated No. 1. This mound was about five feet in height, and was an elongated pyramid in shape, instead of conical, like the others. The remains of seven skeletons were found, three with their heads to the east, and four with the heads to the west. All were lying on their backs. Just above the



FIG. 7.—Two-thirds Natural Size.

skeletons were three or four large stones. Under one of the skulls, belonging to a skeleton having its head to the west, was found a very thin crescent-shaped implement of copper (Fig. 7), which was probably used as a knife.* On the floor of the mound, about four feet north of the center, was found a curious earthen vessel, lying bottom side up. It was about twenty-five inches in circumference, and four inches deep. The frailty of its structure was so great that it was almost wholly destroyed in the attempt to unearth it. Directly under this vessel a perfo-

*A similar implement, from a mound near Fond du Lac, Wis., is figured by Dr. Rau in his *Account of the Archæological Collection of the Smithsonian Institution*, page 60.

rated shell, (a river *Unio*,) was found. The perforation was made near the hinge of the shell, which was probably used as an ornament. In this mound, as in all the others examined, numerous pieces of charcoal were found mixed with the earth.

The next mound examined was No. 4. This was of the usual conical shape, and was about five feet high and sixty feet in diameter at the base. Thirty-one skeletons were found lying promiscuously, but principally with the heads south and feet north. All were adults except one child. As in Mound No. 1 a number of stones were found directly over the bodies. On and below the cervical vertebræ of two of the skeletons, 160 copper beads were found, about equally distributed between the two individuals. In three of these beads the twine on which they were strung is quite well preserved. It is composed of some woody vegetable fiber. Eight perforated bear's teeth were found in connection with one of the piles of copper beads. Among the rib bones of one of the skeletons was a flint spear $8\frac{3}{4}$ inches long, being the largest I have ever seen. Numbers of small bivalve river shells were also found in the mound.

Mound No. 6 was then examined. It was of about the same dimensions as No. 4, but probably a little higher. Five skeletons were found, four being on the floor of the mound, while the other was an "intrusive burial," and was about one foot below the surface. This latter skeleton was in a bed of ashes, and all the bones were black and completely charred.

Mound No. 7 was next examined, and but one skeleton was found. This skeleton was covered with rocks so closely that the soil did not reach it at all. An abundance of charcoal and burned stones were found outside the pile of stones covering the body.

FEBRUARY 2D, 1877.—ADJOURNED MEETING.

Rev. S. S. Hunting, President, in the chair.

Twenty members present. Prof. H. T. Woodman, of Du-buque, was present as a visitor.

On motion of Dr. Hazen, the President, Recording Secretary, and Treasurer were appointed a committee to prepare and present at the next regular meeting an amendment to the By-Laws, defining the duties of the standing committees on Finance and Furnishing.

Dr. Hazen also presented the following resolution, which was adopted:

Resolved. That the thanks of the Academy be tendered to the gentlemen who have so successfully and creditably carried out the public entertainment of an oratorical contest in the interest of this Academy, and that the net proceeds realized from the same, reported as amounting to \$26.03.

now in the hands of the Treasurer, be hereby appropriated in accordance with the expressed wishes of said donors.

Dr. C. H. Preston read an interesting paper, presenting a brief synopsis of scientific progress for the past month.

President Hunting stated that this paper, prepared at his suggestion, was intended as the commencement of a series of such reports to be presented at the regular meetings of the Academy, and asked the active co-operation of the members of the Academy in carrying out this design.

Prof. H. T. Woodman, upon invitation, addressed the Academy on the subject of CORAL FORMATIONS, recent and fossil, exhibiting some interesting specimens of the latter, recently discovered by him. In regard to recent coral formations he had arrived at a conclusion opposed to that held by Prof. Agassiz, his numerous observations showing conclusively that the range and limit of particular species of reef-building corals was dependent on the temperature of the water, and not on the depth or degree of pressure. He also showed that, owing to an imperfect knowledge of the development of recent corals, several fossil forms, representing only different stages of development, had been described as different species or even genera. He also exhibited specimens of *Catenipora*, showing a distinct ray structure which had not been noticed in previous descriptions. He alluded to the singular metamorphoses of corals in geodes, etc.

In reference to mound explorations, Prof. Woodman stated, as an item of practical value in such explorations, that a distance of fifteen feet, or a multiple of it, was frequently observed in these deposits. He complimented the Academy on the progress it has made in such explorations, stating that in some respects the collections here exhibited were unequaled by any other collection in the country.

On motion the thanks of the Academy were voted to Prof. Woodman for his interesting address.

FEBRUARY 9TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Four members present.

Dr. C. C. Parry and Rev. S. S. Hunting were elected members of the Section.

Not much business was transacted, but the evening was spent in the discussion of historical and other topics.

FEBRUARY 10TH, 1877.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President in the chair.

Six members present.

Dr. C. C. Parry offered the following motion, which was adopted :

Resolved, That the Academy assume the subscription to 100 copies of Vol. II, Proceedings of the Davenport Academy of Natural Sciences to complete the number of 150, as required to meet the proposition of J. D. Putnam for publishing the same.

The action of W. H. Pratt, in procuring photographs of the engraved tablets, was ratified.

On motion of Mr. Pratt, the matter of disposing of the photographs in the interest of the Academy, was referred to the Publication Committee with power to act.

Dr. C. H. Preston offered the following resolution, which was unanimously adopted :

Resolved, That in consideration of the important services of Rev. J. Gass in the successful prosecution of his archæological discoveries, and of his generous action in depositing with the Academy the valuable material he has so laboriously collected in these researches, he is hereby constituted a life member of the Academy.

Messrs. Pratt and Riepe were requested to arrange with Mr. Gass for a definite written understanding of the conditions on which his deposits of archæological specimens may be permanently held by the Academy.

FEBRUARY 20TH, 1877.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President, in the chair.

Eight members present. Also present, Chas. E. Putnam, on behalf of the Academy, and Messrs. D. Gould and Francis Ochs on behalf of the School Board.

An informal discussion was had in regard to the proposed

purchase by the Academy of the old High School building, on the corner of Sixth and Main Streets.

On motion of Dr. C. C. Parry, the Trustees of the Academy, requested further time to consider the matter, with a view to making a definite offer for purchase, if thought advisable.

Messrs. Gould and Ochs then withdrew.

On motion of Dr. Hazen it was decided that the Board make an offer to purchase the premises in question—provided, there is a reasonable prospect of securing the necessary funds.

The President and Secretary, with Mr. Chas. E. Putnam, were appointed a committee to endeavor to secure a pledge of \$2,000, through life membership, or otherwise, towards the proposed purchase.

It was voted to authorize the Curator to send the inscribed tablets to the Smithsonian Institution at Washington for examination, subject to the consent of the discoverer—Rev. J. Gass.

FEBRUARY 23D, 1877.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President, in the chair.

Eight members present.

Mr. C. E. Putnam presented a deed of gift from Mrs. P. V. Newcomb, donating a building lot on Brady Street, 45x150 feet, north of the Presbyterian Church. The deed was accepted by the Trustees, and further action deferred to the open meeting of the Academy.

Dr. C. H. Preston notified the Trustees of a valuable collection of geological specimens and cases donated to the Academy by Prof. T. S. Parvin on the condition that the collection be retained in its present form as the Parvin collection. The donation was accepted, and further action deferred to the open meeting of the Academy.

A motion was made and carried that the committee appointed to confer with the School Board in regard to the purchase of the old High School building, be authorized to take into consideration the subject of erecting a building on the lot now donated by Mrs. Newcomb, and canvass the whole question in reference to a permanent home for the Academy.

The Treasurer and Secretary were authorized to renew the insurance on the property of the Academy, the present policy expiring on the 26th inst.

FEBRUARY 23D, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Twenty-four members present.

President Hunting, on account of necessary absence, called the Vice-President, Dr. C. H. Preston, to the chair.

The Curator, W. H. Pratt, reported a number of additions to the Museum by donation.

Dr. Hazen, as Librarian, reported a number of additions to the Library by donation and exchange. He also stated that he had in preparation a complete catalogue of the Library.

The Corresponding Secretary reported the correspondence of the month somewhat reduced.

As Chairman of the Publication Committee, Mr. J. D. Putnam reported that the Proceedings of the Academy had been copied and prepared for publication from January 1st, 1876, to February 1st, 1877, and a portion had already been placed in the hands of the printers. It is expected to issue the first part, bringing the Proceedings of the Academy down to the end of March, sometime during April or May.

Mr. Geo. H. French offered his resignation as a member of the Finance Committee, which was accepted.

Messrs. L. H. Willrodt and J. H. Harrison were elected regular members. The names of five persons were proposed for membership.

The Committee on a Revision of the By-Laws made a report which was laid over to the next meeting for action.

Mr. Pratt was authorized to make arrangements for a lecture or lectures from Prof. Butler, of Wisconsin, on behalf of the Academy, at his discretion.

The following letter from Prof. T. S. Parvin, of Iowa City, was read by the Vice-President, Dr. C. H. Preston:

IOWA CITY, February 21st, 1877.

Charles H. Preston, M. D., Davenport, Iowa :

DEAR SIR :—I propose to donate to the Academy of Sciences of your city my geological cabinet and the cases containing the same—requiring only that the Academy keep the collection, and it alone, in the cases, as my distinct contribution to its cabinet ; and that the Academy take the same from the rooms of the Historical Society in this city, where it has been stored for some years past.

The cases are of white walnut, panelled, with glass sides and front, 6½ feet high, 3½ wide, and 1½ deep, and eight in number. The cases cost me upwards of \$100, and the collection cost me much labor, worry, and about thirty years of time.

The Historical Society need the room they occupy at once, and I know of no better method of disposing of my labors than to transfer them to the Academy. I write this at my office, and my volume of the Transactions of the Academy being at my house, I do not know the name of your President, so write you, requesting you to hand this to him.

If the Academy accepts, it would be better to send one of its members here to take charge of packing and transportation.

The Mineralogical collection I shall bring to my office, subject to future arrangement. You will recollect the collection placed at one time in my lecture room at the University, and have some appreciation of its interest and value.

I am proud of the success and prospective permanency of the Academy, and have given it, therefore, the preference over the High School of Muscatine (at which place I made much of the collection—not in point of locality, more than of time), the Historical Society, or University.

Yours truly,

T. S. PARVIN.

On motion of Dr. Parry, this donation was accepted by the Academy, and Dr. M. B. Cochran was appointed to proceed at once to Iowa City, and take charge of the removal and transportation of the collection, as requested by the donor.

Dr. C. H. Preston then offered the following resolution, which was adopted unanimously :

Resolved, That in accepting from Prof. T. S. Parvin, of Iowa City, the very generous donation to the Davenport Academy of Natural Sciences, of his entire Geological Cabinet, the result of thirty years' labor, and much care and expense, we would hereby express our earnest thanks and high appreciation of the scientific fellowship and good will which has prompted this valuable gift.

Dr. C. C. Parry remarked that this donation, representing the work of an earnest life-time, may be properly regarded as one

of the direct results of the recent publication of the Academy, showing that it was a *live* and likely to be a permanent institution.

On motion of Dr. M. B. Cochran, Prof. T. S. Parvin was recommended for life membership of the Academy.

Mr. Chas. E. Putnam, on behalf of Mrs. P. V. Newcomb, formally presented the following unconditional

DEED.

This Deed of Bargain and Sale, Made and executed this 22d day of February, A. D. 1877, by and between *Patience V. Newcomb, Widow*, of the County of Scott and State of Iowa, of the first part, and "*The Davenport Academy of Natural Sciences*," a corporation duly incorporated under the laws of Iowa, of Davenport, Iowa, of the second part, WITNESSETH: That the said party of the first part, for and in consideration of the sum of *Four Thousand Five Hundred (\$4,500) Dollars*, in hand paid by the said party of the second part, the receipt whereof is hereby acknowledged, has granted and sold, and does by these presents, GRANT, BARGAIN, SELL, CONVEY AND CONFIRM, unto the said second party, its successors and assigns forever, the following real estate, lying and being situated in the County of Scott and State of Iowa, to-wit:

Part of Out-Lot No. Sixteen (16), Davenport, Scott County, Iowa, bounded as follows, to-wit: Commencing on the west line of Brady street, and on the north line of property heretofore conveyed to the Presbyterian O. S. Church of Davenport, Iowa, running thence west along said north line one hundred and fifty (150) feet, more or less, to an alley, thence north forty-five (45) feet, thence east one hundred and fifty (150) feet to Brady street, and thence south along the west line of Brady street forty-five (45) feet to the place of beginning.

This conveyance is made as an unconditional donation to "The Davenport Academy of Natural Sciences," to show my appreciation of its worthy objects, and because of the great regard I entertain for my young friend, J. Duncan Putnam, and my admiration for the noble work he is doing in its behalf.

The intention being to convey AN ABSOLUTE TITLE IN FEE to said real estate, including any right of homestead had therein.

To Have and to Hold the premises above described, with all the appurtenances thereto belonging, unto the said second party, its successors and assigns forever. The said *Patience V. Newcomb* hereby covenanting herself and her heirs, executors and administrators, that the above described premises are free from any incumbrance: that she has full right, power and authority to sell the same; and she will WARRANT AND DEFEND THE TITLE unto the said second party, its successors and assigns, against the claims of all persons whomsoever lawfully claiming the same.

In Witness Whereof, The said party of the first part has hereunto set her hand and seal the day and year first above written.

PATIENCE VIELE NEWCOMB. L. S.

STATE OF IOWA, SCOTT COUNTY, SS :

BE IT REMEMBERED, That on the 23d day of February, A. D. 1877, before the undersigned, a Notary Public in and for said County, personally appeared *Patience V. Newcomb*, to me personally known to be the identical person whose name is subscribed to the foregoing Deed as Grantor, and acknowledged the instrument to be her voluntary act and deed, and that she executed the same for the purposes therein mentioned.

WITNESS, my hand and Notarial Seal, the day and year last above written.

{ LOUIS A. LE CLAIRE. }
 Notarial Seal.
 { SCOTT Co., . IOWA. }

Louis A. LeClaire,
 Notary Public, Scott Co., Iowa.

[Filed for Record the 24th day of February, A. D. 1877, at 2 o'clock P. M., and recorded in Book 38, of Town Lot Deeds, on page 122.

J. A. LECLAIRE, *Recorder.*]

[Entered for taxation this 2d day of March, A. D. 1877.

JAMES DOOLEY, *Auditor.*]

In acceptance of this gift, Dr. Parry offered the following resolutions :

Resolved, That the Davenport Academy of Sciences accept, with profound gratitude, the unsolicited gift by Mrs. P. V. Newcomb of a valuable and eligible building lot in this city ; that the alleged motive of the donation—"to show my appreciation of its worthy objects, and because of the great regard I entertain for my young friend, J. Duncan Putnam, and my admiration of the noble work he is doing in its behalf,"—largely enhances to us the value of the gift ; that upon this broad and assured foundation we have every encouragement to hope that ere long, by the liberality of our citizens, a noble superstructure shall arise for the benefit of future generations, commemorating to all time the name of the generous and esteemed first donor.

Resolved, That Mrs. P. V. Newcomb be at once enrolled on the list of Life Members of this Academy, and that a copy of these resolutions be presented in person by the officers and members of the same.

These resolutions were unanimously adopted by a standing vote of the Academy, all the members present rising to their feet.

A committee to arrange for a formal complimentary call on Mrs. Newcomb, to present the above resolution, was appointed, to consist of Rev. S. S. Hunting and Dr. C. C. Parry. To

these were added, on behalf of the ladies, Mrs. C. E. Putnam and Mrs. C. C. Parry.

Dr. R. J. Farquharson reported a considerable correspondence in regard to the tablets recently discovered by the Rev. Mr. Gass, and that much interest had been manifested in them, and serious doubts expressed as to their genuineness. If truly the work of the mound builders, they were by far the most important relics that have yet been found. In order to satisfy these doubts, Mr. Gass has prepared a detailed statement and complete history of the mound in which these tablets were found.

The following paper was read :

A Connected Account of the Explorations of Mound No. 3, Cook's Farm Group.

BY REV. J. GASS.

To the Academy of Natural Sciences :

Although a second partial report of the explorations of the Mound designated in Vol. I of these Proceedings as Mound No. 3 of the Cook Farm Group, has been submitted, it seems to be desirable to present a more particular description in connection with diagrams so as to afford a connected representation of all the facts and the results of the investigation, and especially so as some errors occurred in the former description and illustration, and also from the fact that on account of recent discoveries this mound has become an object of especial interest. My own ideas regarding the discoveries I will present on a future occasion, giving here only the facts.

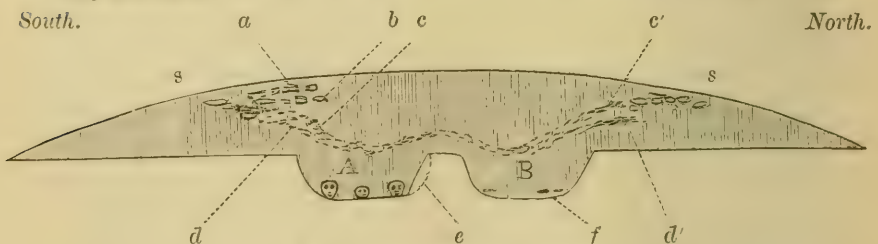


FIG. 8.—Scale, about 10 feet to one inch.

Mound No. 3 is the largest of this group, and is situated on the highest ground in the vicinity (Plate I and page 119, Vol. I, Proc. D. A. N. S.).

FIG. 8.—Vertical section of Mound No. 3, Cook Farm Group.

FIG. 9.—Plan of same mound; so far as the layers of shells and stones extend.

a, Position of limestones met with in the first excavation, one foot below the surface. b, Position of human remains first met with. c, c', Upper shell bed. d, d', Lower shell bed. e, Cavity excavated at the north side of grave A. f, Position of the tablets. s, s', Limits of shell bed bordered by a row or layer of stones.

Its diameter at the base is about sixty feet and height three and one-half feet above the natural grade. Having been many years under cultivation, its height has doubtless been thereby somewhat reduced. The form is not conical, but considerably flattened, as shown by the diagram, Fig. 8. It is a so-called double mound, there being in the central portion two graves, extending east and west, and parallel to each other, separated by three to four feet of earth, and designated by A and B, (Figs. 8 and 9.) Each grave is about six feet wide and nine to ten feet long, and excavated to a depth of two and one-half feet below the natural surface, reaching to the hard clay in the middle of the excavation, which is sloping on all sides, giving it a concave form, though flattened at the bottom. The actual mound raised over the whole is now only three to four feet above the original surface, and presents somewhat the form of a cone. If we divide the mound by a line passing from east to west through the center, the grave A is in the southern and the grave B in the northern half.

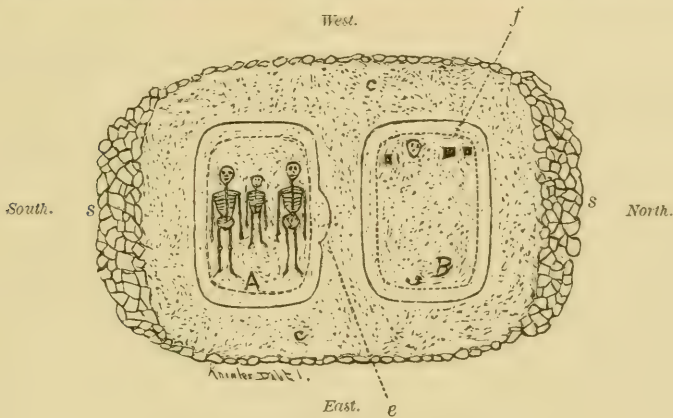


FIG. 9. — Scale, about 10 feet to one inch.

EXPLORATIONS OF 1874.

When, in the latter part of 1874, I, with the assistance of W. Engelbrecht, E. Borgelt and H. Decker, who were at that time theological students, explored the other mounds of this group, I opened at the same time the southern grave, A, of this mound, the details of which work I here give in full, from notes taken at the time.

We made an opening several feet in width, and, as we afterward found, three or four feet to the south of the grave, A. At the depth of one foot we found a scattered layer of limestones (a), under which was a stratum of earth about one foot thick. At the southern side of this opening, one and one-half feet from the surface, we discovered two human skeletons (b). From the condition of these skeletons, and from their arrangement, and the nature of the objects found associated with them, it is clearly shown that they belong to our century, and not to the age of the mound build-

ers, the bones being in a good state of preservation, and, as is often found in Indian graves, covered with the boughs of oak trees.

The objects found with these bones were a fire steel, a common clay pipe, a number of shell and glass beads, and a silver ear ring. A few of the bones exhibit some cuts, made apparently by sharp teeth or some cutting instrument. It should also be remarked that fragments of human bones were found scattered through the earth at about the same depth as the skeletons above referred to, viz: one and one-half feet below the surface.

Immediately beneath the above mentioned skeletons was found a thin layer of river shells, from one to two inches in thickness, which sloped slightly toward the north (c). At the south side of this excavation, about two feet below the surface, we found a large quantity of ashes. This bed of ashes was beyond the circumference of the shell layer, hence we cannot positively determine whether the ashes have been placed there by the mound builders.

The layer of shells above mentioned rested upon a stratum of earth twelve inches in depth, under which was found a second bed of shells (d), three or four inches in thickness. This second layer of shells sloped more abruptly to the northward, which induced us to proceed in that direction, until we reached what proved to be the south side of the grave A. Here, at the depth of about two feet below the second shell bed, about five and one-half feet below the surface, were discovered three skeletons, two of adults, and the third that of a child, lying in a horizontal position on the hard clay, with the heads to the west and the feet to the east. The small skeleton was lying between the two larger ones.

At the east end of the grave we found several small fragments of skulls. All of the bones were covered with loose black earth, occupying the space between them and the lower shell bed. Immediately in contact with the bones of the child's skeleton were a large number of copper beads (see Nos. 12 to 18, Plate VI, Vol. I). About three inches above the southernmost of the two larger skeletons, and near the right shoulder were discovered two copper axes (Nos. 3 and 5, Pl. V, Vol. I) lying side by side, with the sharp edges toward the south.

Near the northernmost skeleton were found three copper axes (Nos. 1, 2 and 4, Pl. V) in the same relative position, except that they were about two feet above the bottom of the grave, and immediately beneath the lower layer of shells. Nos. 1 and 2 were lying side by side, with the sharp edge toward the south, and No. 4 lying across them with the edge westward. All the axes had been wrapped in cloth, which was more or less imperfectly preserved. A few of the bones of the child were of a greenish color, quite well preserved, probably by the action of the copper, while the rest of them, as well as those of the other skeletons, crumbled in pieces as soon as removed.

Just north of the northernmost large skeleton, and in a small cavity excavated at the north side of the grave (e), were found the following articles, viz: 1st, a number of small red stones arranged in the form of a

star, about three inches in diameter; 2d, two carved stone pipes, one having the form of the ground hog (Fig. 4, Pl. IV, Vol. I), and the other a plain one; 3d, several canine teeth of the bear, etc., etc.; 4th, one arrow head; 5th, one large broken pot (which is represented, restored, in Fig. 1, Pl. VIII. Vol. I), with bones of the turtle adhering to the inside of the fragments; 6th, two pieces of galena; 7th, a lump of yellow ochre. Here I would also mention that at each end of this grave were found several stones of a few pounds weight each.

The fact that the bottom of this grave sloped upward and outward in all directions, confirmed our opinion that all the contents of this mound had been discovered, and a further search would be useless. Messrs. Farquharson, Tiffany and Pratt, to whom full permission was given to prosecute a further research, concurred in this opinion, and did not think it advisable to avail themselves of the opportunity. The work on this mound was therefore discontinued, and operations commenced in an adjacent one.

EXPLORATION OF 1877.

In tilling the field containing these mounds, many shells were turned up by the plow last summer on the north side of Mound No. 3. This circumstance led me to believe that the shell layers extended further to the north than I had formerly supposed, and to consider it probable that on the side opposite to the former excavation, *i. e.*, on the northern slope of the mound, a second grave might be found north of the first, or some other reason must exist for the extension of the shell layer so far in this direction.

My intention to begin in the latter part of the summer, the work of a second excavation was repeatedly frustrated by the unusual wetness of the ground and various private hindrances, until the early setting in of severe winter weather made it seem advisable to postpone operations until spring. Learning, however, in December, that the farm was rented to a new tenant, who was to take possession on the 1st of March, 1877, and that after that date the permission to excavate, which had heretofore been freely granted, could no longer be obtained, the shortness of the time remaining induced me to commence a new exploration, in spite of the difficulties attending such work in winter, the ground being frozen to the depth of about two and one-half feet. Accordingly, on the 10th of January, the weather having somewhat moderated, I commenced the work, assisted by Messrs. Willrodt and Stoltzenau, aided also by five other men, whose curiosity attracted them to the spot.

Commencing on the north side of the mound, about fifteen feet northwest of the grave A, and, as we afterward found, about six feet from the grave B, we made an opening several feet in diameter. Five or six inches below the surface we came upon a shell layer (*c'*), one or two inches thickness, which sloped downward toward the southeast until at a distance of four or five feet it reached the depth of two feet, or rather more, from the surface.

Between the surface and this first layer of shells, a number of

human bones were found, scattered through the soil; also, a number of stones, which, as was afterwards observed, were more numerous over the middle of the grave B. Associated with these bones, which, like those on the other side of the mound, were doubtless of modern times, we found a few glass beads and fragments of a brass ring. This layer of shells rested upon a stratum of earth from twelve to fifteen inches in thickness, and beneath this was a second layer of shells (d'). This layer was from three to four inches thick, and in a sloping position nearly parallel with the upper layer. These indications caused us to continue our excavation in this direction, and so we reached the northwest corner of the grave B. Here the shell layer was five inches thick. Below this layer was a stratum of loose black soil or vegetable mould of eighteen or twenty inches, resting on the firm, undisturbed clay. In this soil were discovered fragments of human bones, and small pieces of "coal slate" or bituminous shale.

DISCOVERY OF INSCRIBED TABLETS.

These circumstances arrested particular attention, and caused me to proceed with more caution, until soon after,—about five o'clock in the afternoon,—we discovered the two inscribed tablets of coal slate, (Plates I, II and III) which, with other relics from the mound, are now in the Museum of the Academy. The two tablets were lying close together on the hard clay, in the northwest corner of the grave, about five and one-half feet below the surface of the mound, the larger one to the southward and the smaller one north of it (f). The smaller one is engraved on one side only, and the larger on both sides. The larger one was lying with that side upward which was somewhat injured by a stroke of the spade (Plate I), and the smaller with the engraved side upward (Plate III). Both were closely encircled by a single row of limestones. They were covered on both sides with clay, on removal of which the markings were for the first time discovered. A number of fragments of the coal slate lay in the immediate vicinity of the tablets. It should also be remarked that I did not leave the mound after penetrating through the frost until the tablets were discovered and taken from their resting-place with my own hands.

South of the tablets, *i. e.* in the south-west corner of the grave, were found a few pieces of skull bones, of which one piece was saturated with the green carbonate of copper. Also, several pieces of human cervical vertebrae, a small bit of copper, and an artificially wrought bone. In this grave were a great number of bones of the body, and also in the north-east corner, as in the south-west corner above mentioned, some pieces of kull and bones of the neck. It seems probable that here had been two skeletons, lying one with the head to the west and the other to the east, but this cannot be positively determined.

About two and one-half feet east of the west end, at the south side of the grave and about three inches from the bottom, we found a copper axe, No. 21, which exhibited no indication of having been wrapped in cloth, and two feet still farther east, on the same side of the grave, a few cop-

per beads, fragments of pottery, a piece of yellow pigment. A piece of mica, two crystals of "dog-tooth spar," some flakes of selenite, and a flint arrow head were afterwards found as mentioned in the supplementary report. In all parts of this grave, above the bones, we found many pieces of rotten wood, and, in one instance, a piece of bone about three inches in length, apparently artificially wrought.

The two shell layers over the grave B were united toward the middle of the mound, and formed a continuous layer, with the shells in the southern part, showing that both of the graves were covered at the same time. These layers were lowest immediately over each grave. The shell beds are composed of the species of river shells common in this vicinity, and lying flat-wise in a horizontal position, and frequently in pairs, never having been separated. They extended about two or three feet beyond the graves in every direction, terminating in a border of stones, fitted closely together, and forming on the north and south sides a layer of about two feet in width, and on the east and west sides consisting of only a single row (s s).¹

Over the middle of the broad layer of stones on the north side, was found a bed of ashes and a number of human bones, and at the junction of the layer of shells and stones at the northwest corner, and immediately beneath them a few fragments of bones, with cuts or scratches, like those above described, found on the south side. It was remarked that in the earth near the surface of all parts of the mound were found more or less human bones, showing that it was used as a burial place in comparatively modern times. The piece of pottery represented in Fig. 4, Pl. VIII, Vol. I, was found at the top of this mound, and pieces were also found at the top of other mounds of this group.

It is not impossible that additional discoveries may be the reward of further explorations in these grounds when a favorable opportunity shall be presented.

REPORT OF CONTINUED EXPLORATION FOR THE ACADEMY, CONDUCTED
BY MR. GASS.

Having finished the further examination of the mounds of the Cook Farm group, and particularly of Mound No. 3, conducted in the interest and at the request of the Academy, I would present the following additional report of the work.

It was in this further exploration that the copper axe No. 21, a number of copper beads and fragments of pottery and yellow pigment, mentioned in the description of this mound were obtained. The value of these articles in themselves is scarcely commensurate with the expense incurred, but the opportunity thus afforded for further observations upon the structure of the mound was very desirable, and has given us a better understanding of the whole, and I would present my thanks to the Academy for thus having enabled me to prosecute the work to completion, and to present a more full description of the entire structure.

After the finding of the tablets, some intruders entered the excavation

in our absence, and took out some relics, which, however, I was fortunate enough to obtain from them. These are a piece of mica, some crystals of dog-tooth spar, flakes of selenite, and an arrow head, which are also in the Academy Museum, with the axe and other articles above mentioned.

I now have also to report that in three other places in the immediate vicinity, and to the southward of this group, where mounds were supposed to exist, I have made a careful examination by boring a great number of holes and examining the earth from different depths. We found, in each case, a number of stones, as in the other mounds, and below these stones only sand and gravel and the hard clay, but no indications of shells, human bones, or other artificial deposits, and hence conclude them to be only natural elevations.

It therefore appears that no more mounds are probably to be found south of this group, but to the northward, on Mr. Smith's land, there are a few more mounds, for the exploration of which permission has not yet been obtained.

For further explanation of this work, prosecuted on behalf of the Academy, I would refer to the detailed description already presented.

Respectfully submitted.

J. GASS.

Accompanying this report of Mr. Gass were certificates from Rev. W. Engelbrecht, Rev. H. Decker and Mr. A. Borgelt, who assisted in the excavations of 1874, and from Messrs. L. H. Willrodt, H. S. Stoltzenau, H. Braun, F. Schlimmer, I. Schricker, Ch. Schricker and F. Blumer, who were present and assisted in the explorations of January, 1877, in which they fully confirm and substantiate the above description of the exploration of Mound No. 3 of the Cook Farm group by Mr. Gass.

A vote of thanks to Mr. Gass for his interesting paper was passed by the Academy.

MARCH 6TH, 1877.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President, in the chair.

Seven members present.

On motion of Dr. Cochran, Dr. Preston was appointed to proceed to Iowa City to attend to the packing and removal of the Parvin Geological Collection.

At the suggestion of President Hunting, it was voted that Mrs. C. E. Putnam and Mrs. M. A. Sanders be added to the committee to procure subscriptions for the new Academy building. It was also voted that this committee nominate a Building

Committee of five, to be appointed at the next regular meeting of the Academy.

The following resolution, offered by Dr. Cochran, was unanimously adopted:

Resolved, That in consideration of important and valuable services, untiringly rendered in behalf of the Davenport Academy of Natural Sciences by Mrs. Chas. E. Putnam, her name be enrolled as a life member of the Academy.

MARCH 6TH, 1877.—SOCIAL MEETING.

In accordance with the resolution adopted by the Academy on February 23d, the evening of March 6th was appointed as the time for the members to call upon and formally thank Mrs. P. V. Newcomb for her valuable donation. The officers and gentlemen of the Academy assembled at the rooms of the society, and at four o'clock proceeded to the residence of Mrs. Newcomb. Here they were joined by the lady members, and other friends of Mrs. Newcomb and the Academy. The party, numbering nearly one hundred, was received in a very hospitable and cordial manner by their genial benefactress, her parlors having been beautifully decorated for the occasion.

After a pleasant half hour of social conversation, Rev. S. S. Hunting, President of the Academy, arose and read the resolutions of gratitude and thanks, adopted February 23d, presenting them with the following

Address.

Mrs. NEWCOMB:—In addition to the resolutions of thanks which the Academy of Sciences is only too glad to present on this occasion, it is my privilege, because of the trust now imposed on me, to add a few words to make this day a milestone on the road to that triumphant success on which our Academy has started.

In contributing for science, you may be assured that you are promoting pure knowledge, for we take knowledge and science as synonymous words. Need I suggest what the lamented Agassiz so often taught, that every object of nature is the symbol of a divine thought, and all natural science is knowledge of eternal verities. The martyrs of science are enrolled with those of religion, and both are crowned with the same unfading wreath. The method of study, which to-day is called scientific, is the best possible guarantee we can have that *theory* must conform to *fact* before it can take its place as a recognized scientific truth.

It is to-day a fact on which the citizens of Davenport may well congratulate themselves; that within the last decade so much has been done to put the Academy upon a secure basis, but we all feel that the gift of a lot on which we may and *will* erect a suitable building, is practically the laying of the corner stone of the Temple of Science on the *sunny side* of the city whose citizens, we trust, will never suffer the north wind of indifference to blow upon it. To-day we commend the zeal which founded the Academy, and the energy which has prosecuted so noble an enterprise. It is possible that there may be a martyr here whose life will be a diamond set in gold. If so, let us be thankful for the noble example of self-consecration.

By aiding science, you are putting another stone into the foundation of our public school system. With the products of nature and art before the pupil, his mind is naturally stimulated to earnest inquiry as to the nature and meaning of these things, and he is no longer contented to rest in words, but seeks the knowledge of things, of realities. He becomes curious to learn what is written in the book of nature, and know the right interpretation of the handwriting on the walls of creation. The Academy must, in the nature of the relations between the two, be the ally of our public schools.

Nor are its benefits confined to the youth of the city. It is emphatically the citizens' school, the home of the mechanic, as well as the museum of the learned and the curious.

"Great field here for the imagination," said the distinguished person who visited the museum yesterday. May I not suggest that each specimen on the shelves may yet be read with as much interest by the youth of our city as any well worn volume in the Library? As we are to have a school of the sciences in our midst, can our wealth find a better channel of usefulness than the one here opened for all the generous?

The Centennial year has been as one hundred years in *one* to our city. When our hopes had been consumed in the fire of one night, we sat not down in the ashes, for we saw, with the expiring smoke, a form arising, Phoenix-like, that was equal to the solution of every riddle which the doubter could prepare. That form was the *energy* of woman crowned with *faith*, which carried bravely forward the enterprise of publishing the records of the Academy. Now we speak a living word to every prominent scientific association, both in America and Europe; and every word we send abroad brings back a glad response, freighted with the riches of other minds, and the scientific treasures of both hemispheres are laid at our feet, and freely opened to every citizen.

We gladly, then, gather here to thank you for your generosity, to cheer each other in the good work, to make more sure the conditions of success, to marry intention to action, in such a way, by such measures, as will secure the triumph of our noble enterprise.

This address was briefly responded to on behalf of Mrs. Newcomb by Rev. Dr. Nott. He spoke of the pleasure Mrs. New-

comb experienced in making a donation for the welfare of an institution which has for its object the feeding of the noblest part of man's nature, his mind, through exploration in the domain of science. She felt honored in being elected to a life membership of the Academy, which has already gained a noble reputation for its achievements in an important field of research. It had taken a high position, not only in our own State, but among the most noted scientific institutions and learned people of far distant States. He concluded by expressing the thanks of Mrs. Newcomb for the honor bestowed upon her, and for the visit of the friends and members of the Academy upon this occasion.

Hon. James Renwick offered a resolution, directing the Trustees of the Academy to have painted, with her consent, a full length portrait of Mrs. Newcomb, and that it be placed in one of the chief rooms of the new building soon to be erected by the Academy. The resolution was unanimously adopted.

References having been made to the good offices of another lady, Dr. C. C. Parry rose and read the resolution adopted by the Trustees earlier in the day, making Mrs. Chas. E. Putnam a life member of the Academy. The resolution was unanimously confirmed.

The formal ceremonies being over, the members were entertained with vocal and instrumental music by Miss Jennie Dutton, and her sister, Mrs. Alice Dutton Atwell, after which the party adjourned to the dining rooms, where a rich and bountiful collation had been prepared by the ladies. After supper a short time was spent in social enjoyment.

MARCH 9TH, 1877.—ADJOURNED MEETING.

Dr. E. H. Hazen in the chair.

Sixteen members present.

Under the head of communications, the following letters were read :

To the President and Board of Trustees of the Davenport Academy of Natural Sciences :

GENTLEMEN :— Your action in making me a life member of your society under so pleasant circumstances, and associated with that of our noble patron, Mrs. Newcomb, I regard as a great compliment, and desire to express to you my profound acknowledgment therefor. I feel, however, that the distinction is undeserved, and that the principal credit is due to those earnest workers who established and have maintained the society under so many adverse circumstances, and knowing, too, how greatly funds are needed for building purposes, I must decline receiving this life membership as a gratuity, and herewith enclose the sum of fifty dollars (\$50) in payment therefor, which I beg you will receive.

Very sincerely yours,

Woodlawn, March 9th, 1877.

MARY L. D. PUTNAM.

Also the following :

To the President and Trustees of the Davenport Academy of Natural Sciences :

GENTLEMEN :— In grateful remembrance of him who, next to my mother, was the first to lead me in the path of nature, and was among the first to conceive the idea of founding this Academy, and who alone of its founders has labored unceasingly in its behalf, and to whom the credit of its prosperity is largely due, I desire, in partial acknowledgment, to have the name of William H. Pratt enrolled in the list of life members of the Davenport Academy of Natural Sciences.

I enclose a check for fifty dollars (\$50) to be applied to that purpose.

Very respectfully yours,

Davenport, March 9th, 1877.

J. DUNCAN PUTNAM.

The communications were received with the thanks of the Academy, and the money appropriated as requested by the donors.

Mr. C. E. Putnam, on behalf of Mrs. Putnam, presented a communication from Hon. E. H. Pendleton, of Cincinnati, enclosing a draft for \$250—a donation to the Building Fund of the Academy. The donation was thankfully accepted, and the Secretary was instructed to make proper acknowledgments.

Dr. Farquharson then read the following paper :

On the INSCRIBED TABLETS, found by Rev. J. Gass in a Mound near Davenport, Iowa.

BY R. J. FARQUHARSON, M. D.

LADIES AND GENTLEMEN : — You need scarcely be told that the recent discovery of engraved tablets of stone in one of the mounds of this vicinity, is one of great, even transcendent, importance, not only to scientific persons, but also to the world at large. We are, in a measure, astonished at the unexpectedness of our discovery, and also somewhat embarrassed with its richness ; for in one particular, (that of phonetic writing,) it seems to prove too much. The only evidence we have of the existence of a people—conventionally called Mound Builders—preceding the modern Indians in the occupancy of this continent, consists of material relics, and of these a most abundant supply has been collected ; but of evidences of their language, of inscriptions, there are none—that is none which have a clear and indisputable title to such a character.

Bancroft,* speaking of the importance of material relics, has the following language : “ When, in addition to their indirect teachings respecting the arts and institutions of their builders, antique monuments bear also inscriptions in written, or legible hieroglyphical characters, their value is, of course, greatly increased ; indeed, under such circumstances, they become the very highest historical authority.”

With this abundance of material relics we are not satisfied. There is now, and has always been, in the hearts of the students of American Archæology, a longing for something more intimately connected with the mind of man, for some relic of language, the voice of the soul, the *litera scripta*. It may not not be too presumptuous on our part to hazard the conjecture that upon the face of one of the tablets before us we have the wherewithal, at least partly, to supply this void.

It is objected, and seriously, too, that this discovery comes too *apropos*, too pat, in fact, and so partakes in the minds of some too much of the nature of a stage trick, a *Deus ex Machina*. However, if it is a true, *bona fide* discovery, some one else among the great army of searchers, in the course of time and from the very necessity of the case, must have made the same or a like one ; nor need we fear that our find, remarkable as it is, will long remain unique and solitary, for, as Mr. Haven truly says,† “ *Science and civilization do not leave solitary monuments.*”

However, whether by fortune or misfortune, it has been our lot to make the discovery, and it now becomes our duty, honestly and firmly convinced as we are, of its genuineness and authenticity, fairly to publish it to the scientific world, for its merits there to be adjudged, inviting all fair and candid criticism, yet deprecating, in the most earnest manner, the crude strictures of the hasty and inconsiderate.

If the characters in the cremation scene tablet (Plate I) should prove to be phonetic, or even hieroglyphic, it may be, it doubtless will be long before they are deciphered ; it may be that from inherent difficulties, they

*Native Tribes, &c., Vol. 4, p. 8.

†In a letter to the writer.

may never be deciphered. But we must bear in mind how very long the Egyptian hieroglyphics remained unread; that until quite recently the cuneiform inscriptions were a sealed book. Indeed, the reading of them was for a long time deemed an impossible feat, and the very theory that there was any meaning in the complicated arrangement of wedges, was pronounced absurd by many wise antiquarians. Therefore, let us not despair, but rather let us indulge the hope, though it may seem to some a frail one, that this is but the first of a series of such discoveries; that in time our Rosetta stone may be found, and that in the line of our learned *occidentalists*, there will arise a future Champollion, having a key to unlock this American language.

Here, as well as anywhere, I may mention that one great objection to the reception of this or any other discovery of an inscription, seeming to come from the mounds, arises from the fact that most writers on American antiquities of any authority, however much they may differ on other matters, seem as one on this point, that no American race ever had a written phonetic language; some even go further, and say that as no evidence of such has been found, none ever will be found.

Schoolcraft,* speaking of the inscription on the Grave Creek tablet, has the following emphatic language: "It would contradict all our actual knowledge in this branch of American Archæology, to admit the possession, by them, at any period known to us, of an alphabet of any kind. The characters employed in picture writing by the Toltecs and Aztecs were symbolical, and they have left irrefragable evidences of their high proficiency in them, but nothing more. There can be no pretence that any Indian race who ever inhabited this valley possessed an alphabet."

Again he says:† "Nothing is more demonstrable than that whatever has emanated in the graphic or inscriptive art on this continent from the Red race, does not aspire above the simple art of pictography; and whenever an alphabet of any kind is veritably discovered, it must have had a foreign origin. By granting belief to anything contravening this state of art, we at first deceive ourselves, and then lend our influence to diffuse error."

Brantz Mayer says:‡ "The ancient history of our tribes, it is well known, is a matter of tradition alone, for they had no written language; or if they had, their story was not engraved on monuments, or transmitted on imperishable materials."

Col. Whittlesey says:§ "There is no evidence that they (the mound builders) had alphabetical characters, picture writing, or hieroglyphics, though they must have had some mode of recording events."

These quotations might be greatly extended, but enough has been given to show the general drift of opinion among those writers, generally accepted as authorities.

*History, Conditions and Prospects of the Indian Tribes, Vol. I, p. 123.

†Loc. cit., Vol. I, p. 125.

‡Smithsonian Contributions, Vol. IX, p. 3.

§Topographical and Historical Sketches of Ohio, p. 10.

The subject matter of this paper, our inscribed tablets, will now be briefly considered under the following heads :

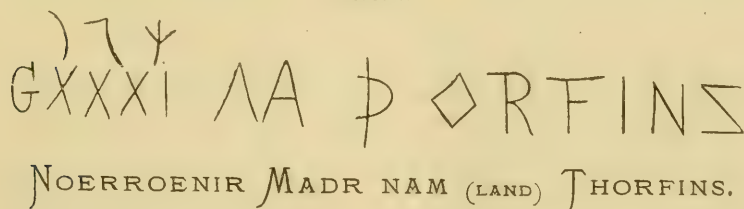
1. A short notice of the various inscribed stones found in the United States and Canada, both true and false.
2. The discovery of the Davenport Tablets, and the evidence in our possession of their authenticity.
3. A description of the Tablets.
4. A commentary on the Calendar Stone.
5. A commentary on the Sepulchral Rite Stone, and on the letters or hieroglyphics.
6. A commentary on the Hunting Scene Stone and its natural history, with some remarks on the question of the contemporaneous existence, on this continent, of man and the mastodon.

I.—INSCRIBED STONES.

The oldest and most celebrated inscribed stone in this country is undoubtedly that of Dighton Rock, in Massachusetts near the mouth of Taunton River. This famous inscription has been described, figured and discussed many times in the past two hundred years ; at one time it was considered a bit of Indian picture writing and no more, in which state opinion rested for a long while. It came again into importance when the question of the Pre-Columbian discovery of America was brought forward. There are two kinds of inscriptions on the rock, one of which is apparently Indian, was so regarded by the late Prof. Wyman, and as such was intelligently translated for Schoolcraft by an Indian. The other, altogether different, is regarded as Runic, and is shown in the cartoon.

The essential parts of the inscription, according to the skillful Runologist, Finn Magnusen, to whom it was referred by Prof. Rafn, are as follows :

FIG. 10.



That is, 151 Northmen occupied this land (with) Thorfins. G or C being the centum majus, or ten dozen (120) of the ancient Scandinavians.

As this reading accords almost exactly with the long lost and recently found Saga of Thorfinn Karlsefn, and is accepted by the French Runologists, it may be accepted as the true one.*

The confidence inspired by this successful reading induced the Royal Society of Antiquarians of Denmark to purchase this rock, and arrange-

*Compte-Rendu du Congress des Americanistes, Nancy, 1875, Vol. I, article Dighton Rock.

ments were very recently being made to remove it to Copenhagen. The excitement caused by this movement culminated lately in a public meeting at Boston, and other arrangements were there made by which this important monument of our early history is to be preserved and transported to that city. In consideration of this concession on the part of the Danish antiquaries, a granite monument is to be erected on the spot now occupied by the engraved rock, thus to commemorate the landing here in 1007 of Thorfinn, as narrated in the Saga, and in the inscription, as read by Magnusen.

For most of the following information in regard to the other inscribed stones, I am indebted to Col. Whittlesey's Tract No. 33, entitled "Archæological Frauds," being the second one by him with that title.

Grave Creek Stone.—This inscribed stone has excited nearly as much comment and controversy as the first. It was discovered in 1838, and was seen by Schoolcraft in 1843, in whose work it is figured from a drawing made by Capt. Eastman, U. S. A.

Schoolcraft considers it genuine; Squier doubts its authenticity; while Col. Whittlesey says: "The best authorities in the United States have condemned it during many years. The preponderance of proof, as well as of probabilities, is decidedly against it." And yet, at the Congress of Americanists, at Nancy, in 1875, it (or rather, according to Whittlesey, an imperfect copy) was read by Mr. Bing, as follows: "Thy orders are laws, thou shinest in thy impetuous clam, and rapid as the chamois." Mr. Bing then adds: "I not only sustain but justify the authenticity of the twenty-three Canaanite or Phœnician letters, comprising the eight words of the Grave Creek inscription."

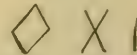
In 1857, M. Maurice Schwab had read the same inscription as follows, viz: "The chief of emigration who reached these places (or this island), has fixed these decrees forever."

Again M. Oppert, another advocate of the Phœnician theory, had read it: "The grave of one who was murdered here; to revenge him may God strike his murderer, suddenly taking away his existence" (*en lui tranchant la main, l'existence*).

These three different renderings of the same sentence by these learned men are doubtless interesting, but it must be admitted that they are also somewhat embarrassing.

The three following characters are common to the inscription on Dighton Rock, and to that on the Grave Creek stone:

FIG. 11.



Of the twenty-three characters on the Grave Creek stone, the seven following, viz:

FIG. 12.



are, according to Schoolcraft, to be found among the so-called "Stick book" characters of the Ancient Bardic (the Billet of the Bards of

Britain); but as Prof. Rafn was totally unable to unravel the inscription, the resemblance is no doubt a fanciful one; just as finding the letters T, O, W, N, in the Davenport inscription may also be pure fancy.

The third engraved stone is a quartz axe, found on the ocean beach in Nova Scotia.

The fourth is the Pemberton axe of New Jersey.

The fifth and sixth are the Holy Stones of Wyrick. They had Hebrew characters on them, and were said to have been taken from two separate mounds in Licking County, Ohio, one near Newark and the other near Jacktown.

The seventh, having Hebrew letters, and alleged to have been taken from the latter mound, though, like the others, evidently a fraud, has a somewhat curious history from the fact that an account of its finding was presented to the Congress of Americanists at Nancy (1875), in whose proceedings it will be found, together with an illustration of it and one of the Wyrick stones from photographs; the savans present wisely reserving their decision.

The eighth engraved stone is an axe from Butler County, Ohio, with English characters.

The ninth is from Grand Traverse Bay, Michigan, with Greek, Bardic and fictitious characters, all jumbled together, without order, and very imperfectly executed with a knife.

The tenth being a stone maul from an ancient mine-pit, Lake Superior, on which are some characters, at first supposed to be letters.

In his last tract, Col. Whittlesey, omits all mention of the Cincinnati stone, whose authenticity was the subject of so much controversy, the weight of evidence being now in its favor. However, it scarcely deserves mentioning here, as the marks on it have no pretensions to being letters, or even hieroglyphic or symbolic figures, being in fact, purely ornamental. A stone like it, but figured on both sides, was found in one of the minor mounds of Grave Creek, and is figured in Schoolcraft's work.

DISCOVERY OF THE TABLETS.

In this regard there is but little to be said in addition to the account already given by the original explorers. Perhaps, however, it might be well enough to state that these tablets are from Mound No. 3 of the series already described in Vol. I of our Proceedings, the hole dug in finding them being on the north or opposite side from the site of the former exploration. Shortly after the report of the discovery, several gentlemen, officers of the Academy, visited the excavation, and through our President, Mr. Hunting, reported, that from the unbroken condition of the layers of shells, and from other evidences visible, they were of the opinion that no disturbance of the mound had taken place since the formation of these layers.

But the indisputable evidence of the authenticity of these tablets rests in the explicit statement of the Rev. Mr. Gass and the gentlemen assisting him,—*that after the penetration of the frozen crust of the earth, they*

did not leave the spot until the tablets were unearched by the hands of the former. This forever silences the doubt in regard to the intrusion or interpolation of these tablets, for, taken in connection with the frozen state of the ground, it makes such an act simply impossible.

DESCRIPTION OF THE TABLETS.

The material of the tablets is the bituminous shale, which is abundantly found in the coal regions, and crops out in various places in this vicinity, notably on Rock River. This shale is quite light and very soft, and has the following composition, the analysis being due the kindness of our associate, Mr. J. H. Harrison :

Water (moisture).....	74 parts.
Inflammable matter (carbon, bitumen, etc.).....	316 parts.
Ashes.....	610 parts.
	1000

Though this material is found so abundantly in this vicinity, it is not a fair inference to conclude that the tablets were necessarily made here, for the substance of which they are composed is equally abundant in very many other places, indeed, wherever coal is found. The large tablet, as found, had a thickness of one and a half ($1\frac{1}{2}$) inches, and is of an irregular, quadrilateral shape, twelve (12) inches long on the unbroken edge, and from eight (8) to ten (10) inches wide. Judging from the sacrificial or cremation scene, nearly or quite one-half of this engraved tablet is missing.

As found, the stone was split into two parts by a separation in the plane of cleavage, and the upper half (the cremation scene) was unfortunately broken also into two pieces by the blow of the spade, which revealed its existence in the soft earth where it rested.

The smaller tablet or calendar stone is composed of the same material, and is in shape an imperfect square, with nearly straight sides of seven (7) inches in length; the thickness, which is not uniform, averages five eighths ($\frac{5}{8}$) of an inch; the holes bored near the upper corners, apparently for the purpose of suspension, have each the diameter of three-eighths ($\frac{3}{8}$) of an inch.

An examination of the surfaces of the stones with a magnifying glass, showing the marks of the original polishing, or smoothing would seem to indicate that they had not weathered much. Whatever signs of weathering exist are equally visible everywhere, that is to say, they have weathered alike the surface and the cuts. The exceedingly friable nature of the stone would indeed render much exposure to weathering influences impossible. The incisions, which are no where very deep, have a depth which is uniformly as the width, and seem to have been made with a cutting point or edge held at angle of 45 degrees to the surface.

CALENDAR STONE (PLATE III).

In addition to the representation on the plate, a very short notice of the marking on this stone will suffice. The central circle was described

with the radius of one inch, and the spaces between the outer circles average nearly three-quarters ($\frac{3}{4}$) of an inch. This certainly has a modern look, but the apparent agreement with modern measures of length may be, after all, merely a coincidence. For in an elaborately carved shell ornament, found by Dr. Jones in a sacrificial or sepulchral mound near Nashville, Tenn.,* and figured in this work, I find very nearly the same measures, the central circle being first of one (1) inch radius, and the distances between the outer circles being about a quarter ($\frac{1}{4}$) of an inch. If we consider this a calendar stone, and the twelve (12) signs as marking the divisions of the year, then it does not in the least resemble the Mexican and Maya calendars. If again we consider it as zodiacal, the signs in the outer circle being symbols of the constellations along the sun's path, then, though the signs are different, yet the resemblance to the common zodiac is so great as to suggest contact with one of the many nations or races which have adopted that very ancient delineation of the sun's pathway through the heavens.

It is very difficult, if not impossible, to make out the animals and other figures on this stone. I can decipher but one, which seems to be the cross-bones surmounted by a flame, the former being found quite frequently in Maya sculpture, but always accompanied, as in modern times, with the figure of a skull.

THE SACRIFICIAL OR CREMATION SCENE, AND THE LETTERS OR HIEROGLYPHICS (PLATE I).









There is a general agreement that this represents a burning of the dead. That the mound builders practiced cremation we have abundant evidence in the burnt human bones in the altar mounds, though Banerott thinks their presence suggests human sacrifice. That they collected a number of bodies, or rather skeletons, for cremation, seems quite probable; this would account for the three bodies present.

La Hontan says: "The savages on the Long River (Mississippi) burn their dead, reserving the bodies until there are a sufficient number to burn together, which is performed out of the village, in a place set apart for the purpose."

We come now to what is, no doubt, to most of you, the most interesting part of the subject—the consideration of the letters or figures occupying the two scrolls above the cremation scene, and also the corners above the scrolls. I must, in the first place, confess my utter inability to throw any light on the subject, the mastery of languages requisite for such a purpose being entirely beyond my power. The following observations may, however, enable you to see the mode and direction of my groping in the dark: Counting the total number of figures, I make ninety-eight (98), twenty-four (24) in one line, twenty (20) in the other, and fifty-four (54) above the lines, deducting twenty-four (24) repetitions, and there remains seventy-four (74) separate figures.

*Explorations of the Aboriginal Remains of Tennessee, p. 43.

The figures repeated are as follows, viz :

	4 times.		4 times.
	7 times.		3 times.
	4 times.		3 times.
	4 times.		3 times.

You have already seen specimens of the written Runic and Bardic characters. Your attention is now called to the letters of the Phœnician alphabet, and it would require no exuberant fancy to see a resemblance between some of these and some of the characters of the Davenport Tablet. The identity, or at least strong resemblance, of several of these, is shown in the cartoon.

We do not know whether the ancient Peruvians had any written language, as none has come down to us, or, indeed, if they possessed any other means of recording events than the colored strings or quippos, and these were merely mnemonic or a kind of artificial memory.

The Mayas of Central America had picture writing, but whether they had made any advances towards symbols for sounds I know not. The Mayas had a peculiar way of noting or marking numbers, which has a striking resemblance to the groups of dots in the Davenport inscription. This similarity I remarked first when looking over the representations of Maya sculpture given in Bancroft's great work, and the impression was confirmed by the perusal of a paper by M. Leon de Rosny, on "The Numeration in the Language and in the Sacred Writing of the Ancient Mayas," read at the Congress of Americanists, at Nancy, in 1875, and published in the *Compte-Rendu* of that body (vol. 2, p. 439). This mode of numeration, which was also used in the ancient Mexican writing, though the language is altogether different, is as follows: $\bullet=1$, $\bullet\bullet=2$, $\bullet\bullet\bullet$ or $\bullet\bullet\bullet=3$, $\bullet\bullet\bullet\bullet$ or $\bullet\bullet\bullet\bullet=4$, $\text{—}=\text{—}=5$, then $\text{—}\bullet$ (5 and 1)=6, $\text{—}\bullet\bullet$ (5 and 2)=7, $\text{—}\bullet\bullet\bullet$ (5 and 3)=8, $\text{—}\bullet\bullet\bullet\bullet$ (5 and 4)=9, $\text{—}\text{—}$, and so on up to $\text{—}\text{—}\text{—}\text{—}$ =20, which is the greater unit of the numeration, it counting onward by 20's, and there being names for the square of 20 (20x20), etc. This vigesimal system of counting, evidently founded on the whole number of fingers and toes, seems to have been confined to the Mayas, Aztecs, and allied nations; elsewhere, in both North and South America, the decimal system prevailed.

But, according to Duponceau, the Indian tribes about the Great Lakes and the neighboring ones, counted by fives, like the Mayas.

The Mexicans had picture writing, as we know, but they had more. Brantz Mayer says :* "The Mexican picture writing consisted of several

*Smithsonian Contributions, Vol. IX, p. 13.

elements : an arbitrary system of symbols to denote years, months, days, seasons, the elements, and events of frequent occurrence; an effort to delineate persons and their acts by rude drawings; and a *phonetic system which, through objects, conveyed sounds that, singly or in combination, expressed the facts they were designed to record.*"

The objection that the mound builders were in too rude a state to have had a phonetic, or, indeed, any written language, seems to me a not insuperable one.

Livingstone* found the people of Bergema (Central Africa) possessed of a written language, consisting of 280 letters or characters, each representing an entire syllable. It is true, they may have inherited this alphabet, or gained it by contact with other nations, but the latter is not known to be the fact.

As having some bearing on the question of the possibility of the mound builders forming an alphabet of written characters, the fact of the devising of an alphabet by a probably kindred people, the Cherokees, is worthy of mention. Now, though the Cherokees had long been in contact with the whites, especially the English, the inventor Sequoyah, or George Guess, did not copy the English alphabet, giving another force to the different letters or characters; he could not even read English, and the alphabet of his invention is totally unlike that of the English, or, indeed, of any modern tongue.

Sir John Lubbock† speaks in the following high terms of praise of the Cherokee alphabet: "Sequoyah invented a system of letters which, as far as the Cherokee language is concerned, is better than ours. Cherokee contains twelve consonants and six vowels, with a nasal sound, *mung*. Multiplying the twelve consonants by the six vowels, and adding the vowels which occur singly, he acquired seventy-seven characters, to which he added eight, representing the sounds *s, ka, hna, nah, ta, te, ti, tla*, making, altogether, eighty-five characters. This alphabet, as already mentioned, is better than ours. The characters are indeed numerous, but when once learned the pupil can read at once. It is said that a boy can learn Cherokee, when thus expressed, in a few weeks, while if ordinary letters are used, two years are required."

THE NATURAL HISTORY OF THE HUNTING SCENE, AND REMARKS UPON
THE QUESTION OF THE CONTEMPORANEOUS EXISTENCE OF
MAN AND THE MASTODON (PLATE II).

Of the animal kingdom, 30 individuals are represented, divided as follows, viz: Man, 8; bison, 4; deer, 4; birds, 3; hares, 3; big horn or Rocky Mountain goat, 1; fishes, 1; prairie wolf, 1; nondescript animals, 3. Of these latter, one defies recognition, but the other two, apparently of the same species, are the most interesting figures of the whole group. These animals are supposed by different critics to represent she-moose, tapirs or mastodons.

*Travels in Africa, p. 228.

†Origin of Civilization, appendix.

We will leave the upper animal out of consideration, though he has a true flap ear like the elephant; the correctness of his drawing seems to have been spoiled by the nearness of the bison, the outlines of whose body are repeated in him. Now, taking the lower animal, and measuring him, we find the following dimensions, viz: Length of body, 45 millimetres: height, 41 m.; length of tail, 13 m.; diameter of fore leg (near the body), 6 m.; diameters of hind leg (near the body), 8 m. Now, assuming the height as 10 feet, we have a length of 11 feet, a length of tail of 3 feet, diameter of the fore and hind legs, respectively, of $1\frac{1}{2}$ and 2 feet—truly a very elephant-like proportion. But the trunk and the tusks are omitted. Well, so are the eye and the ear, yet, nevertheless, we contend that no animal but an elephant has such proportions, such a contour of the back, such legs and such a tail.

The statement of the following fact may not be amiss in this connection: The modern Indians, though generally very accurate in details, sometimes purposely omitted important features of an animal, as, for instance, the horns of the elk, when representing the head of that animal. Examples of this are to be found in Schoolcraft.

Again, in that otherwise truthful delineation of the mastodon, the elephant mound of Wisconsin, the artist has totally omitted the tusks, and shortened the trunk to very modest dimensions. Surely, not for want of space, for the whole animal has a length of over one hundred (100) feet and a proportionate height.

Anyhow, we will assume this animal to be the mastodon, or, at least, a good enough mastodon for our purpose, and proceed to treat of the last portion of our subject, the contemporaneous existence of man on this continent. We will consider the evidence on that subject, seriatim, as nearly as possible in the order, in point of time, that it was brought to light by publication.

First, we have the Indian tradition, as narrated by Jefferson in his "Notes on Virginia," written about 1794, and in answer to an inquiry of a gentleman in France. Jefferson says: "Our quadrupeds have been mostly described by Linnaeus and Monsieur de Buffon. Of these the mammoth or big buffalo, as called by the Indians, must certainly have been the largest. Their tradition is, that he was carnivorous, and still exists in the northern parts of America.

"A delegation of warriors from the Delaware tribe, having visited the Governor of Virginia during the Revolution, on matters of business, after these had been discussed and settled in council, the Governor asked them some questions relative to their country, and among others, what they knew or had heard of the animals whose bones were found at the salt licks on the Ohio (Big Bone Lick, Kentucky). Their chief immediately put himself into an attitude of oratory, and with a pomp suited to what he conceived the elevation of the subject, informed him that it was a tradition handed down from their fathers. That in ancient times a herd of these tremendous animals came to the Big Bone Licks and began an universal destruction of the bear, deer, elks, buffaloes, and other

animals which had been created; that the Great Man above, looking down and seeing this, was so enraged that he seized his lightning, descended, seated himself on a neighboring mountain, on a rock, of which his seat and the print of his feet are still to be seen, and hurled his bolts among them till the whole were slaughtered, except the big bull, who, presenting his forehead to the shafts, shook them off as they fell, but missing one at last, it wounded him in the side, whereupon, springing round, he bounded over the Ohio, over the Wabash, the Illinois, and finally over the great lakes, where he is living at this day."

Mr. Jefferson* also states that, "a Mr. Stanley, taken prisoner near the mouth of the Tennessee, relates that after being transferred through several tribes, from one to another, he was at length carried over the mountains west of the Missouri to a river which runs westwardly, that there these bones (tusks, grinders and big bones) abounded, and that the natives described to him the animal to which they belonged as still existing in the northern part of their country, from which description he judged it to be an elephant."

A recent writer in a newspaper† thus speaks of the Big Bone Lick: After mentioning the fact that when first discovered in 1773, mastodon bones were in great abundance on the surface of the ground, he continues: "This fact affords a key to the living age of these extinct animals that has ever been a matter of conjecture with the scientific world. That bones on the surface would not last a hundred years, probably not more than forty or fifty." He then adds: "So that this key of the Big Bone Lick (never before or elsewhere found) unlocks the mystery, and shows to a certainty that these now extinct giants might have been seen stalking through the forests like moving mountains, with their fearful tusks, glaring eyes, and heads of a thousand pounds, *but a short time before the discovery of their remains.*"

The next link in the chain of our evidence is afforded by the narrative of Dr. Koch, who, in a pamphlet published in St. Louis, in 1840, stated that he had found the remains of a mastodon, in 1838, which had evidently been destroyed by the hands of man. This premature statement of a fact was received with ridicule and scorn, and his reputation, so far as veracity is concerned, remained under a cloud during the rest of his life. This statement was also published in the Proceedings of the St. Louis Academy for 1857, from which it has been repeatedly quoted by various writers.

By good fortune, and through the kindness of our associate, Mr. Leslie, I am in possession of the original pamphlet of Dr. Koch, published in 1840, in St. Louis, while he was exhibiting in that city the skeleton of another mastodon, being the one now in the British Museum. As it is important, in such cases, to have the exact words of an original explorer, I will quote him at some length. After stating how a farmer in Gasconade County, Missouri, in cleaning out a spring, discovered the

*Notes on Virginia.

†Louisville Courier-Journal.

bones; the manner of his hearing of this, and his arrival on the spot in the month of October, 1838, he proceeds thus: "The whole situation in which I found the remaining bones bore every evidence that the animal whose frame they constituted had been destroyed by human hands, which is a circumstance of the highest importance, as I believe no similar one has exhibited itself, or been recorded in geology or history, with the exception of some few Indian traditions, which have been generally discredited, and probably originated in their vague conceptions of the Supreme Being.

"The principal part of the animal had been consumed by fire, that had not been created by a volcanic eruption, but had been made of wood, as I found nine feet beneath the surface a layer of ashes from six (6) to twelve (12) inches in thickness, mingled with charcoal, large pieces of wood partly burned, together with Indian implements of war, as stone arrowheads, tomahawks, etc. I also found more than one hundred and fifty (150) pieces of rocks, varying from three (3) to twenty-five (25) pounds in weight, which must have been carried from the rocky shores of the Burboise (Bourbeuse) River, a distance of three hundred (300) yards, as there was no rock, stone, or even gravel near to be found; and these pieces of rock taken out of the ashes were precisely the same as that found in the river, which is a species of limestone. These had been thrown evidently with the intention of striking the animal.

"I am more of the belief that the animal got mired, than that it died a natural death, as I found the fore and hind foot standing in a perpendicular position, and likewise the full length of the leg below the layer of ashes, so deep in the mud and water that the fire had no effect on them. Whereas, if the animal had died in any other way, these feet and legs could not have remained in their standing position, but would have fallen into a recumbent or reclining posture. As it is indisputable that the animal could not have died and remained standing after its death, excepting that it was so deeply mired that it could not fall; in which case the fire would have had no perceivable effect on the carcass."

It must be said that Dr. Koch's account met with a more favorable reception in Europe, especially in Germany; and it was not very many years before the abundant proofs of the coexistence of man and the mammoth in that hemisphere, even to a drawing of the latter animal on its own ivory, forced an almost universal belief of it. We cannot trace in this country, as in Europe, the existence of man to period when he was the contemporary of many extinct mammalia, and when the outlines of land and sea, and the conditions of climate over large parts of the earth were wholly different from what they now are. But he can be traced beyond the last great change, for Dr. Abbott found worked flint implements in the glacial drift of New Jersey, and he rightly infers, "*that if man was a pre-glacial occupant of this continent, he must have been familiar with the mastodon.*"*

The works of man have been repeatedly found in this country in con-

*Letter to the writer.

nection with the bones of the mastodon, or of other extinct animals, his contemporaries.

Bancroft says :* "The mining shafts of California have brought to light human remains, implements wrought by human hands, and bones of extinct animals, at great depths below the surface, evidently of great age.

Whitney found in California in 1857 the works of man with bones of the mastodon, and says :† "There is every reason to believe that these great proboscideans lived at a very recent period (geologically speaking), and posterior to the epoch of the existence of glaciers in the Sierra Nevada, and also after the close of the period of activity of the now extinct volcanoes of that great chain."

Holmes, in "South Carolina in 1858,"‡ found pottery at the base of a peat bed, on the banks of Ashley River, in close connection with the grinder of a mastodon.

Hilgard, in Louisiana in 1867, in the salt mine of Petite Anse Island, found the works of man, with the bones of a mastodon. There are two instances in America of the existence of the effigies of the mastodon in monumental structures. First, in the splendid ruins of Copan and Palenque, where they occur as sculptured ornaments of buildings, in the form of massive heads with huge trunks ; and secondly, in the instance of the celebrated elephant mound of Wisconsin. Of the latter, the original describer in the Smithsonian Report for 1872, has the following remark : "Is not the existence of such a mound good evidence of the contemporaneous existence of the mastodon and the mound builders ?"

Ladies and Gentlemen, the last link in the chain of evidence of the coeval life of man and the mastodon on this continent, bears the date of 1877, and is to be found on the face of the Hunting Scene Tablet, now before you.

The paper was illustrated by charts of ancient and modern letter characters, and was referred to the Publication Committee.

Prof. W. D. Gunning was present, and in response to a call, made some interesting remarks, in which he alluded to these archaeological discoveries as promising very important results.

Mr. W. H. Pratt exhibited a stone carving, representing a human head, said to have been exhumed from a well excavation at a depth of thirty-nine feet below the surface in Hardin County, Iowa, and which was sent to the Academy by the owner for an expression of its opinion. The letter accompanying left some doubt in regard to the exact location of the speci-

*Native Tribes, vol. 4, p. 688.

†Proceedings of the California Academy of Sciences, Vol. 3, p. 278.

‡Proc. of Phila. Acad. of Nat. Sci., July, 1859, p. 179.

men, but Prof. Gunning expressed the opinion that it probably belonged to the era of the mound builders, as it resembles closely similar relics exhumed elsewhere.

MARCH 30TH, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Fifteen members present.

The Publication Committee announced that forty-eight pages of Vol. II of the Proceedings had been printed.

Various donations to the Museum were announced, among them a Fiji war club from Miss Fanny Timanus, and an additional donation of a large lot of minerals from Prof. T. S. Parvin, of Iowa City, all of which were received, with thanks to the donors. The Parvin Geological Collection has been received and mostly arranged.

A number of valuable additions to the Library were reported, including a set of Agricultural Reports from Ohio, and various foreign scientific publications received through the Smithsonian Institution.

The Furnishing Committee announced the donation by President Hunting of a much needed extension table, which was accepted with thanks.

A communication from J. D. Putnam, Chairman of the Committee on Publication, addressed to the President and Board of Trustees, was read, stating in a precise form the conditions under which the publication of Vol. II of the Proceedings had been undertaken; the necessity of more liberal support in the way of subscriptions to meet the obligations assumed by the Academy, which had not yet reached one-half of the required number of 150 copies, and would soon be required to meet accruing bills, and to provide for necessary illustrations; also, dwelling on the importance of the work in order to keep up the future standing and usefulness of the Academy, especially in securing exchanges from kindred associations at home and abroad. Following the reading of this communication it was voted to appoint a committee to solicit subscriptions, which was selected as follows: H. C. Fulton, W. J. Skinner, E. P. Lynch, W. H. Pratt, E. H. Hazen.

The Corresponding Secretary reported a large number of letters written, and about as many received, besides several packages of books, etc.

Letters were read from the following persons in acknowledgment of their election as honorary or corresponding members of the Academy: Joseph Henry, Washington, D. C.; Asa Gray, Cambridge, Mass.; Dr. John L. Le Conte, Philadelphia, Pa.; Dr. Herman Behr, Henry Edwards, Dr. A. Kellogg, W. G. W. Harford, San Francisco, Cal.; L. N. Dimmock, Santa Barbara, Cal.; Henry Ulke, Washington, D. C.; Baron C. R. Osten Sacken, Newport, R. I.; Dr. H. A. Hagen, F. W. Putnam, Cambridge, Mass.; Herman Strecker, Reading, Pa.; John Wolf, Canton, Ill.; James Lewis, Mohawk, N. Y.; Dr. Edward Palmer, St. George, Utah, and others.

President Hunting announced the appointment of S. F. Smith as a member of the Finance Committee in place of George H. French resigned.

A building committee was nominated and confirmed by the Academy to consist of Chas. E. Putnam, E. P. Lynch, C. C. Parry, M. B. Cochran, E. H. Hazen.

The amendments to the By-Laws presented at the last meeting, were adopted, as follows:

ARTICLE IX.—COMMITTEES.

SECTION 1. Strike out the word "and" after "*Library*," and after "*Publication*," insert "*on Finance*" and "*on Furnishing*."

At the close of Section 6 add:

SECTION 7. The Committee on Finance shall consist of three members, the Treasurer of the Academy being *ex-officio* chairman of the committee. It shall be their duty to take into consideration all subjects directly connected with the financial interests of the Academy; to recommend from time to time such action as may seem advisable for raising necessary funds for regular or extraordinary expenses, and at each annual meeting to present an estimate of the funds required for the ensuing year, with suggestions in reference to the most feasible means of securing the same.

SEC. 8. The Furnishing Committee shall consist of five members, of whom not less than three shall be ladies connected with the Academy; it shall be their duty to take charge of all entertainments devised and car-

ried out for the interests of the Academy, and all monies derived from such sources, or special donations to the furnishing funds, shall be expended by them on orders approved by the President, in supplying necessary furniture to render the rooms of the Academy comfortable and attractive. It shall be their duty to present at the annual meeting a condensed statement of such receipts and expenditures, and offer such suggestions as may seem advisable for promoting the efficiency of such objects.

Chas. Schmidt, Weller Reed, M. V. Gannon, P. S. Blackmon, of Davenport; Prof. T. S. Parvin, of Iowa City, and Hon. T. H. Howe, of Pittsburg, Pa., were elected regular members of the Academy. Prof. Parvin was elected a life member. The names of nine persons were presented for regular membership, and of one hundred persons for corresponding membership of the Academy.

Dr. C. C. Parry offered the following resolution :

WHEREAS, The United States Department of Agriculture, under the administration of Commissioner Watts, for the past six years, has failed to meet the requirements of advanced agriculture, its official acts and published reports being neither creditable to the country nor of any essential benefit to the large agricultural community for whose benefit it was instituted, and,

WHEREAS, The time has fully come when American science should be properly represented at the capital of the nation ; therefore,

Resolved, By the Davenport Academy of Sciences, that we urgently recommend, as citizens of a State largely devoted to agricultural pursuits, that the position of United States Commissioner of Agriculture should be filled by one whose large experience, eminent abilities, scientific training, extensive travels and acknowledged executive ability are calculated to elevate the standard of progressive agriculture, meet the pressing want of supplying the necessary information in efficiently combatting insect foes, and creditably represent American science both at home and abroad, and that these desirable qualifications are worthily exemplified in Dr. John L. Le Conte, the distinguished entomologist, of Philadelphia, who is eminently qualified to fill such a position, with credit to himself and benefit to the country at large.

Mr. W. H. Holmes offered as an amendment :

Resolved, That it is inexpedient for the Academy to make any recommendation in reference to the appointment of a United States Commissioner of Agriculture.

The amendment, being put to vote, was lost, and after some discussion the original resolution was adopted.

W. J. Skinner made a motion that an amendment to the By-Laws be proposed at the next meeting, requiring that all names proposed for regular membership be accompanied by the regular initiation fee of \$5.

The following paper was read by title and referred to the Publication Committee: *Botanical Features of the Desert Region of South-eastern California*, by *Dr. C. C. Parry*.

APRIL 9TH, 1875.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President, in the chair.

Six members present.

An offer from the Eclectic Club, of Davenport, to give a dramatic entertainment for the benefit of the Academy was accepted, and a Committee of Arrangements, consisting of Dr. C. H. Preston, Dr. C. C. Parry, Clarence Lindley, and Chester Pratt, was appointed, with authority to make all necessary arrangements.

It was also voted, that if convenient to the performers, the play entitled "Fate" be given at the Burtis Opera House on Monday, the 16th inst.

APRIL 13TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Ten members present.

Quite a number of donations were reported, among them the first Directory of the City of Davenport in 1855; Eastman's History of the State of New York, 1831, from Mr. Pratt; also a piece of wood from Commodore Perry's flag-ship, "Lawrence," and one from the celebrated frigate, "Constitution;" an old table-fork of Queen Elizabeth's time, together with a curious old china pitcher and cup, etc.

Several contemplated papers, relating to various subjects concerning the history of this vicinity were reported, and a general informal discussion was had. Great regret was expressed by the members present that so many valuable historical documents belonging to the Scott County Pioneer Society had been destroyed in the late fire in Eldridge & Brother's office.

APRIL 14TH, 1877.—BIOLOGICAL SECTION.

J. D. Putnam in the chair.

Nine members present.

Mr. J. D. Putnam presented the following

REPORT OF THE DIRECTOR :

Ladies and Gentlemen :

It is now a little more than a year since ten members of the Academy met together "to form a working section of those members specially interested in Botany and Zoölogy, for the purpose of listening to and discussing the reports of observations and collections in these departments made by the members." Since that time there have been eight meetings of the Section, besides one "Field meeting," an average of about eight members being present on each occasion. Other meetings and excursions were planned, but failed on account of the weather, or because of other engagements by the members.

The active work of the Section has fallen upon a very few, and although but comparatively little was accomplished in adding to our knowledge of the Biological features around us, we have gained some experience, and will, no doubt, be better prepared for the great work before us. With the exception of the flowering plants, the shell-bearing mollusca, and a few of the orders of insects, we know almost absolutely nothing regarding the Botany and Zoölogy of the neighborhood in which we live, and even in these branches our knowledge is exceedingly crude and imperfect. Our first and principal object should be to learn all we can of the living things in our own vicinity, and in this way we will not only come to a better knowledge of our own resources, but we may be able now and then to add something to the entire stock of knowledge already possessed by the scientific world. To do this it is necessary to make close observations of the animals and plants which we meet in our rambles, and to carefully record them as nearly at the time as possible. Much valuable information that is now of use to but a single individual, might prove of vast importance to many others if it were put on record in proper form. Biology is essentially a science based on observation or experiment, which is observation under artificial arrangements. As we cannot always bear in mind names for so great a multitude of objects, or we may not know the proper terms in which to describe our observations intelligibly to others, it will often be found necessary to collect the specimens so that we can at our leisure study out their characteristics and compare them with others.

The careful collection of specimens, taken in connection with their observations and study, before and after, is of the greatest importance in aiding us in the study of the physical characteristics of any region, but their greatest value lies in the fact that they are veritable proofs of the correctness of our observations.

I hope that the members of the Section will bear this in mind, and not only observe carefully, but also record their observations and report them at our meetings, so that they may be preserved in a permanent form in our Proceedings, and thus be of use to others besides ourselves. The number and variety of living things is so great, that in order to make any very satisfactory progress, we must each of us confine our principal attention to some one or more particular and limited departments. A few things thoroughly learned will be of much greater value than any amount of half made observations on a great variety of objects. Having made these more general remarks, I will now make more particular mention of the present condition and future needs of the various departments of Biology in our own locality.

In *Phænogamic Botany* more progress has been made than in any other department. As early as 1847, the flowering plants growing in this vicinity were collected by Dr. C. C. Parry, and he included them in his list of the plants of Wisconsin, Iowa and Minnesota, published in Owen's Report. Since that time other collections have been made by the late Alfred Sanders, and by Messrs J. J. Nagel and J. G. Haupt, whose collections have been included in the Herbarium of the Academy. In the list prepared by Mr. Haupt, and published in the first volume of our Proceedings, 410 species are enumerated. During the past year several additional species were collected, and it is likely that others will yet be found. It may prove interesting and instructive for our collectors to give some attention to the local distribution, times of flowering, and other habits of the various species. In addition to the local collections above mentioned, the Herbarium contains a very complete collection of about 2,000 species of eastern plants, presented by Hon. G. W. Clinton, of Buffalo, N. Y., and smaller collections received from J. C. Arthur, of Charles City, Iowa, and from Dr. E. Palmer, collected in Southern California. The Herbarium is contained in four walnut cases, made after the design of Dr. Parry.

In *Cryptogamic Botany* scarcely anything has been accomplished, as yet. The field is a comparatively new one and the difficulties are great, but we hope our members will continue to persevere, and success will be sure to crown their efforts.

But it is in *Zoology* that we feel the greatest need of more active workers. Strange as it may seem, we have practically no definite knowledge whatever of the *Vertebrates* found in this vicinity. Nothing like a complete list has ever been attempted. A small number of stuffed birds and mammals are contained in the Museum of the Academy, but they are not determined or labeled, and are in danger of being destroyed by insects for want of proper cases to receive them. An interesting collection of skulls has been commenced by Mr. Pratt, and should be continued until all our species are represented. It would be well, in some instances, to carefully preserve the entire skeletons, even if not able to mount them. I hope that this year we may be able to make the beginning of a more systematic survey of the zoölogical features of this district, and would particularly urge our friends of the shot-gun and fishing-tackle to remem-

ber the wants of science when on a hunt or fishing excursion, and report to the Academy lists of the various animals they may meet, together with notes of any peculiar habits that are observed. Even the most trivial facts often prove of the greatest interest in solving the difficult problems of nature. If some of our experienced sportsmen would furnish us with an account of our game animals, their haunts and habits, with a notice of the relative abundance in different years and at different seasons, it would be a paper of great interest, not only to the naturalist, but to the historian and the climatologist. Observations in regard to the times of the migrations of our birds, and in regard to their food, might prove of vast importance to our farmers and fruit growers. While a complete collection of our birds and mammals is very desirable, it is not necessary that every specimen should be stuffed and mounted in a life-like attitude. That would require a skill in taxidermy which few of us possess, or are likely to acquire. A carefully preserved skin, together with the skull, will be amply sufficient to identify the species, and while it may not add so much to the beauty of our cabinets, it will be just as *useful*, and much more easily procured and taken care of.

Mr. Pratt has already suggested, in his report as Curator, that special attention be given this year to a collection of the *Fishes* and *Reptiles* found so plentifully in our midst, and about which we know so little. The smaller species, especially, should not be neglected, and with careful management a small amount of alcohol may be made to do good service. The season is already well advanced, and an effort should be made at once to procure a supply of alcohol, and proper jars or other vessels in which to preserve the specimens. Arrangements should be made with the various fishermen to have them preserve for us any peculiar animals which they may take, and our school children should be induced to bring to the Academy any curious reptiles and insects, or other animals that they may chance to meet. We would thus soon have a collection to be proud of, and in which each collector might feel a personal interest.

Our *Mollusks* have hitherto received more attention than any other branch of the animal kingdom. The early efforts of Prof. Sheldon and Mr. Pratt have left but little to be done in the way of collecting. In 1867 Mr. G. W. Tryon published in the *American Journal of Conchology*, Vol. I, a list of the species collected by Prof. Sheldon, embracing 102 species. Mr. Pratt, in his list published last year, increased the number of species to 117. During the past year some interesting observations were made in regard to the local distribution and habits of several of the species, and it is hoped that these may be continued during the present season. Mr. Tiffany was so fortunate as to add three species to those previously known to occur here in a living state. While collecting insects in the Rocky Mountains some years ago, I made a small collection of the Mollusks. These have been studied by Ernest Ingersol, of Jersey City, and his report is nearly ready. Mr. Pratt has already paid some attention to the shell beds occurring along the river banks above high water. I hope that these observations may be continued and that we may thus obtain some knowledge of the changes that have occurred in our fauna during past

ages, and besides, in some instances it is not unlikely that we may learn something more of the pre-historic inhabitants of this country. In this connection I would suggest a more careful examination of the shells found in the loess of the bluffs.

In the department of *Entomology*, to which I have devoted my special attention, considerable collections have been made, but owing to a variety of causes they have not as yet been sufficiently studied. Lists of the Coleoptera and Macro-Lepidoptera, collected by me, were published in the first volume of our Proceedings, but they are certainly far from complete. During the past year several Lepidoptera and a larger number of Coleoptera, not yet determined, were collected for the first time. A knowledge of our insect fauna has scarcely been commenced, and there is enough to keep a score of active entomologists busy for many years. I have so far had the work entirely to myself, and I am not aware of the existence of another entomologist in the county, and scarcely in the State. A few others have commenced collections, but none have persevered. I hope this will not continue long, but that some of our young men or women will take some thought of these most interesting animals. To any such I will gladly extend all the assistance within my power. To properly observe, collect, preserve and study insects, requires much care and perseverance, and above all a thorough love of the subject. When once interested, the pursuit of entomology becomes exceedingly fascinating, and I hope it may hereafter receive more of the attention which it deserves. My own collection, although still very incomplete, will, I hope, form the basis of a large and useful collection, which it is my intention to present to the Academy as soon as sufficiently safe and convenient quarters are procured. Thanks to various friends, portions of the collection have been carefully determined and arranged, thus greatly increasing the value. The *Coleoptera*, numbering over 1,000 North American species, have all been named by Mr. Henry Ulke, of Washington; the *Hymenoptera* by Mr. E. T. Cresson, of Philadelphia, and the *Orthoptera* by Dr. Cyrus Thomas. In determining the *Lepidoptera* I have received valuable assistance from Henry Edwards, R. H. Stretch and Dr. Herman Behr, of San Francisco, Cal., Herman Strecker, of Reading, Pa., J. A. Lintner, of Albany, N. Y., S. H. Peabody, Chicago, and B. P. Mann, of Cambridge, Mass.; from all of whom I have received many specimens in exchange or by gift. During his short visit here last summer, Baron Osten Sacken gave me much valuable assistance in the classification of the *Diptera*, so that I have been enabled to arrange them by families. The *Neuroptera* have been arranged by families, while the *Hemiptera*, *Arachnida*, *Myriapoda* and the lower *Articulata* are as yet almost entirely unarranged. There is more work to do in caring for and arranging this collection than I can ever hope to accomplish.

In regard to special entomological work during the coming season, I would suggest a careful study of the maple tree bark louse, its habits, enemies, and the means to be used in combating it, a matter of vital importance to this community. The small *Crustaceans*, such as Mr. Pratt found so abundant last spring, should be carefully looked for and their

habits learned. Observations and collections of all varieties of animal life are very desirable, and I hope that the members will report them regularly at our meetings for publication in the Proceedings of the Academy.

Another matter which has been suggested, I hope in time to see practically carried out, and that is to organize under the auspices of the Section, classes in *Botany*, and in some of the branches of *Zoology*, with which our members may be most familiar. Dr. Parry has signified his willingness to assist a class in practical Botany, and no doubt other members will do what they can in other branches of natural science. Prof. Barris has suggested a similar plan for the Geological Section, and I hope that we will soon be able to make a beginning in this important educational work.

I would recommend that the meetings of the Section be held regularly, and as often as possible to have field meetings in the vicinity of some of the best localities for making collections.

In closing this report I must thank all who have in any way assisted in the work of the Section, and beg them to continue their aid to my successor. Having through your courtesy held the office of Director for one year, I now beg leave to tender my resignation, in order that you may elect to that office some one who, possessing greater abilities, accompanied with better health, will be more able to make the work of the Section a success.

Mr. Putnam's resignation was laid on the table.

A discussion was had on the ways and means of carrying out some of the suggestions contained in the above report. Mr. J. A. Crandall was appointed to see what could be done toward procuring a supply of alcohol at a reasonable cost.

The following papers were presented for publication:

Description of a New Species of Acrididæ from Arizona.

BY DR. CYRUS THOMAS.

Caloptenus (Hesperotettix) picticornis. Sp. nov. (Plate IV, fig. 1, 2).

Medium size; head, thorax and legs yellow, sprinkled over profusely with dark-brown quadrate dots; antennæ banded alternately with yellow and dark brown.

Female.—Head short; vertex between the eyes rather narrow, very slightly deflexed, with a shallow groove; suddenly expanded, subhexagonal and more deflexed immediately in front of the eyes, this portion being depressed in the middle. Frontal costa deeply sulcate, forming two carinæ nearly parallel and reaching to the clypeus; lateral facial carinæ distinct, nearly parallel with the frontal costa; cheek carinæ below the eyes somewhat distinct. Eyes ovate, acuminate above, prominent.

Pronotum sub-cylindrical, without any distinguishable carinæ; posterior sulcus behind the middle. Elytra and wings passing the abdomen slightly. Posterior femora not so robust as usual in *Caloptenus*; about as long as the abdomen; anterior and middle femora comparatively slender. Antennæ a little longer than the head and thorax. Prosternal sharply conical, broadest lengthwise at the base; directed obliquely backward so as to approach the border of the mesasternum.

Color (dried after long immersion in alcohol).—Ground color throughout, yellow varied only in shading and by the dark brown dots mentioned, which are scattered profusely over nearly every part of the external surface, except the elytra, wings and venter, being rather sparse only on the sternum and posterior tibiæ. On the face they are found chiefly on the carinæ; on the pronotum there is usually a band of them along the front and posterior margins, and a group on the middle of the disk; on the posterior femora they are chiefly placed in longitudinal rows, one along the central line of the disk, and one on each carinæ. The head and posterior femora, and sometimes the front part of the pronotum, are of a darker, somewhat orange, shade. The eyes are usually marked with numerous oval yellowish spots. The antennæ are banded alternately with yellow and dark brown, very distinct and well defined, the yellow being at the nodes, and the dark on the internodes; the yellow bands are alternately broad and narrow, thus making the dark bands appear in pairs. Elytra and wings immaculate; the former a transparent greenish yellow, the latter slightly more pellucid; both were probably pale green when living.

Male.—Differs but slightly from the female. Is much smaller; the vertex between the eyes very narrow and more distinctly grooved; elytra and wings longer as compared with the abdomen; face more oblique. The abdomen is scarcely or but very slightly enlarged at the tip; the last ventral segment somewhat elongated and narrowing to the tip, which is strongly elevated; cerci small, and rapidly tapering to a point; superanal plate, elongate-triangular, rounded at the tip, with a distinct median longitudinal groove above.

The face of the female is nearly vertical; that of the male somewhat oblique.

Dimensions.—♀ Length to tip of abdomen, 1.00 inch to 1.05; length to tip of elytra, 1.10 in.; elytra, .82 in.; posterior femora, .53 in. ♂ Length to tip of abdomen, .62 to .75 in.; to tip of elytra, .80 to 1.00 in.; elytra, .52 to .75 in.

Five females and three males collected in Arizona by Lieut. Wheeler's Expedition in 1874, and accidentally omitted in the report made to him by me.

This well marked and very distinct species can be easily recognized, both from alcoholic or living specimens, no matter what the general color of the latter may be. It evidently belongs to Scudder's new genus, *Hesperotettix*, formed by him to receive my *Ommatolampis viridis*.

Contributions to the Flora of Iowa.

BY J. C. ARTHUR.

The following list comprises all the species of Iowa plants brought to my notice up to date, and not mentioned in my "Flora of Iowa." Specimens of each from which the names were determined are either in my private herbarium, or in the herbarium of the Agricultural College, and were all furnished by Dr. Geo. E. Ehinger of Keokuk, J. G. Haupt of Davenport, Prof. C. E. Bessey of Ames, and R. Burgess of Ames.

- 76^a *Draba verna*, L. Ames.
 97^a *Hypericum prolificum*, L. Keokuk.
 110^a *Lychnis vespertina*, Sibth. Decorah.
 207^a *Lespedeza violacea*, Pers. Keokuk and Davenport.
 236^a *Agrimonia parviflora*, Ait. Keokuk.
 353^a *Eupatorium altissimum*, L. Harrison County.
 362^a *Aster Shortii*, Boott. Keokuk.
 365^a *Aster ericoides*, L. Keokuk.
 369^a *Aster tenuifolius*, L. Plymouth County.
 468^a *Senecio aureus*, L. Var. *obovatus*, Gr. Ames.
 422^a *Aphyllon uniflorum*, T. & G. Keokuk.
 427^a *Collinsia verna*, Nutt. Keokuk.
 533^a *Conoclea multifida*, Benth. Keokuk.
 539^a *Veronica Americana*, Schw. Keokuk.
 579^a *Monarda punctata*, L. Cedar Rapids.
 638^a *Apocynum cannabinum*, L. Var. *pubescens*, DC. Blackhawk Co.
 644^a *Asclepias quadrifolia*, Jacq. Keokuk.
 670^a *Froelichia Floridana*, Moq. Cedar Rapids.
 751^a *Salix sericea*, Marshall. Plymouth County.
 754^a *Salix lucida*, Muhl. Plymouth County.
 811^a *Trillium erectum*, L. Decorah.
 843^a *Cyperus inflexus*, Muhl. Ames.
 934^a *Glyceria fluitans*, R. Br. Ames.

Lespedeza capitata, var. *angustifolia* of the "Flora of Iowa", (No. 209), should be changed to *L. leptostachya*, Engelm. The following description of this new species is from Proceedings American Academy of Arts and Sciences, Vol. XII (Dec. 1876): "*Lespedeza leptostachya*, Engelm. —Clothed with appressed, silky pubescence; leaves linear; petiole longer than the terminal petiolule; spikes paniculate, slender, somewhat loosely flowered, rather longer than the peduncle; legume equal to or slightly longer than the calyx. Minnesota, T. J. Hale; Illinois, Bebb.; Iowa, J. C. Arthur, Bessey. Has passed for *L. angustifolia*, from which its slender spikes and paniculate habit at once distinguish it."

Many names have been reported from different parts of the State, but not being accompanied by specimens, it is thought best not to include them in this list. Additions will be made as often as sufficient material accumulates.

APRIL 27TH, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Seventeen members present.

The Publication Committee reported 120 pages of the Proceedings printed, and that the first part of Vol. II would be ready for distribution as soon as the necessary illustrations were completed.

The Committee on raising subscriptions to the building fund, reported that \$2,000 had been subscribed, of which some \$400 had been paid into the Treasury.

Dr. Farquharson reported letters from Dr. E. Sterling, of Cleveland, Ohio, in reference to the discovery of inscribed tablets by the Mormons in Southern Illinois, and from Prof. Jos. L. Barfoot, of Salt Lake City, containing copies of the inscriptions and the account of their discovery. They are twelve in number, covering either side of six brass bell-shaped plates, which were dug from a mound near Kinderhook, Pike County, Ills., by Robert Wiley, in 1843.

A letter was also read from Prof. S. F. Baird, Assistant Secretary of the Smithsonian Institution, to whom the tablets found by Mr. Gass were sent for examination, in which he says "there appears every evidence of the genuineness of the specimens, and the discovery is certainly one of very high interest."

The usual number of donations to the Library and Museum were announced, and accepted with a vote of thanks to the donors. Among the latter, a stuffed heron (*Ardea herodias*) from Dr. J. H. Reid; a fine peacock from Jas. Ryan, and a magnificent collection of crystals from near Little Rock, Ark., donated by Mrs. H. M. Mandeville.

Messrs. E. A. Clark, S. F. Smith, J. S. Pierce, Mrs. Isabel Sheaf, Mrs. J. J. Humphrey, Mrs. George McClelland, Miss Rose Dawson, of Davenport; Messrs. Chas. H. Truax, B. F. Reeve, D. A. Fletcher, of Maquoketa, were elected regular members, and the following persons corresponding members of the Academy:

Chas. C. Abbott, Trenton, N. J.	J. A. Allen, Cambridge, Mass.
Alex. Agassiz, Cambridge, Mass.	Dr. Edmund Andrews, Chicago.

- E. P. Austin, Cambridge, Mass.
 Spencer F. Baird, Washington, D. C.
 James Behrens, Socilito, Cal.
 G. W. Belfrage, Clifton, Texas.
 E. L. Berthoud, Golden City, Col.
 Prof. C. E. Bessey, Ames, Iowa.
 Rev. C. J. S. Bethune, Port Hope,
 Ontario.
 W. G. Binney, Burlington, N. J.
 T. S. Brandegee, Berlin, Conn.
 Harry A. Brous, Manhattan, Kan.
 Edward Burgess, Boston, Mass.
 Rev. R. Burgess, Ames, Iowa.
 James D. Butler, Madison, Wis.
 Prof. S. Calvin, Iowa City, Iowa.
 Dr. R. M. Byrnes, Cincinnati, Ohio.
 W. M. Canby, Wilmington, Del.
 Lucien Carr, Cambridge, Mass.
 J. D. Caton, Ottawa, Ills.
 V. T. Chambers, Covington, Ky.
 T. B. Comstock, Ithaca, N. Y.
 T. A. Conrad, Philadelphia, Pa.
 Edw. S. Cope, Philadelphia, Pa.
 Dr. Elliott Coues, U. S. A.
 J. M. Coulter, Hanover, Ind.
 E. T. Cox, Indianapolis, Ind.
 J. J. Croke, New York.
 W. H. Dall, Washington, D. C.
 Rev. Dr. E. A. Dalrymple, Balti-
 more, Md.
 J. D. Dana, New Haven, Conn.
 Chas. R. Dodge, Washington, D. C.
 W. H. Edwards, Coalburg, W. Va.
 James H. Emerton, Salem, Mass.
 George J. Engelmann, M. D., St.
 Louis, Mo.
 Prof. W. G. Farlow, Cambridge,
 Mass.
 Dr. E. Forman, Washington, D. C.
 Prof. S. A. Forbes, Normal, Ills.
 James T. Gardner, Albany, N. Y.
 Thos. G. Gentry, Germantown, Pa.
 Townend Glover, Washington, D. C.
 Prof. Geo. L. Goodale, Cambridge,
 Mass.
 Rev. E. L. Green, Silver City, New
 Mexico.
 W. G. Gunning, Boston, Mass.
 Prof. A. Guyot, Princeton, N. J.
 James Hall, Albany, N. Y.
 Dr. H. W. Harkness, San Francisco.
 B. Waterhouse Hawkens, Philadel-
 phia, Pa.
 Dr. F. V. Hayden, Washington.
 Wm. Holden, Marietta, Ohio.
 Dr. Geo. H. Horn, Philadelphia, Pa.
 Alpheus Hyatt, Boston, Mass.
 Malvern W. Iles, Baltimore, Md.
 Ernest Ingersoll, Jersey City, N. J.
 Dr. Joseph Jones, New Orleans, La.
 Capt. W. A. Jones, U. S. Eng. Corps.
 Dr. Isaac Lea, Philadelphia, Pa.
 W. H. Leggett, New York, N. Y.
 Joseph Leidy, Philadelphia, Pa.
 Leo Lesquereux, Columbus, Ohio.
 J. A. Lintner, Albany, N. Y.
 Rev. H. C. McCook, Philadelphia.
 B. Pickman Mann, Cambridge.
 Prof. O. C. Marsh, New Haven.
 Prof. O. T. Mason, Washington.
 Theodore L. Mead, Ithaca, N. Y.
 Thomas Meehan, Philadelphia, Pa.
 Lewis H. Morgan, Rochester, N. Y.
 Rev. J. G. Morris, Baltimore, Md.
 Dr. Wesley Newcomb, Ithaca, N. Y.
 Col. S. T. Olney, Providence, R. I.
 Dr. A. S. Packard, Jr., Salem, Mass.
 Rev. Stephen D. Peet, Ashtabula, O.
 Thos. C. Porter, Easton, Pa.
 Dr. Chas. Rau, Washington, D. C.
 J. H. Redfield, Philadelphia, Pa.
 Albert Reilly, Henrietta, Texas.
 Robert Ridgway, Washington, D. C.
 Wm. Saunders, London, Ontario.
 S. H. Scudder, Cambridge, Mass.
 Prof. N. S. Shaler, Cambridge, Mass.
 J. E. Shroyer, Cincinnati, Ohio.
 S. I. Smith, New Haven, Conn.
 Prof. F. H. Snow, Lawrence, Kan.
 Robt. E. C. Stearns, Berkely, Cal.
 Prof. Sanburn Tenney, Williams-
 ton, Mass.
 George Thurber, New York.
 George W. Tryon, Philadelphia, Pa.

Philip R. Uhler, Baltimore, Md.	J. D. Whitney, Cambridge, Mass.
Dr. Geo. Vasey, Washington, D. C.	W. D. Whitney, Baltimore, Md.
A. E. Verrill, New Haven, Conn.	Col. Chas. Whittlesey, Cleveland, O.
Sereno Watson, Cambridge, Mass.	Prof. Burt G. Wilder, Ithaca, N. Y.
R. P. Whitfield, Albany, N. Y.	H. T. Woodman, Dubuque, Iowa.

The Committee on Dramatic Entertainment reported the expenses greater than the receipts—causing a deficit of \$14.05.

Rev. J. Gass reported that he had lately examined another Mound, No. 10, in the Cook's Farm Group, which presented some peculiar features, and promised a more detailed description. The wetness of the weather has interfered with this work.

APRIL 28TH, 1877.—BIOLOGICAL SECTION.

J. D. Putnam, Director, in the chair.

Six members present.

Mr. J. A. Crandall reported that he had made arrangements by which the Academy could obtain alcohol at reduced prices.

Dr. C. H. Preston stated that six or eight years ago he found *Trillium nivale* blossoming in March over a limited area on Rapid Creek, near Iowa City.

Mr. Putnam reported that the first butterfly noticed this year was *Vanessa antiopa* on April 7th; *Pyrameis atalanta* was first seen on April 14th, and *Lycæna pseudargiolus* on April 17th. On April 15th, a species of *Simulium* was quite abundant, and caused some annoyance to men and horses. The weather has not been particularly favorable for the development of insects, and but few have been observed. Mr. Tiffany reports a borer, probably the larva of *Trochilium tipuliforme*—quite destructive to his currants.

Mr. Putnam stated that while engaged in collecting insects in Colorado in 1872 and 1874, in Wyoming in 1873, and in Utah in 1875, he had also made a small collection of the Mollusca. This collection, which now belongs to the Academy, was placed by Prof. Sheldon in the hands of Ernest Ingersoll, of Jersey City, for determination, and he has prepared the following report:

On a Collection of Mollusks from Utah and Colorado.

BY ERNEST INGERSOLL.

The following list is a catalogue of an interesting collection of Mollusks from Colorado, Utah and Southern Wyoming, made by Mr. J. D. Putnam, a member of the Academy, in the years 1872, 1873 and 1875.

The collection, although embracing only thirty-two species, is typical of the Molluscan fauna of that region, affords one or two names not hitherto recorded from beyond the Rocky Mountains, and is particularly interesting as including specimens of two species discovered only two years ago in the mountains of Colorado.

It is of the greatest importance to have collections like the present accurately labelled as to localities and stations, from all parts of the rugged territory between the Rocky Mountains and the Sierra Nevada, for a study of the molluscan life of no other part of North America is likely to yield more aid in elucidating the history of the origin and geographical distribution of our mollusks; and very interesting results are already foreshadowed.

I have received willing help from Dr. James Lewis, of Mohawk, New York, in identifying the puzzling forms of the limneas and physas; and am glad to acknowledge his superior judgment, and thank him for his kindly assistance.

Jersey City, March, 1877.

ERNEST INGERSOLL.

CATALOGUE OF MOLLUSCA.

Pulmonata Geophila.

HELICIDÆ.

Limax castaneus, Ingersoll.

Locality: Davidson's Ranch, Boulder County, Colorado; Summit Cañon, Mt. Nebo, Utah.

Described in Hayden's Annual Report, 1874, p. 396. Determined by W. G. Binney.

Vitrina limpida, Gould.

Locality: Empire, Col. [Common among the beaver dams, August, September, 1872.]

Vitrina Pfeifferi, Newcomb.

Locality; Summit Cañon, Mt. Nebo, Utah. [Common, August, 1875.]

Microphysa Ingersolli, Bland.

Localities: American Fork Cañon, Wahsatch Mountains, Utah; Summit Cañon, Mt. Nebo, Utah.

Type specimens from the Saguache Mountains of Southern Colorado.

[Some notes regarding localities, etc., added by the collector, are distinguished by being placed in brackets.—J. D. PUTNAM.]

Zonites arboreus, Say.

Localities : American Fork Cañon, Wahsatch Mountains, Utah ; Summit Cañon, Mt. Nebo, Utah.

Zonites fulvus, Drapernand.

Localities : American Fork Cañon, Wahsatch Mountains, Utah ; Summit Cañon, Mt. Nebo, Utah ; Empire, Col.

Patula Cooperi, W. G. Binney.

Localities : Summit Cañon, Mt. Nebo, Wahsatch Mountains, Utah : [Floyd's Hill, Clear Creek, Col. ; Cañon City, Col.]

These specimens present the usual difference of size, shape and markings, which render it so difficult to determine between this species and three or four closely allied forms.

[Of this species I have found the dead shells in great abundance, and very widely distributed, both in Colorado and in Utah. On the mountains near Summit Cañon, Utah, I often found the dead shells among barren rocks, at a height of from 8,000 to 10,000 feet, and it was only after several weeks searching that I succeeded in finding a few living specimens among the debris in the bottom of some deep crevices at the base of a high rocky cliff. Although it was in the latter part of August, these had all hibernated. It seems very probable that this species may hibernate, both for cold and for dry seasons.]

Patula striatella, Anthony.

Localities : American Fork Cañon, Wahsatch Mountains, Utah ; Fort Bridger, Wyoming Territory ; Empire, Col. ; Summit Cañon, Mt. Nebo, Utah.

Vallonia pulchella, Müller.

Locality : American Fork Cañon, Wahsatch Mountains, Utah.

Pupilla muscorum, Linnæus.

Locality : American Fork Cañon, Wahsatch Mountains, Utah.

Pupilla Blandi, Morse.

Locality : Summit Cañon, Mt. Nebo, Utah.

More common throughout the West than the preceding. It was known only as a fossil in the drift along the Upper Missouri, until in 1874 I found it living at various elevated points in Colorado.

Pupilla alticola, Ingersoll.

Locality : ?

Several specimens of this well-marked species, discovered among the mountains of South-western Colorado in 1874, are included in the present collection, but the precise locality unfortunately is unrecorded. They have heretofore been found inhabiting elevations up to the extreme of timber growth, some of my specimens having been obtained above 11,000 feet.

[Found either in the vicinity of Empire City, Col., or among the Wahsatch Mountains of Utah.]

Vertigo Californica, Rowell.

Locality : Summit Cañon, Mt. Nebo, Utah.

Succinea lineata, W. G. Binney.

Locality : Empire, Col.

Both this and the preceding species are common throughout the West in suitable localities.

Succinea Nuttalliana, Lea.

Locality : Utah Lake, Utah. [On rushes close to the water.]

The common species of the Central Province.

Pulmonata Linnophila.

LIMNÆIDÆ.

Limnea stagnalis, Linnæus.

Localities : Utah Lake and Spring Lake, Utah.

[Very large and abundant among the rushes growing in shallow, brackish water at the southern extremity of Utah Lake. A favorite article of food with the ducks, which were very plentiful in the same locality.]

Limnea palustris, Müller.

Locality : Utah Lake, Utah.

[Plentiful, but never found in company with the above.]

Limnea elodes, Say. Variety ?

Locality : Fort Bridger, Wyoming Territory.

[In small pools.]

Limnea desidiosa, Say.

Locality : Utah Lake, Utah.

[In the waters of a fresh water spring near the southeast shore, with *L. palustris*.]

Limnea catascopium, Say.

Locality : Utah Lake, Utah.

[Semi-fossil, on a salty mud flat.]

Limnea bulimoides, Lea. Variety ?

Locality : Denver, Col.

[In small pools.]

Carinifex Newberryi, Lea.

Locality : Utah Lake, Utah.

Semi-fossil on a mud flat.

Physa elliptica, Lea.

Locality : Empire, Col.

Physa gyrina, Say, of which, by some authors, this is considered only a variety, has been found at various points in the Territories ; but I do not think this particular form has been reported heretofore from any locality west of the Mississippi.

Physa Sayii, Tappan.

Localities : Fort Bridger, Wyoming Territory ; Utah Lake, Utah.

Two large lots in alcohol. All are more or less damaged, as is so likely to be the case under the circumstances; but they seem to be of this species, which to my knowledge, has not been reported heretofore from the West. They vary much in appearance, some being almost exact miniatures of *P. Lordi* and *P. ancillaria*. But they seem to coincide in the points of *P. Sayii* more nearly than in those of any other of the very confused species of this variable genus.

Physa heterostropha, Say.

Localities: Cañon City, Col.; Empire, Col.; Hot Sulphur Springs, Middle Park, Col.

Some specimens from pools near Denver, which are small, horn-colored, and streaked across the whorls with white, resemble closely the descriptions and figures of *P. virgata*, but as I have no specimens of that species to compare them with, I hesitate to identify them as such.

Planorbis ammon, Gould.

Localities: Utah Lake, Utah; Spring Lake, Utah.

This splendid shell, of which many fine specimens are at hand, seems pretty well distributed west of the Rocky Mountains, having been found on the Pacific slope and in several of the interior Territories.

Gyraulus parvus, Say.

Localities: Davidson's Ranch, Boulder Co., Col.; Utah Lake, Utah.

Found everywhere among the mountains of the West.

VALVATIDÆ.

Valvata tricarinata, Say.

Locality: Utah Lake, Utah.

The degree of carination among these specimens, all of which are of small size, and in a semi-fossil condition, varies greatly, and it would not be difficult to assign some of them to *V. sincera*, but it would be hard to draw any line of demarcation between such and the truly tricarinated specimens.

RISSOIDÆ.

Fluminicola fusca, Haldeman.

Locality: Utah Lake, Utah.

Semi-fossil, on a mud flat.

Conchifera.

UNIONIDÆ.

Anodonta oregonensis, Lea.

Locality: Utah Lake, Utah.

Many specimens living.

[Found very abundantly and of good size in the brackish water at the Southern extremity of Utah Lake in the soft mud. Occasionally eaten by the inhabitants, who sometimes declare them "better than oysters." They are also to be seen displayed for sale in the markets of Salt Lake City. I was several times told of another clam with heavy shells, found

in streams of running water. This is probably a *Unio*, but I was unable to procure a specimen.—*J. D. P.*]

CORBICULADÆ.

Sphærium striatinum, Lamarek.

Locality: Utah Lake, Utah.

[Semi-fossil in a mud flat.]

Pisidium abditum, Haldeman.

Locality; Empire, Col.

[Very abundant among the roots of moss and other plants in still water.]

Mr. J. G. Haupt presented the following report on the first appearance this spring of the various plants mentioned:

APRIL 9TH.—*Hepatica acutiloba*, on hillsides sloping eastward.

APRIL 14TH.—*Sanguinaria Canadensis*, on Horse Island, and a little later on hillsides sloping northward.

APRIL 16TH.—*Populus tremuloides*, abundant, but small, north of the city. *Capsella bursa-pastoris*, a few specimens on roadsides near Walcott.

APRIL 18TH.—*Populus monilifera*, near Walcott; also, near Davenport, April 20th.

APRIL 20TH.—*Populus grandidentata*, a single small tree in Northwest Davenport; quite abundant near the mouth of Duck Creek. *Salix petiolaris*.

APRIL 21ST.—*Ulmus fulva*. *Ranunculus fascicularis*, top of hills, on southern slope. *Caltha palustris*, very abundant in marshy places between Davenport and Walcott. *Acer dasycarpum*, the blossoms did not seem fully open until now. *Dentaria laciniata*, very abundant on Horse Island; also, to be found on Black Hawk hillsides. *Uvularia grandiflora*, Horse Island and around Davenport. *Negundo aceroides*, is quite plentiful along Duck Creek. It is cultivated to a considerable extent in different parts of the city. *Corylus Americana*, very abundant; the plants are exceedingly full of pistillate flowers, which promises a bountiful harvest of nuts.

APRIL 23D.—*Populus balsamifera*, var. *candicans*. *Draba cuneifolia*, a single plant on C., R. I. & P. R. R., six miles from Davenport.

APRIL 25TH.—A walk of over twelve miles gave me an opportunity to see quite a number of old friends. With these I found three plants not seen or noted in previous years by Mr. Nagel or myself. *Houstonia minima*, Beck., grows quite abundantly at a rocky spot a mile east of the city. The almost invariable height of the plant was between 1½ and 2 inches. The color of the blossoms on different plants varied from purple to almost white, but the stems of all were scabrous, while other characteristics also plainly proved them to be *H. minima*. *Amelanchier Canadensis*, var. *oblongifolia*, T. and G. indicated its presence even in the distance, by its numerous white blossoms. The shrub grows on very rocky soil, near the river bank. *Draba Caroliniana*, Walt., is quite common to the upper part of the hillsides for a long distance east of the city. I can

hardly see how I could have overlooked this in previous years, it being quite easily distinguished from *D. cuneifolia*, which has much longer racemes. I am inclined to think *D. Caroliniana* to be more abundant here than *D. cuneifolia*.

The old pets that I noticed in addition to some of those previously reported, are given in the following list: *Thalictrum anemonoides* is still quite abundant. It does not seem to disappear from grazed fields as fast as other plants. *Dicentra cucularia* and *Claytonia Virginica* seemed to have been in blossom for several days. *Viola cucullata* is abundant. *Erythronium albidum* presented few blossoms this year. In many places where I found great numbers of single-leaved flowerless plants, not a single blossom was to be seen. *Androsace occidentalis* is very abundant. In size it about equals our *Draba*, being from two to three inches high. But the larger blossom of the latter distinguishes it even in the distance, while the foliage easily indicates the plant on nearer approach. *Mertensia Virginica* and *Ranunculus repens* are common. *Anemone Caroliniana* was quite abundant on the rocky soil east of the city a few years ago, but has fast disappeared, there being but a few plants remaining at present. *Ranunculus abortivus*, *Trillium recurvatum*, and *Viola pubescens* are in blossom on Duck Creek.

MAY 8TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Seven members present.

Mr. W. R. Smith was elected a member of the Section.

The following donations were reported: Davenport City Directory for 1870-71, and for 1874-75, from J. A. Crandall; bound file of the Vermont Journal for 1819 and 1820, from C. G. Plummer; Worcester's Gazetteer of the United States, 1818; Gazetteer by Wm. Chapin, published in 1831; Iowa Instructor, Vol. I, 1859-60, from W. H. Pratt.

Mr. W. C. Putnam read the first of a series of very interesting papers, entitled "Davenport and Vicinity during the War of 1812." The paper was mainly occupied with an account of the fortification of Fort Shelby at Prairie du Chien, its subsequent capture by the British and Indians under Col. MacKay during the summer of 1814, and the defeat at Campbell's Island in July, 1814, of a large reinforcing party of Americans under the command of Lieut. Campbell, who were sent from St. Louis to assist the garrison at Fort Shelby.

An interesting discussion was had upon early reminiscences, and regarding the noted Mr. Bonny, the detective employed

against the murderers of Col. Davenport, and who wrote the historical romance entitled "Banditti of the Prairies."

MAY 12TH, 1877.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President, in the chair.

Six members present.

After some discussion the following resolution was adopted :

Resolved. That the President of the Academy be requested to confer with the Presidents of the Davenport Library and Art Associations respectively, and agree with them on the time and place for a meeting of the three Associations or their delegates, to be held to consider the feasibility of the three societies uniting their efforts toward procuring a building for the accommodation of the several associations.

MAY 17TH, 1877.

Special meeting, pursuant to notice, to confer with the Davenport Library and Art Associations, or their delegates, to consider the feasibility of uniting the efforts of the three Associations toward procuring a building for the accommodation of the several societies.

Dr. C. H. Preston, Vice-President, in the chair.

Nine members present ; also, on behalf of the Library Association, Mesdames McCullough, Young, Wing, Ballou and Bryant, and on behalf of the Art Association, Messrs. Benson and Harrison.

The object of the meeting having been stated by the Chairman, and discussed by the members present, the following resolution, presented by Charles E. Putnam, was unanimously adopted :

Resolved. That the Library and Art Associations be invited to join with the Academy in the erection of a suitable building for the joint occupancy of the three societies.

After some time spent in a rather informal discussion of the project, which seemed to meet with general favor, and comparison of some provisional plans which were presented, it was voted : that the ladies of the Library Association be requested to take the matter into consideration in connection with the Art Association, and determine upon some definite action or propo-

sition, and notify the Academy at their earliest convenience, when a meeting shall be held for the further consideration of the subject.

MAY 18TH, 1877.—GEOLOGICAL AND ARCHÆOLOGICAL SECTION.

Rev. S. S. Hunting in the chair.

Eight members present.

Mr. Gass presented some inscribed rocks, granite boulders, which he had found in Cleona Township, a few miles from the city, and stated that there were several more at the same place, but almost inaccessible at present on account of the mud and water from the recent rains. He proposed to make a further exploration when the season shall be dryer, and would defer making a report of the matter until after such further research.

Mr. Pratt had collected a few fossil shells from the Davenport and Buffalo quarries, but not much had yet been done in geological work.

The members agreed to endeavor to make a further examination of Mound No. 9, on Capt. Hall's land, on Saturday, May 26th.

A letter was read and put on file, written by Mr. Gass in reply to a letter from Maj. J. W. Powell, requesting suggestions from members of the Academy, regarding the best methods of procedure in opening mounds, such suggestions being intended for use in a manual of archaeological research, soon to be published.

MAY 25TH, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Twenty-three members present.

On motion, it was voted that W. H. Pratt be appointed Recording Secretary *pro tempore*, during the absence of Dr. C. C. Parry.

The Corresponding Secretary reported, in addition to the usual amount of ordinary correspondence, the receipt of a large number of letters, from persons recently elected corresponding members, acknowledging their election.

Donations to the Museum and Library were reported, and a vote of thanks was tendered to the donors.

Mr. Leo Shumacher was elected a regular member. Several names were presented for membership.

Rev. Mr. Gass presented a brief account, given by Mr. Ahnman, of Pleasant Valley, of a curious relic found by him in digging a post hole where was formerly an Indian village. It was of a material resembling yellow clay, but as hard as stone. It was a very smoothly carved, though rude and incomplete, representation of the human form, and six inches in length. The face was very distinctly carved, the forehead very flat, the hands were resting on the chest, lower limbs not carved out.

Mr. Gass also presented the following communication :

To the Davenport Academy of Natural Sciences :

Believing that specimens of scientific interest will be much more valuable and useful in a public museum than when scattered, and finding that heretofore some specimens stored away by the workmen for the Academy, had been taken for private collections, and did not reach the Academy at all, Mr. F. Fangmeier, foreman at Mr. Schmidt's quarry below the city, has, with the concurrence of Mr. Schmidt himself, communicated to me the following offer and promise, viz :

" All petrifications and other valuable mineral specimens found in our quarry will, hereafter, no longer be collected for private purposes, but only for the benefit of the Davenport Academy of Natural Sciences, and will be delivered only to such persons as may be authorized by the Academy to receive them."

Mr. Fangmeier wishes that the above determination may be kindly received by every one, and strictly respected.

On motion the proposition was accepted, with a vote of thanks to Messrs. Schmidt and Fangmeier, and Messrs. Pratt and Gass were appointed to receive such specimens.

The following papers were read and discussed :

A Recent Find of Skulls and Skeletons in Ohio.

BY REV. S. D. PEET, ASHTABULA, OHIO.

To the Davenport Academy of Natural Sciences :

SIRS:—I desire to call your attention to a recent find of skulls and skeletons.

In Columbia, about twenty miles from Springfield, Ohio, there is an elevation which overlooks the bottom land of the Lagonda River. This elevation is formed by a gravel bank of the drift period, as it rests on the

limestone which here comes to the surface. The bed has been recently excavated by the C., C. & I. R. R. for ballast for their road bed. The bank is within a stone's throw of the depot at Columbia Station, and in full sight from the passing cars. On the summit there is at present a cottage and a field, but no forest.

In the gravel there were found a large number of skeletons and skulls, some of which I have had the opportunity of examining. The pit in which these skeletons were found was an irregular cavity situated not far from the eastern side of the bluff, and on its summit. The skeletons were situated near the surface, from two to four feet below it, and were found in a variety of attitudes, but the majority of them in a sitting posture. No careful examination of the spot or of the remains has been made, and no relics have been collected as accompanying them.

The most of the skulls have crumbled so that they can not serve any purpose in discovering the race connection of the people there buried. Those which have been preserved are now scattered, some of them in the cabinet of Delaware College, five in the possession of one of the professors of Wittemberg College, Springfield, one in the office of the Springfield *Republican*, and others with various physicians and private individuals.

The peculiarity of the skulls to which I desire to call your attention, is the remarkable orthocephalic character. Dr. S. G. Morton's collection has several skulls which have been marked "mound builders." They are all distinguished by their peculiar straightness in the occipital protuberance, the height in their frontal sinus, and the elevation of the coronal suture. The contrast between them and the dolicocephalic character of certain skulls, and the brachiocephalic nature of others is very marked. In this collection, however, the peculiarity is much more distinctive.

Professor Schoffer, of Wittemberg College has in his possession, a skull taken from the sand upon the island of Oahu in the Pacific Ocean. The prognathic character of this skull contrasts strongly with the skulls from this collection, taken from the gravel beds, in which the lower maxillaries are unusually delicate and small, the teeth inserted in a straight line, and closely fitting. These are as good specimens of the typical mound builders of the Morton classification as I have been able to discover. They contrast with a collection recently exhumed from the neighborhood of Elyria, on the Black River, about three miles from Lake Erie, and now in the possession of the Northern Ohio Historical Society. They are also different from others which were taken out of an ancient burying-ground in Ashtabula, on the banks of Lake Erie.

The point of inquiry is, however, how we can determine their race affinity by their shape and peculiarities. These skulls were found in a gravel bed, in a sitting posture, both characteristic of the burial of the later Indians. No mound exists and no other sign has been discovered of their being mound builders. On the other hand, the narrow, dolico-

cephalic skulls in the Historical collection were taken out of a burial mound or tumulus near the banks of Lake Erie.

Here, then, are mound builders' skulls found in the environments of the later Indians, and the skulls of the later Indians, as we suppose, probably Wyandots or Eries, in the tumulus of the mound builder. The anomaly somewhat puzzles us. The only explanation which I have been able to give is that possibly the spot was a battle field. There are in the collection a few skulls which have all the characteristics of the red Indians, large occipital protuberance, low frontal sinus, short lateral diameter, the longitudinal diameter in great proportion. There are also the skulls of little children in the collection, and the number and variety in the pit give some indications of an indiscriminate slaughter.

The only difficulty in this supposition is that there are no traces of wounds in any of the crania, and yet their shapes and variety preclude the idea that they were deposited in a funeral feast after the manner of the later Indians. Allow me to say that we are accustomed to draw the distinction in this State between the two races with considerable certainty. We rely not only upon the traditions of the Algonquins, but the study of the remains, in their skull formations, their attitudes in burial, and the relics attending them, and especially the differences of the earthworks.

By these three sources of evidence we are able to ascribe different geographical localities to the two races. We find on the streams running north traces of a great military race, who are supposed to have been red Indians. South of the watershed there are traces of another race, which, from the evidence of their high state of architectural and artistic skill, their agricultural mode of life, and their highly developed religious system, we judge to have been entirely different from the Indians, and these we call *the* mound builders. In this state, the division is geographical. The point of enquiry now is, whether we shall discover the differences which shall prove to be chronological and ethnical. There are mounds which contain skeletons in a recumbent position at the north and on the lake shore. The red Indians generally buried in lone heaps or in sitting postures, and rarely, so far as we know, in the recumbent attitude, or in mounds. Were the two races successively occupants of the whole territory, and are their works to be distinguished chronologically? We hope to secure attention to the subject, so as to ultimately arrive at some sure conclusions in reference to the pre-historic races.

Very respectfully,

STEPHEN D. PEET.

Ashtabula, Ohio, April, 1877.

Report of Exploration of Mound No. 10, Cook's Farm Group.

BY REV. J. GASS.

To the Academy of Natural Sciences:

Having recently explored another mound of the Cook Farm Group, I would respectfully present the following brief description of it :

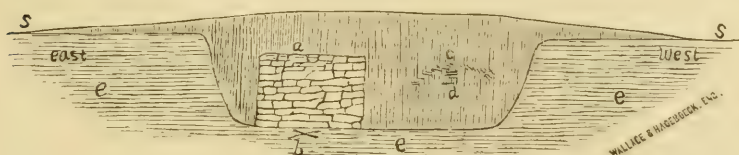


FIG. 15.—Scale, six feet to one inch.

Vertical section of Mound No. 10, Cook's Farm Group, east and west; *ss*, original surface of the earth; *eee*, undisturbed earth; *a*, altar or pile of stones; *b*, human leg bones under the stones; *c*, layer of shells; *d*, fragments of pottery.

This mound, which we will designate as Mound No. 10, is situated in the second or northwesterly row of mounds, and is ninety-five feet northwest of Mound No. 1, and 100 feet northeast of Mound No. 5. It should be mentioned that these mounds have been numbered in the order of their exploration, and without reference to their relative position. Mound No. 10 is the smallest and least important one of the group. It was about fifteen feet in diameter, and about eight inches above the surrounding surface. All the mounds in this row, viz: Nos. 7, 5 and 10, are less elevated than those of the other line. Six inches below the surface I found a pile (or altar?) of stones, which were packed closely together throughout, and although of irregular size and form, they were so arranged as to present a tolerably even surface on each side of the pile, which was $3\frac{1}{2}$ feet long from east to west, and $2\frac{1}{2}$ feet from north to south, and $2\frac{1}{2}$ feet high. The whole pile rested upon the hard, undisturbed clay at the bottom of the excavation, and 3 feet from the surface of the ground. The excavation was about ten feet long from east to west, and 6 feet wide, rather more than 2 feet deep, and rounded at corners and bottom, being of the same form as those already described in Mound No. 3. The mound was 3 feet in depth, from the surface to the hard clay at the bottom of the excavation. In the lowest layer of the pile was a flat stone, 2 feet long, 10 inches wide, and about 2 inches thick, lying with the smoother side downward. Beneath this stone I found fragments of the leg bones of a human body, pressed down into the clay. About 2 to $2\frac{1}{2}$ feet west from this pile, and 1 to $1\frac{1}{2}$ feet below the surface, was a small layer of the usual river shells, about 3 feet long from north to south, and $2\frac{1}{2}$ feet wide and 1 inch thick. This layer was in an arched form, the north and south edges being curved downward. The shells were much decayed, and not a single one could be preserved. Three or four inches below this shell layer, and directly under the middle, were several fragments of pottery, evidently comprising not nearly all of the original vessel, and three small polished stones. The pieces were nicely packed

together in a little pile, showing clearly that they were thus broken before being placed there. No farther indications of relics or human bones could be discovered.

The articles above named are in the cabinet of the Academy, and although but few relics were obtained, the observation of the structure and arrangement may add something to our knowledge of the subject, and especially of this very interesting group.

Description of some Inscribed Stones found in Cleona Township,
Scott County, Iowa.

BY REV. J. GASS.

To the Davenport Academy of Natural Sciences :

A number of remarkable stones, with ancient engravings, are imbedded in a creek about twenty-two miles west of Davenport. I visited the place twice to obtain the needed information and help for the exploration. The second time, *i. e.*, on the 15th of May, I discovered five inscribed stones. Two of them are now in our Museum, and the other three, even if I had the power to move them out of the creek, would have been too heavy for my vehicle, though one of them, the largest and most important, covered with many inscriptions, might be of particular value to our Academy.

Some other stones of more or less importance will, perhaps, be found there when the water in the creek is lower.

Now, the whole group of stones, except the largest one, is below the surface, and it was only by several hours of arduous labor that I could accomplish what I have already done.

For a further exploration, I have obtained from the kind owner of the farm, a written permission, and with the assistance of the Academy to hire some help, I shall be able to obtain possession for our Museum of some more of these relics, so valuable for investigation and comparison, and to gain additional facts for a second and more detailed report.

JUNE 2D, 1877.—BIOLOGICAL SECTION.

J. D. Putnam in the chair.

Eight members present.

Mr. Putnam reported the receipt of a specimen of *Gonyleptes ornatum*, Say, from Mr. Albert Reilly, at Henrietta, Texas. He also stated that he had observed the following Lepidoptera during the month of May: *Papilio turnus* (once only), *P. asterias*, *P. troilus*, *P. philenor*, *Colias philodice*, *Danaus errippus*, *Pyramis atalanta*, *Nisoniedes* sp., *Hesperia vialis*, *Lycæna* sp., *Deilephila lineata*, *Actias luna*, *Samia cecropia*, and many others he could not specify.

Prof. D. S. Sheldon presented the following list of shells to be added to Mr. Pratt's list, published in Vol. I of these Proceedings :

Unio Higginsii, <i>Lea.</i>	Helix perspectiva, <i>Say.</i>
Unio grandiferus, <i>Lea.</i>	Pupa armifera, <i>Say.</i>
Limnophysa palustris, <i>Muhl.</i>	

Miss Emma A. Smith, of Peoria, Assistant State Entomologist of Illinois, was present, and called the attention of the members to the bark louse on the soft maples of this city, and gave a very interesting account of it, and of its various insect enemies, of which the lady birds are the most useful and abundant. Various methods of fighting it were discussed by Messrs. Nissen, Putnam and other members present. An account of this insect was first published by Walsh and Riley in the American Entomologist, Vol. I, page 14, under the name of *Lecanium acericola*, where a very poor illustration is given. Mr. Putnam stated that he had examined this insect in 1871* and was now engaged in further observations.

JUNE 23D, 1877.—TRUSTEES' MEETING.

Rev. S. S. Hunting, President, in the chair.

Nine members present.

Mr. Chas. E. Putnam, on behalf of Mrs. P. V. Newcomb, presented the following deed, conveying to the Academy three additional feet of land on the north of the tract formerly conveyed, making forty-eight feet in all:

Know all men by these presents, That, whereas, on the 22d day of February, A. D. 1877, by deed of that date, I conveyed to "The Davenport Academy of Natural Sciences," for certain purposes and considerations therein named, a certain tract of real estate, adjoining the Presbyterian Church in the city of Davenport, Scott County, Iowa. *And, whereas*, the description of property in said deed did not include all the tract intended to be conveyed thereby. *Now, therefore*, this Indenture witnesseth : That I, Patience Viele Newcomb, in consideration of One Dollar, to me in hand paid, do hereby grant, bargain, sell and convey unto "The Davenport Academy of Natural Sciences," of Davenport, Iowa, the following described tract of real estate in said city, to-wit : a part of out-lot No. Sixteen (16), bounded and described as follows, viz : commencing at a point

*See these Proceedings, Vol. I, page 37.

on the west line of Brady street ninety (90) feet north from the north-west corner of Brady and Seventh streets, thence north along the west line of Brady street forty-eight (48) feet, thence west parallel with the north line of Seventh street one hundred and fifty (150) feet to an alley, thence south along said alley forty-eight (48) feet to the north line of property belonging to the Presbyterian church; thence east along the north line of said church property one hundred and fifty (150) feet to the place of beginning, intending hereby to convey three (3) feet front on Brady street in addition to the forty-five (45) feet heretofore conveyed.

In thus renewing and increasing my donation to the Academy, while I earnestly reiterate and emphasize the inducements and reasons stated in my former conveyance, I also desire to make this donation a *Memorial* of my late husband, Daniel T. Newcomb, for the benefit of his former fellow citizens, and in doing so I will express the hope that it may be found practicable, and not inconsistent with the objects of the members of the Academy, to include in their enterprise provision for an Art Gallery, and also that at no distant day their already valuable and growing collection of books may be opened and established as a free public library.

And, while my donation to the Academy is made unconditional, it is my desire that a building should be erected on this property for the purposes named.

In witness hereof I have hereunto set my hand this 20th day of June, A. D. 1877.

PATIENCE VIELE NEWCOMB.

STATE OF IOWA, }
SCOTT COUNTY. } ss.

Be it remembered, that on this 20th day of June A. D. 1877, before the undersigned a Notary Public in and for said county, personally appeared *Patience Viele Newcomb*, to me personally known to be the identical person whose name is subscribed to the foregoing deed as grantor, and acknowledged the instrument to be her voluntary act and deed, and that she executed the same for the purposes therein mentioned.

Witness my hand and notarial seal the day and year last above written.

{ LOUIS A. LECLAIRE, }
Notarial Seal,
{ Scott County, Iowa. }

LOUIS A. LECLAIRE,
Notary Public,
Scott County, Iowa.

[Filed for record June 26th, 1877, at 8:49 o'clock A. M., and recorded in Book 36 of Lot Deeds, on page 395. J. A. LECLAIRE, Recorder.]

[Entered for taxation this 26th day of June, A. D. 1877.]

JAS. DOOLEY, County Auditor.
by W. H. DOOLEY.]

Thereupon Dr. Cochran moved the adoption of the following resolution:

Resolved, That the Davenport Academy of Natural Sciences return grateful thanks to Mrs. P. V. Newcomb for this addition to her generous donation, and in accepting the same assure her that the property will be

used in accordance with her expressed wishes, and that, so far and as soon as practicable her excellent recommendations shall be carried into execution.

After some discussion upon the resolution, it was adopted.

Mr. C. E. Putnam, Chairman of the Building Committee, stated that a rough estimate had been obtained upon a brick building, 40x50 feet, basement and two stories, with slate roof, at a cost of about \$4,000. He thought the committee would recommend, that if no arrangement be entered into in connection with other societies, the Academy should proceed whenever practicable to erect such a building as a wing to a more extended building contemplated for the future.

On motion of Dr. Preston it was voted that the Trustees approve of the recommendation of the chairman of the building committee, that we limit ourselves for the present to the building of a rear wing, and request from the committee further and more definite plans.

Mr. J. D. Putnam offered the following resolution, which was adopted :

Resolved, That the invitation heretofore extended to the Library and Art Associations to unite with the Academy in the erection and occupancy of a building, be and hereby is renewed.

On motion, it was voted that the Treasurer be authorized to pay the freight on a box of specimens from Colorado, donated by C. H. Enos, Deadwood, Dakota Territory.

JUNE 29TH, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Seventeen members present.

The Corresponding Secretary reported the correspondence of the month. A letter was read from Prof. S. F. Baird, stating that the preparation of photographs of the inscribed tablets for second volume of Proceedings had been completed, and the prints, executed by the albertype process, would soon be forwarded. The thanks of the Academy were tendered to Prof. Baird. Letters were also read from various foreign societies, acknowledging the receipt of Vol. I of the Proceedings, and placing the Academy upon their exchange lists.

The Librarian reported a number of publications received by donation and in exchange, among them a fine illustrated volume on the HETEROPTERA from Prof. Townend Glover, of Washington, D. C., and a set of "Annals of Iowa," from Mrs. D. S. True.

The Curator reported a long list of donations to the Museum—among which is an archaeological collection of about 500 flint and stone implements, with several of copper, some pottery, etc., solicited and collected by Capt. W. P. Hall, and a complete collection of the ferns of Scotland, 135 species, donated by John E. Wilson, of Galt, Canada, through Mr. John Hume.

The thanks of the Academy were voted to all persons making donations to the Library or Museum.

Thos. G. Milsted, E. H. Smith, and Wm. Allen, Jr., were elected regular members, and the following persons were elected corresponding members: Dr. E. Sterling, Cleveland, Ohio; Dr. Fred. Brendel, Peoria, Ills.; Dr. A. W. Chapman, Apalachicola, Florida; Prof. Alex. Winchell, Syracuse, N. Y.; President A. D. White, Cornell University, Ithaca, N. Y.; Mrs. Mary Treat; Robert Clarke, Cincinnati, Ohio; Theodore Gill, Washington, D. C.; D. Cleveland, San Diego, Cal.; Edward Norton, Farmington, Conn.; Prof. E. S. Morse, Salem, Mass.

Mr. C. T. Lindley reported the money paid in for life membership fees of Prof. and Mrs. D. S. Sheldon, contributed by Griswold College students, and their names were ordered enrolled upon the list of life members. Mrs. S. B. R. Millar, having contributed \$50 to the building fund was also declared a life member. The names of several persons were proposed for membership.

The President read a communication from the Secretary of the Library Association, stating that the invitation from the Academy, to join in the matter of building, was presented at their last meeting, and laid over for one month. A communication was also read from the Y. M. C. A., inviting joint action of the Academy with them in procuring an Association building. On motion, the thanks of the Academy were tendered to the Y. M. C. A., and Messrs. C. E. Putnam, E. P. Lynch and Dr. M. B. Cochran were appointed a committee of conference.

Upon request, Prof. F. E. Nipher, of St. Louis, made some remarks, urging the importance of prosecuting archaeological work with vigor, as much valuable material is being destroyed by persons whose zeal is much greater than their skill. The Archæological Section of the Academy of Science of St. Louis has been doing good work in the mounds of south-east Missouri, and a few of the results of the researches there were given. Six or seven hundred specimens of pottery have been collected during the past few years. These vessels were found in burial mounds, as many as 300 specimens being found in a single mound. Such mounds are found near the sites of ancient cities, which are marked by the "dug outs," over which the rude habitations of the mound builders were erected. The habitations were formed by digging a small cellar-like cavity in the earth, over which was built an arch of brush and poles, which was covered with clay and dried in the sun. Excavations in these "dug outs" reveal a hearth of burned clay, covered with charcoal and ashes, in which vessels containing charred bones are occasionally found. There are many hundreds of these which are yet to be examined. No implements of war are found.

The decorations of the pottery are most frequently made in paint. Some of the vessels are marked with an equal armed cross, surrounded by a circle, ⊕, which, as is well known, was the ancient Asiatic symbol of the sun-god. In one case the symbol was surrounded with a system of rays, by which the artist had plainly attempted to represent the sun itself. The finding of this symbol in the mounds coupled with the fact that some of the American aboriginal tribes were sun worshipers, is certainly of great interest. Two amulets of shell have been found lying on the breasts of skeletons, almost alike in their markings. One was found in the bluff's opposite St. Louis, and the other in the southern part of the State. On each of these shells was scratched an excellent representation of the tarantula, on the back of which was the symbol before described, ⊕.

The speaker remarked the striking difference between the pottery and skulls found near Davenport, and those found in Southern Missouri. He exhibited photographs of a remarkable pipe found in Macoupin County, Ills., which consisted of a

human figure in a stooping posture, the features being exactly similar to the features represented on the mound pottery of Missouri. Over the head of the figure is represented a head-dress, consisting of the skin of an animal, the hind legs and tail being carved on the back.

The importance of preserving specimens of the earth in which bones are found was urged, as it may possibly lead to a rough estimate of the age of the mounds, by comparison with a like examination of the condition of bones in our older cemeteries.

Miss Emma A. Smith, of Peoria, being requested to present some entomological notes, gave an account of the nearly complete defoliation of a large forest of oak trees in Illinois, extending from Elmira to the north of Kewanee, by a small leaf roller moth, the *Argyrolepis quercifolia* of Fitch. Specimens of the moth and of its parasites were exhibited.

Mr. J. D. Putnam stated that he had recently discovered a new bark louse on the soft maple. It is small, less than one-tenth of an inch long, and is covered with a circular elevated scale, composed of concentric layers around the small reddish larval scale, bearing considerable resemblance to the shells of the genus *Ancylus*—fresh water limpets. It belongs to the section DIASPIDES of the family COCCIDÆ, and is found in abundance on the same trees with *Lecanium acericola*.

Mr. W. H. Pratt presented the following report:

On the Exploration of the Mounds on the Farm of Col. Wm. Allen.

BY W. H. PRATT.

Having, by the kindness of Mr. Wm. Allen, Jr., obtained the privilege of making some explorations in the group of ancient mounds on the farm of his father, the late Col. Wm. Allen, who was a member of the Academy, an examination was made on Monday, June 25th. Our party consisted of Rev. J. Gass, Dr. C. H. Preston, T. G. Milsted, Thomas Farquharson, Chester L. Pratt and W. H. Pratt.

DESCRIPTION.

The group of mounds, originally six in number, is situated about six miles down the river from Davenport, upon the extreme edge of the bluff, which is very high at that point, about half a mile from the river, and commanding one of the most extended and finest views to be had of this portion of the Mississippi Valley. The position is a very prominent one, and is distinctly visible from the city, though six miles distant. The

mounds were in a curved row, corresponding to the contour of the bluff, and nearly in a north-east and south-west direction. They were of different sizes, from two and a half to five feet in height, and from 100 to 150 feet apart, and had never been disturbed by cultivation. The locality was formerly covered with brush, but no large trees were there.

In the first mound, counting from the east end of the row, stands a tall flag staff, in excavating for which we learn that a quantity of bones were discovered, but we have no details of its contents or structure.

The fifth mound, the largest of the group, was removed in excavating for the cellar of the mansion built by Col. Allen in 1871, and now occupied by his family. A considerable quantity of human bones were exhumed, probably five skeletons, and one or two quite well preserved skulls, and some trinkets of brass, now lost, which last probably belong to modern Indians, who may have been buried there, as is not unfrequently the case wherever the ancient mounds are found.

The sixth or most westerly one of the group was also removed several years since to level the earth for a croquet ground. Some pains were taken in the exploration of this, and portions of several skeletons were found with some relics, the principal of which were two earthen vessels of rather light structure and well burned. One of these, which is now in the possession of the family, is of the capacity of about one quart, rounded at the bottom so that it will not stand, and has four ears or lugs on the outside at the top, only two of which, however, were perforated so as to admit of any attachment by which to suspend it. The other vessel was sent to the Smithsonian Institution by Capt. Joseph A. Crawford, who, I believe, also sent an account of the mound and contents.

The fourth mound was also removed and explored some years ago. It was four or five feet high, and contained the bones, it is said, of three skeletons; also a sea shell, which is still preserved.

Mound No. 3—Special Description.—The third mound from the east end was the one selected for our examination at this time. It was nearly circular, from thirty to forty feet in diameter, and two and a half feet high. Near the middle the surface was flattened or very slightly depressed, as if some excavation had been made there at some time, and it is reported that some boys once dug down a short distance in it, and found some arrow heads. We made an excavation about five feet wide, across nearly the whole diameter of the mound from north to south, and found it to be composed of mixed clay and black earth, containing very few small gravel stones, two or three small flint flakes, no shells, no ashes, charcoal or other indications of the action of fire, and only one piece of limestone. This was a rough fragment, about ten inches long and one and a half by three inches in thickness and width, and was near the south side of the mound, and standing in an upright position, its upper end, which was rather pointed, being about one and a half feet below the sod. The mixed earth above mentioned extended down to four feet below the surface in the middle of the mound, where we found the natural undisturbed yellow clay very distinctly defined, and easily distinguished from the darker and

mixed earth above it. This clay surface was therefore the bottom of an excavation which had been made about one a half feet below the natural grade in the middle, and of a shallow basin or saucer-like form, and, as nearly as could be determined, about six by eight feet across, and largest from north to south, the slope being gradual from the middle upward on all sides. Very few and poorly preserved fragments of bones were to be found, amounting to less than two ounces probably in all. At some distance south of the center was the body or solid portion of a human cervical vertebra, the processes being decayed, worn, or broken off. Near the middle were a few small bits of bone, as soft and friable as the clay itself, and quite undistinguishable as to the portion of the skeleton to which they belonged. None of the leg bones, which are usually best preserved, and none probably belonging to a skull were found. A little to the south of the center we discovered a very perfectly wrought stone pipe of the ordinary pipe stone, red and gray colors mixed. It is of the type invariably found in the mounds of this region, *i. e.*, the base being about three times as long as wide, curved slightly upward in the middle, and transversely convex on the under side, the bowl, which in this case is a plain round one, standing upon the middle of the base, and a small hole drilled through the base from one end to communicate with the cavity of the bowl. A flattened oval stone, of dimensions about $1\frac{3}{4} \times 1\frac{1}{2}$ inches and 1 inch thick, apparently artificially wrought or worn by use, was found. A fragment of pottery, about an inch square, was all that was discovered. All of these articles were placed, not at the bottom of the excavation, but about three feet down, or slightly below the level of the natural grade.

Rev. J. Gass, W. H. Pratt and John Hume were appointed a special committee on Mound Explorations.

JULY 4TH, 1877.—This morning at about 9 o'clock, Judge Wm. Cook hauled the first load of stone for the new building of the Academy, and Mr. A. C. Fulton brought a corner-stone. About fifteen members were present, and Mr. Hunting made a brief informal address.

JULY 13TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Seven members present.

Mr. W. C. Putnam read the second part of his paper upon "Davenport and Vicinity in the War of 1812," giving an account of the defeat of Major Taylor and several hundred Americans by a large force of British and Indians, in August, 1813, on the three willow islands opposite the lower part of our city, and his subsequent retreat down the river to St. Louis.

On the afternoon of July 17th, 1877, a "Kettle-drum" entertainment was given by the lady members of the Academy for the benefit of the BUILDING FUND, on the grounds of Mr. and Mrs. Chas. E. Putnam at "Woodlawn," which was a great social and financial success; from 700 to 800 of the citizens of Davenport, Rock Island and Moline were present. Among many other attractions, the extensive entomological collection of Mr. J. D. Putnam was on exhibition.

JULY 21ST, 1877.—SPECIAL MEETING.

Dr. E. H. Hazen in the chair.

Nine members present.

The following reports were presented, viz :

Report of Conference Committee.

To the Davenport Academy of Natural Sciences :

The undersigned, appointed a committee to confer with committees from other societies with reference to the erection of a union building, beg leave to submit a report of their action.

Similar committees having been appointed by other organizations as follows to-wit: On the part of the Library Association, Mrs. W. F. Peck, B. B. Woodward, Esq., and Hon. John F. Dillon; of the Art Association, Hon. H. H. Benson and J. H. Harrison; and of the Christian Association, Messrs. U. N. Roberts and S. F. Smith. A conference of these various committees was called for Monday, July 2d, at 4 o'clock P. M., at the rooms of the Academy of Sciences.

All these committees being present at the time and place above stated, except that of the Art Association, an informal discussion as to various plans and projects for a union building was had among the members.

In explanation of the invitation extended by the Academy to the Library Association and other societies to join in the erection of a union building for the joint occupancy of all, it was stated in substance by your committee that this action on the part of the Academy was in response to a very general sentiment prevailing in the community favorable to such a union, with which the members of the Academy were in hearty accord. It was further represented that societies whose objects are in harmony ought to work easily and strongly together, and thus be able, with less expense to the community, to erect a building for their joint occupancy which would be an ornament to the city. It was also stated that through the generosity of an esteemed lady in our city, the Academy had become the owner of a lot for such purpose, centrally and favorably located, and that through the liberality of other citizens, a building fund had been started, and a considerable amount already raised. It was further represented on behalf of the Academy, that the preservation of its valuable museum, and the need of more room, made immediate action on its part necessary. The proffer was therefore made

to the other societies represented in the conference, and including the Art Association, to give them the benefit of our property, and for them to join in the erection of a union building thereon.

In response to this invitation, the committee from the Young Men's Christian Association, while expressing themselves as favorable to a union building, considered the location selected as objectionable, and stated that in view of the special objects of their society, it was indispensable that it should be located as nearly in the center of business as possible.

The committee representing the Library Association also objected to the location, and expressed the opinion that the needs and objects of their society require that it also should be situated in or near the center of business; and, further, that from want of pecuniary resources they were unprepared at the present time to join in any building enterprises.

The committee of the Art Association were not present at this conference, but inasmuch as that association has heretofore expressed a willingness to join in the erection of a union building, it is recommended, should it still be desired, that provision be made for its occupancy in our completed building.

Your committee, therefore, are compelled to report a total failure in the efforts to secure the erection of a union building, and ask to be discharged from further duty.

All of which is respectfully submitted.

CHARLES E. PUTNAM,
M. B. COCHRAN,
E. P. LYNCH,

Committee.

July 3d, 1877.

The report was received and the committee discharged.

Report of the Building Committee.

To the Davenport Academy of Natural Sciences:

The undersigned Committee on Building herewith submit the following report of their action:

The other societies having declined to join in the erection of a union building, all plans having reference thereto have been abandoned, and it is now recommended that immediate steps be taken for the erection on the property donated to the Academy, of a plain and unpretentious edifice, sufficiently large for the present needs of the Academy, but not so large as to leave it in debt.

Your committee have had plans prepared in accordance with these views, and the same are herewith submitted for your action and approval. They have been so designed as to allow the erection of only a part of the same at the present time, and it is recommended that only the main or central portion be built now, leaving the ornamental front, and the cir-

ular rear addition for library, to be erected in the future, whenever required by the Academy, or its resources will permit.

All of which is respectfully submitted.

CHARLES E. PUTNAM,
M. B. COCHRAN,
E. P. LYNCH,
R. J. FARQUHARSON,
E. H. HAZEN,

Committee.

July 19th, 1877.

Thereupon the following resolution was presented, and on motion adopted :

Resolved, That the report of the Building Committee be approved and its recommendations adopted, and that the committee be now instructed to have working plans and specifications prepared for the erection of the central portion of the building, and that they report at the next regular meeting.

Dr. M. B. Cochran presented the following resolution, which was unanimously adopted :

Resolved, That the thanks of the Academy be extended to the ladies who so earnestly and successfully carried out the "Kettle-drum" party for the benefit of the Academy, and that the especial kindness of Mr. and Mrs. Putnam has placed the Academy under additional obligations, which we cannot too highly appreciate.

JULY 27TH, 1877.—REGULAR MEETING.

Dr. C. H. Preston, Vice-President, in the chair.

Eighteen members present.

The Curator reported a list of donations to the Museum, consisting of archaeological relics from various parties, solicited by Capt. W. P. Hall, and some fossils, minerals, and natural history specimens from several citizens. Also, a few additions to the library.

Mr. and Mrs. E. H. Pendleton, Cincinnati, Ohio; Mr. Isaac Rothschild and Mr. John Berwald, of Davenport, were elected regular members.

Prof. Otto Torrell, Stockholm, Sweden; Prof. J. M. Gregory, Champlain, Ills.; Dr. Asa Fitch, Salem, N. Y.; Miss Emma A. Smith, Peoria, Ills.; Prof. F. E. Nipher, St. Louis, Mo., were elected corresponding members.

The Treasurer reported that Mr. and Mrs. E. H. Pendleton, of Cincinnati; Rev. and Mrs. S. S. Hunting, of Davenport, and Mr. Israel Hall, of Davenport, had paid their life membership fees, and their names were ordered enrolled on the list of life members.

Mr. W. H. Pratt presented a brief report of the exploration of another mound (No. 1) on Col. Allen's farm on the 30th of June. It is the mound in which is set the flag-staff which is visible for many miles both up and down the river. The mound was but three feet in height and about thirty feet in diameter, and was found to contain as many as eight skulls, and many bones, probably the whole or greater portion of that number of skeletons or more. The skulls were none of them sufficiently well preserved to be secured without crumbling to pieces. The bones were all much decomposed, and except in the case of a few of the long bones, which were laid side by side, were much scattered, and had evidently been buried without any order or regularity, as is more frequently the case than otherwise in all our mounds. About two feet from the surface were a number of rather large, flat, rough limestones, irregularly placed, and seeming to have no relation to anything else in the mound. Six flint implements were obtained, several of which were placed immediately beneath the long bones above referred to. About three feet from the center was a quantity of fragments of pottery, of the form and style of ornamentation usually found, and near these a quantity of charred human bones.

AUGUST 10TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Ten members present.

Ten volumes of the "Documents of the Colonial History of New York," and two volumes of the "Documentary History of New York," were donated by Mr. C. E. Putnam.

Mr. H. C. Fulton read the first chapters of his contemplated work on the history of Davenport, giving a description of the place while still in the hands of the Indians; of the troubles which gave rise to the Blackhawk war, and of the first settlements made by the whites.

Mr. W. C. Putnam read an unpublished letter of the late Gov. Joseph Duncan, describing the battle of Fort Stephenson, fought at Lower Sandusky, August 2d, 1813, where 150 men, nearly all of whom were very young, and whose commander, Major Croghan, was but twenty-one, defeated 3,000 British and Indians in a hardly fought battle.

AUGUST 17TH, 1877.—GEOLOGICAL AND ARCHÆOLOGICAL SECTION.

Prof. W. H. Barris in the chair.

Fifteen members present.

The following communication was presented :

Examination of a large Mound in Jackson County, Iowa.

BY REV. J. GASS.

To the Davenport Academy of Natural Sciences :

During the month of June of this year I visited and examined a very large mound in Jackson County, Iowa. This is, perhaps, the largest mound in the eastern part of the State. It is of an oval form, the longer diameter at the base being about 200 feet, and the shorter 120 feet, the circumference nearly 700, and height 30 to 35 feet. The sides are very steep, sloping probably at an angle of about 70° from the horizontal. The top is a flat surface, about 30 x 50 feet, and oval. Contrary to the custom of the mound builders, this mound is built in a deep ravine, on the bottom of a small valley, and near the bank of a creek.

At the center of the surface I dug a hole twelve to fourteen feet deep, but found neither bones nor other indications of burials; only a few pieces of iron ore—hematite—some of which had evidently been burned, and two arrow heads, all of which are now in our Museum. Owing to the looseness of the earth, it was not safe to penetrate deeper, and I was still about twenty feet above the level of the base. Not satisfied with the result, but convinced of the impossibility of a successful exploration under present circumstances, I was obliged to give up the work.

A thorough exploration of this mound would seem to be a matter of very great importance, on account of its extraordinary size, its particular form, its peculiar situation, its undisturbed condition, and the fact that no such large mound has been fully investigated here in the West.

The public attention being so much directed toward mound explorations, a case of so much importance as this will soon come to public notice, and our Academy may lose a valuable opportunity to secure important facts of the pre-historic time. I would therefore express the earnest hope that the Academy will take measures to assist me in making an exploration of this remarkable mound as soon as possible.

Respectfully submitted.

J. GASS.

Rev. Mr. Hunting then called the attention of the meeting to some fragments of mound pottery which he had recently obtained in Wisconsin, and presented to the Academy. He also presented some specimens of copper ore and other minerals from Wisconsin, and described the position and circumstances in which they were found.

The following paper was then read :

The Shell-Beds of the Vicinity of Davenport.

BY W. H. PRATT.

The deposits of shells in the soil along the banks of the river in this vicinity have always attracted attention and excited some interest, and seemed to challenge a more thorough and careful examination than has hitherto been given them.

Two different opinions have prevailed to some extent regarding the origin of these formations. Some have been inclined to consider them wholly, or principally, an artificial accumulation, formed—like the “kitchen-middens” of Denmark and other parts of Europe, and some probably in the United States—of the refuse of the repasts of our predecessors in the occupancy of this country; while others have attributed them to the action of the river itself. As these beds are of considerable extent in the aggregate, being found at the head of Rock Island, and near the lower end of Credit Island, and on this side of the river at East Davenport and at Gilbert, and also on the Illinois side, both above and below Moline, and as they are of very uniform character, it may be best to give first a general description, and then to note the particulars more in detail.

In the first place, then, the layers are usually in a horizontal position, and varying from three or four centimeters to one meter in thickness, pretty evenly distributed for some distance. No abrupt slopes or curves are observed, and the layers never terminate or change very abruptly, but thin out rather gradually in each direction, though the very thin layers, or lines, of shells are sometimes of but small extent. Where the accumulation of shells is very heavy, they are packed quite closely together, and the interstices are filled with the usual soil of the particular locality, and the layer is usually covered with from three or four to thirty centimeters of earth. One layer is not found above another, except in cases where they are very thin, and close together, *i. e.*, where layers of earth are interstratified. Sometimes the shells are so few and scattered as not to form a continuous layer at all.

The shell bed is usually found at, or very slightly above, high-water mark, though, of course, it is upon rare occasions only that the water attains that height, the highest flood during the year being usually considerably less. The shell layer is ordinarily raised slightly above or built upon the general surface of the plateau, and extends but a little way

back from the present edge of the bank, though it is impossible to say just how much of it may have been carried away by the encroachments of the river. It should also be observed that the river bank in front of these beds is usually neither muddy, nor abrupt, or overhanging, but is *rocky* and sloping toward the water.

PARTICULARS.

A bed of shells, about two-thirds of a meter in thickness, at the foot of Mississippi avenue, at East Davenport, now removed or rendered inaccessible by the late improvements there, was some one and one-half meters above high water, but this is the only instance of the kind observed, and it is at a point in the rapids where the river bed would probably wear down in a century or two, considerably.

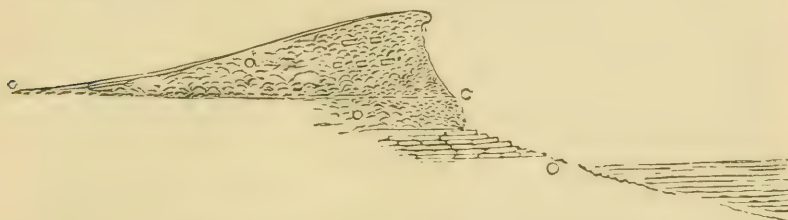


FIG. 16. Section of Shell Bed at the head of Rock Island. *a*, Bed of limestone rock. *b*, Shell bed. *c, c*, General surface. *d*, Shell heap superposed upon the general surface.

At the head of the Island (Rock Island), where are found the most extensive accumulations in this region, we find, at several places along the edge of the bank, an additional deposit of shells heaped up above the general shell bed, which is itself very heavy at the same point. One of these heaps is still over two meters high above the regular continuous bed, its contents being similar in every respect. These superficial deposits slope off or thin out inland rather rapidly, extending back but a short distance from the present edge of the bank, and the face of the bank is vertical here down a meter or two to the solid limestone rock, being broken down and washed away by the high waters of every season, thus always presenting a good vertical section of the strata.

Usually, and notably in the case of the shell deposits along the river a short distance above Moline, these deposits are found at intervals, and situated on the *up-stream side* of the projecting points of land, where, by the sinuosities of the shore, the curves are exposed more directly to the action of the current when the water is high.

CONTENTS.

These beds are composed of shells of the same species now living here. No species now extinct have ever been reported as found among them, and they are of the usual size, and as far as has been determined, about in the same proportions of the several species as are now found close by, with this exception, however, that the very small, as well as the very thin species are seldom recognized, as, for example, the *Unio parvus*.

zig-zag, gracilis, lævissimus, monodontus, and the various species of *Anodon*. This, however, might be expected, as they are so frail that when the epidermis is decayed, they will soon crumble in pieces, and it appears probable that a considerable portion of the minute fragments, of which we find a great quantity, are the fragments of these thin shells.

I have found the following *Uniones*, and about in the following order of abundance, viz: *Unio pustulosus, verrucosus, metanevrus, plicatus, æsopus, cornutus, ligamentinus, ellipsis, gibbosus, crassidens* and *trigonus*. Several species would be very difficult to distinguish when weathered and decomposed, *c. g.*—*anodontoides* from *rectus, asperrimus, elegans*, etc. In addition to these, of the larger aquatic univalves, *Melantho subsolida* is usually abundant, and the *Vivipara subpurpurea* is not uncommon in the Rock Island beds, and the larger land snails, *Helix profunda, thyroides, multilineata* and *alternata* are very numerous. All this seems to indicate very positively that the molluscan fauna of this region has not materially changed in character since the formation of these shell strata. In rather rare instances relics of the work of human hands have been found associated with the shells.

In about the middle of the shell-bed at East Davenport I found, in May, 1870, the bone awl figured in Vol. I, Plate VII, fig. 7, and some animal teeth, perhaps those of the deer, and a stone ax was said to have been found, not long previous, in a similar position, by one of the workmen on the road, in digging near the same spot. Also, about midway in the depth of the regular layer on the Island, I have found two "hammer-stones" in place, and recently a grooved stone axe in the upper edge of the same bed.

Mr. Tiffany found, some years ago, in the same shell layer, seventy-five centimeters below the surface, a bone from the head of the ox or the cow, over the left eye, exhibiting cuts made with an axe or some such smooth, sharp instrument, indicating that the deposit does not date prior to the use of iron or steel instruments, and the introduction of domestic cattle.

Prof. Sheldon has also found several fragments of bones of some of the larger animals, perhaps the deer, one of which has been fashioned into an awl, similar to the one from East Davenport; also some very small bones, one of which, probably a bone of some bird, has evidently been cut off with some cutting tool. He also found there a few fish bones and one arrow head.

A NATURAL DEPOSIT.

If these shell beds have not accumulated as refuse heaps, of course they are not to be considered as the work of human hands at all, as no other occasion or method has, so far as I am aware, ever been assigned for the intentional or unintentional collection of such quantities of shells. That they are not of such artificial character is, I think, clearly indicated by the following considerations, viz:

First. The beds are frequently of considerable extent and thickness, showing that a long time must have been required for a refuse heap to

attain such dimensions, and consequently the spot in such cases must have been occupied for a considerable period. In many instances there is higher ground near at hand, places much drier and more suitable for huts or camping grounds, and where that was not the case, we know that the earlier races not unfrequently raised "tenement floors" of earth to secure those advantages, but these shell beds are never found upon such elevations, either natural or artificial, but always on the low flats, close by the water.

Second. The great scarcity of relics of human handiwork, as there are certainly not more than might well be expected to be accidentally dropped and lost in the streams and along the banks, while the undoubted "kitchen heaps" invariably contain an abundance of such remains, and the fragments of them. Also, the absence of a dirty and trodden floor, and of any dirt mixed with the shells, as the soil which fills the spaces between the shells, and which not unfrequently constitutes by far the greater portion of the whole mass—for the shells are in many cases very few and far between—is exactly the same in character as that immediately surrounding the place, and fragments of limestone which often abound there are sharp, angular and unworn, like those still lying on the slope below.

Third. The species of shells are about in the same proportion as might be expected in a natural deposit, while, if the mollusks were used as food, there would surely be evidences of *selection*. Even in the heaps of shells collected by musk-rats, we find them in very different proportions, the hardest and toughest classes are scarcely at all collected by the rats. The *Uniones, rectus, gibbosus, verrucosus, tuberculatus, plicatus*, and *ligamentinus* are scarcely ever to be found there, nor are the aquatic univalves, nor the land snails, while in our shell beds all of these are present in full proportion. If, then, these were the remains of the daily meals of our human predecessors, they must have selected with less taste and less intelligently than the musk-rats of later days. In hundreds of cases, also, the shells are found in pairs, closed, having apparently never been opened.*

Fourth. The almost total absence of remains of all kinds of food. Surely, we cannot suppose that a people subsisted entirely upon clams! But, though close by the water, there are almost no fish bones, and appar-

*I would refer, also, in this connection, to the shell heaps, as they are called, at the edge of the high sand bank by the river, about a mile below New Boston, Ills. They are situated on the very highest part of the sand ridge, which is many feet higher than the prairie surface a short distance back from the river, and have the appearance of a row of large heaps of shells. Upon examination, however, I found that they are but the remaining portions of a horizontal or somewhat undulating shell-bed, fifteen or twenty centimeters in thickness. As the sand washes away and the shells fall down the slope on all sides, it gives the appearance of a shell-mound. All the shells, however, have fallen from the top, and are only on the surface of the sand. The layer remains at the top, a level surface of a meter or two in extent, and growing narrower every year, and of the depth above named, and no shells nor fragments are to be found in the sand immediately beneath it. The species found here exhibit the same indications of selection as those of the musk-rat heaps before mentioned, the same species being absent in both cases.

Relics of flint and pottery are also numerous among these shells, as should be expected in a refuse heap, and the sand beneath the shells is much discolored, black and dirty.

ently no signs of any culinary operations having been carried on. As to the *superficial* heaps at the head of Rock Island, already alluded to, a different theory might be suggested, but we will consider farther on whether that is necessary or tenable. I conclude, then, that the shell beds of our vicinity are natural deposits, but the question is,

HOW FORMED?

It has been mentioned that in most, if not all cases our shell-beds are situated where the bank is in a position more or less opposed to the current of the river, and also where it is sloping to the river and rocky. In the breaking up of the ice, the floating cakes are often pushed up these slopes, and piled upon the bank, carrying with them, of course, whatever loose material may be lying in the way.

At the head of the island, the whole extent, where are found the largest shell deposits in this region, stands square across the path of the current of floating ice, and is a very long, rocky slope. Doubtless the shells were much more abundant in this part of the country formerly than now, as they are growing scarcer every year, and in the neighborhood of Moline they are still more plentiful than in any other locality I have seen. At the time when the coffer dam was built there some eight years since, and a considerable extent of the river bed exposed, many wagon loads of shells could have readily been shoveled up immediately opposite that town, and no doubt there must have been immense quantities there in former times.

Under these circumstances it must follow, as a matter of course, that quantities of shells would be pushed up the bank by the moving ice at its breaking up in the spring, and would not unfrequently be carried to the top of the bank, and must be left there by the melting ice. This operation, repeated from year to year, or, at least, many times, would necessarily result in beds of shells of greater or less thickness, according to the circumstances, such as we find them. Of course, it would be only at longer intervals that the debris in the river at and near its edge, would be carried up to the fullest extent, when the river was high, the ice strong and the break-up sudden.

I have stated that at prominent or projecting points of the river bank, shell-beds are usually found at the up-stream side, provided the bank is firm and sloping. In short, it appears that the form and position of the river bank relatively to the motion of the floating ice, is the key to the whole matter of these wide-spread shell deposits. Where the ice would run up most readily and certainly, we find most shells at the top.

With this principle to guide us, we can, by observing the contour of the river banks from the distance of a mile or two, point out the places, with almost unerring certainty, where the accumulations of shells will be found. It may be asked why this operation should cease. I do not know that it has ceased everywhere, but, as before remarked, shell life in the river (as well as on the land), is constantly diminished by the progress of civilization. A city soon almost utterly destroys it in its own vicinity, and for some distance down the stream. As the prairie grass and many

indigenous plants disappear from a region which is pastured and trodden by domestic animals; as the beaver, the deer and the buffalo, the forest and the cataract, languish and vanish at the approach of the white man, one of whose chief characteristics is vandalism, so it is with the seemingly not very sensitive mollusk. The disturbance of the balance of the conditions in which it flourishes, dwarfs, deforms and destroys it. We must now visit unsettled districts to secure numerous good specimens of aquatic shells.

Again, it is well known that the river bed is constantly wearing deeper, that the great Mississippi is gradually letting itself down into the earth, and especially is this the case on the rapids, and the labors of man in making a channel for the improvement of navigation hasten this depression. So every few years new "high water" and "low water" marks must be adopted, and always lower than of old, and the waters will never more reach altitudes which formerly were frequently attained. These two facts—the decrease of molluscan life and the lowering of the river-bed—will doubtless fully account for the cessation of the formation of shell-beds here, and, of course, no very long period would be requisite to cover them with a light layer of soil.

SHELL HEAPS.

In regard to the shell heaps above the general surface at the head of the island, I believe they may be rationally accounted for in the same way. After a shell bed of such extent as we find there was formed, three or four feet in thickness in some parts, the constantly encroaching waters, breaking down the bank containing it, and washing away the light soil, deposited, as it still does, great quantities of these old shells upon the denuded rocky slope, which is there but a meter or two below the sod. Then, upon the rush of a mass of strong and thick ice, great quantities of these must be carried up and superposed, forming great heaps or a ridge along that shore.

I have already remarked that beside the largest heap there still remain portions of several others, or perhaps of a continuous ridge along the portion of the bank which is nearly at right angles to the general direction of the stream. Much of this has already evidently been washed down, and ere long, unless the authorities protect the bank or destroy it themselves, the river will complete its work of removing its own shell defences along that coast.

MOUND AT THE LOWER END OF THE ISLAND.

In this connection we ought not to overlook a bed of shells formerly existing near the foot of Rock Island, at the bottom of which the skull which we have designated the "shell-bed skull," was found by Mr. Tiffany in the fall of 1871. He described it as follows*: ". . . at a depth of three feet from the top is a deposit of shells, mostly *Unios*, but including *Melantho subsolida*, and two or more species of *Helix*. This shell bed at this exposure varies from six to sixteen inches in

*Proc. D. A. N. S., Vol. 1, p. 42, Plate XXVI, fig. 1; Plate XXI, fig. 26.

thickness. Accurate levelings prove the deposit to be eighteen feet above the highest water mark known since Fort Armstrong was established on the Island."

Again: "The covering was evidently an aqueous deposit, the sedimentary lines being perfect and unbroken. Deposited with and above the shells are gravel and sand, the material becoming finer toward the top, the last foot being fine alluvium and vegetable mould." He further says: "The section has been visited by many members of the Academy, and by Prof. Alexander Winchell, while some of the bones were in place, and all agree that the covering of this pre-historic man was a sedimentary deposit."

I must say that I had then no serious doubts of the correctness of this conclusion. Later experience, however, and examination of shell-beds and mounds have fully convinced me that this was an ancient burial mound, and for the following reasons:

First. It was eighteen feet above high water, and if a natural aqueous deposit of shells would accumulate there, certainly others should have been formed at the same period, and in similarly elevated positions, but this is the only instance of the kind in these parts.

Second. The bed was very irregular in thickness and position, being abruptly curved, and presenting an appearance similar to layers, since found in several ancient mounds, and especially in Mound No. 3, where the inscribed tablets were discovered, while none of the layers anywhere else except in the mounds were of this character; and further, it was not in a position where it could have been produced by floating ice, or any other natural means as yet suggested, even if the river had been eighteen feet higher.

Third. With the skull and other bones of the skeleton were found, as described in Vol. I, "the point of an antler of a deer or elk," the exact counterpart of several which we have since found with the other relics in the ancient burial mounds, and which have been found nowhere else.

At a meeting of the Board of Trustees held on August 20th, 1877, the President stated the especial object of the meeting to be the reception and consideration of a communication from the Trustees of Griswold College.

Mr. C. E. Putnam, who was present by invitation, handed in the following paper, which had been received by him:

To the Academy of Sciences:

The Executive Committee of the Board of Trustees of Griswold College (subject to the approval of said Board), make the following offer:

I. To grant by perpetual lease so much land as may be needed for use of the Academy of Science for its buildings in the north-east corner of Cathedral Block, the Academy of Science to pay all taxes or assessments, municipal or otherwise, that may be lawfully levied upon the lands or the buildings thereon; the buildings to be used for the appropriate objects of the said Academy of Science.

II. The architecture of building to harmonize as nearly as possible with the buildings on said block, approaches to be so made as not to interfere with the use of the grounds not taken up by the Academy of Science building.

III. The lease to end when the Academy dissolves or ceases to act, and buildings to become the property of the college.

IV. Premises not to be sub-let or used for any other purpose than as above indicated; the lease not to be transferred; the buildings are not to be used on Sunday; no lectures assailing the Christian religion are to be delivered therein, (the doctrines of such religion being those set forth in the Apostle's Creed). This restriction is not intended to prevent the full and free discussion of scientific truth.

V. In case of the dissolution or extinction of the Academy, its collections, books, manuscripts, etc., as well as the buildings to become the property of the College.

VI. To identify the College and the Academy the Curator of the Academy shall be *ex-officio* an officer of the College.

VII. The heads of the several departments of Natural Science in the Academy are to be *ex-officio* Professors of the corresponding departments in the College, each to deliver every year not less than four (4) free lectures to the students on subjects connected with their departments; Mr. J. Duncan Putnam to be Professor of Entomology, Dr. Parry, Professor of Botany.

VIII. The collection of Griswold College in natural science, as well as its library of works on scientific subjects, to be added to the collection and library of the Academy.

This is but a rough outline of what is proposed. As the Academy advances more professors can and will be added. The details can be arranged hereafter as well as legal forms.

S. E. BROWN, Chairman.

J. L. DAYMUDE,

Committee.

Mr. J. D. Putnam presented the following resolutions, and moved their adoption :

Resolved, That, while the proposition from the Trustees of Griswold College to erect the Academy building on the Cathedral Block, is supported by many inducements and offers great advantages, yet as the location proposed is less central and accessible than that so generously donated by Mrs. Newcomb, and, moreover, as the offer is accompanied with conditions and restrictions inconsistent with the free action, and independent existence of the Academy, it is therefore most respectfully declined.

Resolved, That the thanks of the Academy be extended to the Trustees of the College for the recognition of the educational value of our society, which is implied in their friendly offer.

Resolved, That we extend to the Trustees of Griswold College our congratulations upon the proposed revival of that institution, and tender to them the free use of our museum and library for the benefit of its faculty and students.

After discussion, the resolutions were unanimously adopted.

On motion of Dr. Cochran, the following resolution was also adopted :

Resolved, That the free use of the museum and library connected with the Academy be granted to the public schools and all other educational institutions of our city, and that, under proper regulations for their preservation, they be allowed the use of such specimens as may be needed to illustrate studies in natural science.

Mr. W. H. Pratt presented the following resolution, which was adopted by a unanimous vote :

Resolved, That, in consideration of his valuable services in archæological research and large contributions to the Museum, Mr. W. P. Hall, of Davenport, be enrolled a life member of the Academy.

At a meeting of the Trustees, held August 27th, 1877, the Building Committee reported that the estimated cost on the *central* section of the Academy building was so much in excess of the ability of the Academy that they recommended the erection of the *rear* portion of the building instead, and presented specifications and plans thereof, drawn up under the direction of the committee by B. W. Gartside, architect, which, after some slight alterations, were approved and adopted. Mr. B. W. Gartside was appointed superintendent of the building. The Building Committee was directed to advertise for proposals for erecting said building in accordance with the plans and specifications adopted.

Dr. C. C. Parry, Rev. S. S. Hunting and Charles E. Putnam were appointed a committee to make all necessary arrangements for a public ceremony in connection with laying the corner stone.

AUGUST 31ST, 1877.—REGULAR MEETING.

Dr. C. H. Preston, Vice-President, in the chair.

Seventeen members present.

The Corresponding Secretary reported a considerable correspondence, and also the receipt of a number of valuable publications from various foreign societies in exchange for our Proceedings.

The Curator reported a list of donations to the Museum, received during the month.

On motion it was voted that the especial thanks of the Academy be tendered to Dr. M. W. Iles for his valuable donation of one hundred or more varieties of minerals, fully named and described.

The following persons were duly elected regular members: Mrs. Lottie Hall Whitaker, Col. H. M. Mandeville, Mr. Charles Davison, Miss Ella Davison, Mr. S. F. Smith, Mrs. S. F. Smith, Mr. T. W. McClelland, Mrs. T. W. McClelland, Mr. B. B. Woodward, Mr. J. Meredith Davies, Mr. Robert Mackintosh, Mr. Walker Adams. Mr. Otto Steiniger, of Bellevue, Iowa, was elected a corresponding member.

The fees of life membership for the following members were

reported paid: Mr. Chas. Davison, Miss Ella Davison, Dr. C. C. Parry, Mrs. C. C. Parry, Mr. S. F. Smith, Mrs. S. F. Smith, Mr. B. B. Woodward, Mr. Walker Adams, Mrs. Walker Adams, Mrs. Karolin Fejervary.

Dr. M. W. Iles gave a brief description of the collection of minerals, which he has added to the Museum of the Academy, and then read a paper, describing three new chemical tests of his own discovery, viz:—1, Detection of Nickel in the presence of Cobalt; 2, Direct test for Calcium in the presence of Barium and Strontium; and 3, Test for Boracic Acid. The paper was illustrated by a few simple experiments.

The chairman read an official circular from the Superintendent of the United States Naval Observatory, announcing the discovery on the 11th and 17th inst. of two satellites of Mars, by Prof. A. Hall. A large chart, prepared by Mr. W. H. Pratt, showing the relations of Mars to the other planets during the present month, was exhibited.

At a Trustees' meeting, held September 8th, 1877, the bid of Franklin Kirk to erect the Academy Building, in accordance with the specifications, for \$4,080, was accepted, it being the lowest bid presented. The President and Secretary were directed to execute a contract with Mr. Kirk for the erection of the building, as specified, to be completed by the 14th of December, 1877.

On the evenings of September 10th and 11th, Miss Emma A. Smith, of Peoria, delivered two lectures on the External and Internal Anatomy of Insects, under the auspices of the Academy, in the rooms of the Young Mens' Christian Association. The lectures were well attended, and much interest was manifested.

SEPTEMBER 14TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Seven members present.

The donation of several books were reported.

Mr. W. C. Putnam read a paper on "The Battle of Fort Stephenson, August 1st and 2d, 1813." The memorable siege

of this fort, occurred on August 1st and 2d, 1813, at Lower Sandusky, now Fremont, Ohio. It was defended by a force of about 150 Kentuckians, under the command of the gallant Major Croghan, who were attacked by 1200 or 1300 of the combined British and Indians under General Proctor. The siege was commenced on the afternoon of the 1st by the opening of heavy cannonade on the fort, which consisted of nothing but a stockade of small logs, with a ditch around it which Croghan had dug but a few days before, this cannonading being continued all that night and until late the next day. At 5 o'clock on the afternoon of Sunday, the 2d, the British made their assault on the fort. When they reached the ditch they received a terrible discharge from the only cannon in the fort, a six-pounder, which the young commander had placed in a masked embrasure, so as to rake the ditch. The British, who lost 120 killed and wounded, immediately retreated, and returned to Canada that same night, having been rejoined by 2,000 more Indians under Tecumseh. The Americans lost but one killed and seven slightly wounded. For this heroic defense, Congress, though not till twenty-five years afterwards, voted Croghan a gold medal, and each of his officers an elegant gold sword.

At a meeting of the Trustees, held September 22d, 1877, the following resolution, offered by Dr. M. B. Cochran, was unanimously adopted :

WHEREAS, One of the rooms in that part of the building now being erected was designed as an Art Gallery, but for the present may be required for other purposes ; and,

WHEREAS, The Art Association of this city has expressed a desire to make some arrangement for its occupancy, therefore,

Resolved, That the Art Association be granted the free use and occupancy, in connection with the Academy, of said rooms, on condition that a fair proportion of the running expenses of the same be paid by said Art Association.

SEPTEMBER 28TH, 1877.—REGULAR MEETING.

Dr. C. H. Preston, Vice-President, in the chair.

Seventeen members present.

On motion of Dr. Hazen, the thanks of the Academy were tendered to Miss Smith for her able and interesting lectures,

September 10th and 11th; also, to the Y. M. C. A. for the use of their rooms for said lectures.

The following persons were elected regular members of the Academy: Mr. John Bahls, Mrs. Karolin Fejervary, Mrs. D. S. True, Mrs. L. S. Davies.

The following paper was read:

A Review of the Published Statements regarding the Mounds at Payson, Utah, with an Account of their Structure and Origin.*

BY DR. EDWARD PALMER.

In Vol. II, Part 1, of the Proceedings of the Davenport Academy of Natural Sciences, on page 23, it is stated that Dr. C. C. Parry read some interesting extracts from a letter by a correspondent in Utah, Miss Julia J. Wirt, describing the recent exploration of a mound near Utah Lake, situated on the farm of Mr. Amasa Potter, adjoining Payson, Utah. As the substance of this communication has created much unfavorable comment, and as I have recently made a systematic examination of the mounds at Payson, I beg leave to review what has been published.

The first thing commanding our attention is the remains of a skeleton, said to have been found therein, measuring six feet seven inches in length. Mr. Potter, in answer to questions about this, stated to me that the people carried it away, piece by piece, until nothing but the skull was left, which latter his wife gave to an Indian. This appears unusual for an Indian, as they do not like to look upon, much less to handle, the bones of the dead, and, according to my knowledge, they will not do so willingly. The correspondence further states that between the teeth of the skeleton was inserted the stem of a pipe, the bowl weighing five ounces. How it happened that several feet of earth and rubbish could fall upon that skeleton without breaking or displacing the pipe is somewhat surprising! Mr. Potter informed me that he did not have the pipe, that it was borrowed by one of his neighbors, who, on being questioned, declared she never saw it. The pipes found by me in the ruins of Utah are very small and made of clay, the bowl and stem being straight and continuous. There was no necessity for large pipes with the ancient people of Utah. The native plants used as tobacco by them was so strong that a small quantity sufficed, and hence the pipes were small.

The following, if true, would have been a most wonderful discovery: "An air-tight stone box, encased in mortar or potter's clay, containing another stone box of about two quarts capacity, was found at the head of the above mentioned skeleton. The second box contained, on opening, about a quart of light mouldy wheat, of which a few of the best grains were planted and grew." On making inquiry of the residents of Payson

*Ante, pages 28 and 82.

in regard to the finding of this wheat as above stated, one and all declared they did not believe any stone box containing wheat was found, for in other mounds that had been leveled near by, wheat was also found, but it was carried there by rats. In the mounds opened by me in the same locality, I found several holes, three to five feet below the surface, filled with wheat, and while leveling the mound, three rats were killed. The same kind of wheat shown to me as having grown from the grains purporting to come from the stone box, I saw ripe in a field near the spot in which the box was claimed to have been found. Why so much pains was taken to conceal wheat in a double stone box is more than I can reasonably account for. I have never found anything deposited with the remains in ancient ruins or in modern Indian graves, that was specially prepared for preservation. If seeds of native plants instead of wheat had been found in an *earthen* vessel, it would not have been unreasonable, for I have seen with skeletons several kinds of seeds in such receptacles while exploring in Utah. Besides, no tools have been found in the ruins or mounds of Utah that would serve the purpose of hewing or cutting stone with the edges to fit, so that mortar or cement would render them air tight. The most conclusive evidence against the matter is that the Indians who left these ruins behind, like the present races, did not work for the sake of work, but only did what labor the collecting, preparing and preservation of native animal and vegetable substances required to convert them into articles of food and clothing.

I was shown some of the cement said to have come from around the box. In my opinion it is not cement, but grooved pieces of clay, that once formed part of the roof covering of a house whose ruins helped to make the pile of earth in which the box of wheat was claimed to have been found. In constructing a roof, small poles and sticks were used, over which wet mud was thickly plastered. When, by natural decay or by fire the wood was destroyed, the clay was broken in pieces, and left with the grooves formed by the sticks. Mr. Potter had taken one of these pieces, and asserted for a fact that it did come from around his box!

It is said that with the above mentioned skeleton were numerous articles of pottery, some of them beautifully ornamented with pictures of flowers and animals, and also one piece "having painted upon it a quite recognizable sketch of a range of mountains visible from the locality of the mounds." If this is true, it is unlike anything I have ever found in Utah. Mr. Potter could show me only parts of dishes which were either plain or ornamented with parallel lines. I made special inquiry for the piece having the said mountains painted on, but was told it had been borrowed by a neighbor. Through a friend acquainted with this person, I made inquiry, and learned that the said piece of pottery was not in possession of nor had ever been seen by the person said to have borrowed it.

The correspondence says the mounds of this locality "are connected by gravel walks." There does seem at first sight to be remains of gravel walks, which are readily traced, as vegetation grows very scantily thereon, but on a closer examination it is discovered that they are an-

cient water ditches, used by the former inhabitants of these ruins, not only to water their fields, but to bring the water to the dwellings for domestic purposes, and to be used in making the rude mud bricks or *adobes* of which the houses were built, and the ruins of which form the so-called mounds of Payson. The reason that the soil is so poor in the vicinity of the ditches is because the constant flow of water carried off the rich earth, leaving the sand and gravel in its place, and the modern cultivation of the surrounding land has only covered over these sufficient soil to hide them from view, so that grain and corn planted in this thin soil soon present a very decided contrast to that planted in the richer soil near by.

In a letter published in the Eureka (Nevada) *Sentinel*,* Mr. Potter gives a somewhat different account from that by Miss Wirt. He says, "in the right hand" of the large skeleton "was a huge iron or steel weapon which had been buried with the body, but which crumbled to pieces on handling." Mr. Potter, it seems to me, must have mistaken a piece of juniper wood that had decayed to dust by the side of the skeleton for his supposed "iron or steel weapon." The color would be the same, and to one so ready to draw conclusions to suit his preconceived desire to have his explorations verify the book of Mormon, this would be sufficient. The Book of Mormon tells of a people called Nephites, who once inhabited Utah, and who were acquainted with the use of iron, so that metal must be found to prove the fact. A close examination would have convinced him of its being wood instead of iron or steel, or may-be even the wood was wanting; one cannot be blamed for being skeptical after so little truth is found in Mr. Potter's statements. A great many mounds have been leveled in other parts of Utah by other persons without finding iron or steel.

It is also stated that, "near the skeleton was also found pieces of cedar wood, cut in various fantastic shapes, and in a perfect state of preservation, the carving showing that the people of this unknown race were acquainted with the use of edged tools." As I could get no trace of these, I would state that many rotten pieces of wood, and only one sound piece, were found by me in Utah, and these were without form or ornamentation. Nor have I ever found tools in Utah ruins that either whites or Indians could use to cut or carve cedar wood into fantastic shapes. In this letter he also makes a different statement regarding the stone boxes containing wheat. He says: "Close by the floor was covered with a hard cement, to all appearances a part of the solid rock, which after patient labor and exhaustive work we succeeded in penetrating, and found that it was but the corner of a box similarly constructed, in which we found about three pints of wheat kernels." The letter further says: "We have found plenty of charred corn-cobs, with kernels not unlike what we know as yellow dent corn." Close examination would have shown that it was the same kind of corn now grown by the Pah Ute Indians and the Moquis of Arizona. The letter also speaks of finding "moulds made of clay for the casting of different implements." Many

*Since re-published in Popular Science Monthly for Nov., 1877, Vol. XII, p. 123.

of these so-called moulds. Mr. Potter showed me lying in his door-yard. They were evidently only pieces of clay which had formed part of the roof-covering, as above described when speaking of the "cement" around the "stone-box."

A "neatly carved tombstone" was said to have been found at the head of a second skeleton. This being shown me proved to be only a long narrow piece of rock, neither carved nor cut, and showing that it was broken accidentally into its present shape. It appeared to me like half of a slab of stone used for baking bread, which being broken was discarded. Besides a people who destroy with the dead everything they possess have no use for tombstones. They keep nothing to commemorate the dead, and even destroy the houses over them. In this letter the following statement differs from that by Miss Wirt: "Upon one large stone jug or vase can be traced a perfect delineation of the mountains near here for a distance of twenty miles." If this had really been found, an article of so much value would certainly have been cared for. Yet, while Mr. Potter has carefully preserved all sorts of things from the mounds of little or no value, the valuable ones were not on hand. "Stone lasts" were shown me by the correspondent of the *Eureka Sentinel*, but they proved to be only rudely shaped natural stones.

In referring to the ancient people of Utah Mr. Potter says: "The inhabitants here say a race of people existed here fourteen hundred years ago, and belonged to a tribe known as the Nephites, who were often referred to in the Book of Mormon, which also speaks of terrible encounters these people had with their ancient enemy, the Lamanites. We find houses in all the mounds, the rooms of which are as perfect as the day they were built. All the apartments are nicely plastered, some in white, others in red color." This is correct only so far as the fact of there being ruined houses in the mounds, but an examination of the walls referred to in Mr. Potter's letter, showed no traces of either white or red plaster, nor could any be found in the debris thrown out of the interior of the room.

As Mr. Potter's letter does not explain the formation of these mounds, I will do so in order to give a better idea of the simple habitations of the people that once inhabited Payson. The mounds prove on examination to be debris of many dwellings successively built in the same location. Often walls were found most perfect at the base of the mound, the one above much broken, and often one side wall was found inside the ruins of the lower house, while the opposite wall was outside. As no walls were found of the original height that point must remain unknown, but it appears to me that about six feet was the most probable height. The walls were too thin to admit of an upper story, besides if two story houses were built they would require large timbers, which would necessitate implements to cut them with, none of which have as yet been found in Utah. The houses have generally two rooms with an alley or partition between. One room was usually smaller than the other, and the fact of its containing the debris of fires would suggest its use as a kitchen.

The size of the largest rooms may be said to be about twelve feet long

and ten feet wide, with the walls varying from ten to twelve inches in thickness. The smaller rooms are about ten feet long and eight feet wide, with the walls ten inches thick. The width of the passage between the rooms is two feet and ten inches. These measurements indicate the average size of the dwellings in the Payson group of mounds. The walls were constructed of what may be appropriately called sun-dried mud brick. Close by each mound, or pile of ruined houses, is a depression in which the bricks for building were made, and near it the ancient canal which supplied them with water. A close examination shows that while the clay was soft it was taken up by the hand and laid in the wall, and another similar lot laid over this, and the upper surface and sides smoothed with the hand. This is shown by finger marks still remaining on the interior but obliterated from the exterior surfaces. The joints between the various layers were very irregular. If the men, who inhabited Utah in early times, disliked work as much as the present Indians do, then the females were the house builders and their own architects.

That these people were destitute of cutting tools is shown, not only by the entire absence of such tools, but by the fact that the remains of wood, with few exceptions, have been found. The small, narrow rooms required only short poles to be laid across and covered with mud, to form a roof sufficient in the climate of Utah, where it rains so seldom.

It may be asked, "Who were the Ancient People of Utah?" From the evidence left behind in their ruined dwellings, they appear to belong to the same class of Indians as the Moquis of Arizona, a people simple in all their wants and habits, yet plain Indians. This is evident by the materials taken out of their ruined dwellings, consisting of stone mortars in which to grind their corn and the seeds of native plants. Large flat stones for baking bread, pottery, bone awls, arrow points, a few beads and square pieces of bone that were probably used for gambling, were the most important articles found, as all perishable substances had decayed. A highly enlightened people would have left a far different collection. Since this people were driven across the Colorado river to Arizona they have attained to their present advanced condition, having larger and better houses and an increase in everything required for domestic purposes. This change has been caused by the incessant wars that have been waged upon them by their numerous enemies, driving them across the Colorado river. Selecting elevations that afforded abundance of stone, they erected their present large three story houses, the roofs of which afford ample opportunity for defence against their enemies, being secure places of retreat when they had drawn up their ladders, which afforded the only means of entrance and intercourse between the numerous apartments in the different stories. After having been brought together in communities by force of circumstances, many changes of habits were made to suit their altered condition. Yet after the lapse of so many years we find them making pottery, as well as other articles, that are identical in their characteristics with those found in the ruins of their ancestral dwellings in Utah.

In reviewing Miss Wirt's letters to the Davenport Academy of Sciences

and Mr. Potter's letter in the *Eureka (Nevada) Sentinel*. I have done so, not with the view of showing their statements intentionally false, but to correct the errors arrived at by a minute examination of the mounds referred to by them. Mr. Potter is alone responsible for all the statements, which were evidently made with the idea of proving that these ruins belonged to the ancient race known to the Mormons as Nephites, who are said to have been a great people, cultivating wheat and acquainted with the use of iron. Miss Wirt derived her information wholly from Mr. Potter. Various persons in Utah, Latter Day Saints, spoke to me freely regarding these discoveries and regretted that the statements should have been made in the proceedings of the Academy, or that they should in any sense be regarded as gotten up in the interests of the Mormon church, inasmuch as none of them concur with Mr. Potter in his extravagant, and as we have shown, absurd views.

Inscribed Rocks in Cleona Township.

BY REV. J. GASS.

To the Davenport Academy of Natural Sciences :

In accordance with a request of the Academy at the meeting of May 25th, in reference to some inscribed stones found in a creek near Cleona, I visited the place again on the 20th of this month (September) for the purpose of a further investigation of this remarkable group of stones. The water in the creek is now very low, giving a better opportunity for a close examination of the spot. My labor was soon rewarded by obtaining two inscribed stones, which are now in our Museum. The very large one I found upon further examination to be of very little interest, and scarcely worth moving.

These stones (except one), are a very dark-colored, very hard, heavy and coarse greenstone. One of these stones, the one exhibiting the greatest number and variety of forms cut upon its surface, is of a very irregular natural form, and seemingly ill-suited for such a use. The figures, however, though exceedingly crude and rough, are quite distinct and unmistakable, and consist of a human head, a four-footed animal (perhaps a bear), a bird, a form much resembling the human forms cut upon the Cook Farm tablets; a portion of the features of another human face, and the upper portions of another human form; also, some other marks which have no significance as far as we can recognize.

Another of the stones is of an almost regular oval form, about twice as large as a man's head, and on it is cut in sharp grooves the outlines of the human features with perfect distinctness and quite regular form.

Another smaller stone exhibits a few mere scratches, or irregular curved and straight lines.

The fourth stone, which is much larger, weighing 100 lbs. or more, a very hard, light-colored quartzite, presents only a very uncouth human head on one side, and an equally crude tree on the other.

All the other stones of this group are entirely destitute of engravings

of any kind, still it seems to me that they must have been collected and placed there for a particular purpose by human hands. But for what purpose the people selected them, by what intention they were guided, with what kind of tools the inscriptions on such hard material were made, by what nation the engraving was executed, Indian or Mound Builder—these are questions which I do not venture to answer.

I would only call your attention to the significant fact that two years ago a copper implement was found among these stones, and furthermore, that in the neighborhood of them are several mounds.

Respectfully submitted.

J. GASS.

Report on a Mound in Jackson County.

BY REV. J. GASS.

To the Davenport Academy of Natural Sciences :

A few days since I employed a person to open a mound in Jackson county, in which he found the following relics, viz : three copper implements a, few fragments of pottery, and a number of burned bones, which I herewith present to the Academy for the archæological department of its museum. The elevation of this mound above the surrounding surface was about four feet, and the diameter at the base about thirty feet. The construction was very simple. A few feet below the surface were found a number of stones and many pieces of wood, all scattered in very irregular positions. At the depth of about five feet he reached a quantity of ashes, intermingled with which were the burned bones already mentioned. Here, also, were found fragments of pottery of a very dark color ; two different shaped knives of malleated copper, and a copper spear-head made in the same manner.

Respectfully submitted.

J. GASS.

September 28, 1877.

OCTOBER 4TH, 1877.

This afternoon the CORNER STONE of the Building of the ACADEMY was laid. The ceremonies commenced at 4 o'clock, and were conducted by Grand Master Z. C. Luse of the Grand Lodge of Ancient Free and Accepted Masons of Iowa, assisted by the Knight Templars and other Masonic bodies, according to the following

ORDER OF EXERCISES :

Music by Strasser's Band.

Prayer, by Rev. J. G. MERRILL.

Address by the President, Rev. S. S. HUNTING.

Address by Rev. S. S. Hunting.

Members of the Davenport Academy of Natural Sciences, all friends of the same, and members of the Masonic fraternity, it is my privilege to congratulate you this day upon the advancement of your enterprise, which was begun nearly ten years ago. December 14, 1867, a few gentlemen met in a humble place to form a Natural History Society, and the result of that meeting was the organization of the Davenport Academy of Natural Sciences. The publications of this Academy show what has been done in these ten years—more, certainly, than the most sanguine predicted at the time of the organization. We have come hither to-day to lay the stone which will mark the first decade of the life of the Academy; it will be the symbol of the corner-stone of more than a material building—that of the temple of science destined to rise in this city.

It is not the time to repeat the story of the efforts, the struggles, the delights, and the disappointments which have been thus far connected with this enterprise. He who would tell that story should speak from his own experience—one who has borne the heat and burden of the day. My task to-day is different from that. It is to speak a word in the interest of true science. The object of our Academy is the study of any department of nature. Science is another name for knowledge, and the truth which we seek is as many-sided as the variety of natural objects and the phases of life in the universe.

Longfellow has introduced his poem, "The Mask of Pandora," by the workshop of Hephestus, who appears standing before the statue of Pandora. He then describes the fashioning of Pandora, "moulded in soft clay," till the lovely form stands forth in every part. Her floating drapery "was like a cloud about her, and her face was radiant with the sunshine and the sea."

It was fitting for poetic genius to personify nature in Pandora, the all-gifted, subject to the Fates and the Furies, yet attended by the Graces. If left to the care of ignorance and stupidity, what the Greeks named Epimetheus, or After-thought, her open chest sent forth all manner of evils to afflict mankind, her benevolent uses being perverted by untutored minds and unskilful hands. But Pandora closed her chest before Hope escaped.

Prometheus is science that dares ascend into the heavens or go down to Sheol, for the evidences of truth. Under the direction of knowledge, Pandora becomes, not an evil genius, sending forth disease and death, but a beneficent order of life. Life in rock, in plant, in animals; life on the earth, and in all the other planets; in the stars no less than in the soul of man, "erect and free," the crown of nature. So we all say, "Beautiful Pandora, thou art a goddess still."

The continents appeared, the earth was clothed in luxuriant vegetation, the coal beds were formed, the rocks were stratified, and man appeared in total ignorance of all things; but there was a day coming when nature would open her treasures, reveal her secrets, and speak an

intelligible word. She has spoken; her voice has been heard, and her word we christen as Science. That word is truth. Man cannot know all the truth she has to impart, but he can make approaches to her inmost shrine; he can deal in evidences; he can accumulate knowledge, and systematize it, and by his reason he can change darkness to light and bring order out of chaos. That light and order are science, the substance, of which material forms are but symbols. The man of science puts no limits upon investigation, but the whole boundless universe is his. As the astronomer, he calculates the distances of the stars and estimates the forces which keep them in their orbits or bend them from their courses, and with his eye a thousand times magnified, he penetrates infinite space, resolving star-dust into nebulae, and nebulae into worlds. Mars has been riding through the heavens the thousands of years that man has lived, and none were wise and keen-eyed enough to see the servants that attended him, till last August his satellites were seen by the astronomers at Washington.

With the microscope man discerns the dust in the eye, the pestilence in the air, the inhabitants that live in our breath, and the gases of the sun, and the very passions of mankind are caught by the light in the camera of the photographer, and the soul is inspected by the artist. The revelations of science are perpetual. The last page in a book whose leaves are infinite in number can never be read, but as man reads page after page he is inspired with hope, and ever has the baptism of new light. In her temple those minister who are self-consecrated, and none are debarred from coming who will make the sacrifices she demands. Every one entering here may speak with the oracle face to face, and all shall stand or fall by their own merits. Those only may teach in this temple who are loyal to the evidences of truth. Says Mr. Huxley, "The most ardent votary of science holds his firmest convictions, not because the men he most venerate holds them, not because their verity is testified by portents and wonders, but because his experience teaches him that whenever he chooses to bring these convictions into contact with their primary source—nature, whenever he thinks fit to test them by appealing to experiment and observation, nature will confirm them. The man of science has learned to believe in justification by verification."

The careful study of nature with the habit of mathematical thought, makes one morally exact in his conduct. The reader who opens the second volume of Charles Darwin's book, "The Descent of Man," will find a postscript to the first volume in which he frankly says: "I have fallen into a serious and unfortunate error in relation to the sexual differences of animals. The explanation given is wholly erroneous, as I have discovered by working out an illustration in figures." Then follows the needful correction of the error. It is such honesty as that, united with consummate ability, which commends the thoughts of the scientist to the candid consideration of the reader.

Science is, and is destined still to be, the great reconciler of the conflicting interests of mankind, because it appeals always to facts and their verification, and an international exposition of the products of art

and the results of science, is hailed as a peace-maker among the different nations. Simon Newcomb, recently the President of the American Association for the Advancement of Science, in his opening address at the late meeting in Nashville, gave this incident in these words: "A few years ago it was my fortune to be in Paris, at a time when the celebrated Commune was in full sway. In the reaction which followed the downfall of Louis Napoleon, the populace was engaged in destroying every remnant of monarchy. The mystic letter "N" was torn down, and even the names of streets which savored of monarchy displaced. One day I was being shown through the rooms where the Academies of France held their meetings. I noticed in a prominent position a picture bearing the well-known face of the great warrior, and under it 'Napoleon Bonaparte, First Consul.' I expressed my solicitude as to that picture's remaining there. Why it happened to remain there was met by the emphatic response, '*Politics never enter here.*' Thus during seventy years of internal turmoil among the most excitable people known, in an association which contained extremes of both parties, that picture had remained untouched during the revolutions which had affected the government of France. This is the spirit of science everywhere." Such, friends, is the spirit which shall reign within this building, whose cornerstone we lay this day.

We all know something of the utility of the knowledge which is scientific. When cities were ill-drained, ill-lighted, ill-ventilated and ill-watered, and the people ill-washed, ill-fed and ill-clothed, the plague came as a visitation of Providence. Science destroys the possibility of the plague. By the use of the steam engine and the forcing pump, mines are successfully worked. Wheels turn on axles with inconceivable velocity, without burning or flying into pieces. The air-pump has taken away the dread of locomotion by steam.

It is the mission of science to utilize all the forces of the earth, which exist in air and water, rock and soil. The forces resident in the sun are now being utilized, and the colors are made parlor companions and kitchen servants. Here by the side of the "Father of Waters," which is building up a continent in the Gulf of Mexico with the soil taken from our feet, we would do something for science; we would lay the cornerstone of her temple on this spot, that, if possible, our works may go forth to help build in human life that continent of knowledge from which may spring a more perfect form of human society than has yet appeared upon this earth.

I would emphasize the thought that the exact knowledge which is sought in scientific pursuits is the sure ground of prosperity and the essential thing to bring man into the freedom of his reason and liberty of action. It were fit if the kind of stone we here lay were the undermost stone of the earth's crust, for as the earth has its foundations upon granite, so all the prosperity of mankind is conditioned upon the knowledge of the laws of nature in matter and in mind, which knowledge comes by the patient study of that book which always bears the imprint of its author.

After an appropriate song, Grand Master Z. C. LUSE, of the Grand Lodge of Iowa, delivered the following

ADDRESS.

My Brethren and Citizens:

It has been our custom from time immemorial, with appropriate ceremonies to lay the corner, or foundation-stones, of such edifices as it was supposed would endure to after ages, and by this means transmit to posterity a brief history of our people, the nature of our institutions, the progress we have made in the arts and sciences, and the achievements towards civil and religious liberty. Anterior to and all through the middle ages, our ancient brethren took almost sole direction of the science of architecture, and it is to them that the world is indebted for those magnificent specimens of grandeur, which lie scattered throughout Europe, as beautiful relics of a refined and cultivated people.

Those magnificent edifices were the result of the labors of associations of Freemasons of various nations who united by secret pledges and governed in lodges, traveled from country to country, wherever their superior skill was demanded. They transmitted the mysteries of the craft from generation to generation. Countenanced by the wisest men and the most powerful monarchs until their traditionary lore became disseminated among the people, and finally resulted, through arbitrary power and papal selfishness in the organization of that important fraternal institution which we now humbly represent.

In the hands of our ancient brethren the implements of architecture were used for the construction of material temples, while in our hands they have become expressive symbols, to prepare our hearts and minds for the spiritual temple which cannot be completed until time shall be no more.

“Over two hundred years ago the corner stone of the fifth and present St. Paul’s Cathedral of London, was laid. The grand and majestic structure, which rears its noble proportions above the ashes of many temples that previously had stood upon the sacred site, was designed by Sir Christopher Wren, whose rare architectural skill was only matched by his acquirements of natural philosophy and other sciences. One of the first architects and scholars of his time—he was likewise the Grand Master of Masons, and by his hand with the craft assembled about him, and by the same ceremonies we observe to-day, the corner stone of that wonderful building was placed.”

“On the 24th day of June, 1792, the corner stone of our national capitol was laid in accordance with ancient Masonic usage. President Washington, whose name is a household word throughout our land, acted as Grand Master of Masons on the occasion—placed the corner stone, and caused the corn, the wine and the oil to be poured thereon, employing these emblems with the same significance that now attaches to their use.” On the 17th day of June, 1825, the noble, brave and patriotic LaFayette assisted in laying the corner stone of Bunker Hill monument. He applied to the angles and surfaces of that stone the square, the plumb and

the level. "The lofty column on Bunker Hill, which carries the history of those times down to future ages, was designed no less to perpetuate the memory of the martyr Warren, who, on that spot poured out his blood in the cause of liberty, than the remembrance of the event, which will live long after that pillar of granite shall have crumbled into ruin." It was indeed a fitting tribute to his memory, that the corner stone upon which rests that immense structure should have been tried by the square and adjusted by the level and plumb of LaFayette—that brother whose unselfish patriotism and exalted benevolence made him the confidential friend of our Washington.

With such precedents as these it does not seem strange or inappropriate that the institution here represented should frequently be called to perform work like that of to-day. If it be asked why preference is shown to the Masonic organization in the rendering of such service, the answer may be found, perhaps, in the fact that the custom has long been established—reaching back to a period when other kindred societies, some of which are now most honorable and influential, were not in existence.

We are here to-day clothed in white gloves and aprons, the insignia of Free and Accepted Masons, to place in the north-east corner of the ground plan the first stone upon which is to be built a super-structure to be dedicated to the promotion of science. The corner stone has its casket, the depository of the evidence of the condition of the people, religious and political, and of the history of the times when it was laid.

Dr. C. C. Parry then read the following :

ODE.

On Laying the Corner-Stone of the Davenport Academy of Natural Sciences, October 4th, 1877.

BY C. C. PARRY.

In ocean's depths, long ages past,
 A floor of solid rock was laid.
 From which, in later times recast,
 A fitting corner-stone is made.

This block, transformed by human art,
 We now would lay with rev'rent hand,
 Where it may needful strength impart,
 On which our temple wall may stand.

Within its massive bed we place
 Some tokens of the present age,
 In which the future man may trace
 The brightening light on Science page.

Above this corner-stone we aim
 To rear no monumental fane,
 Which shall, in solemn tones proclaim
 That human works and hopes are vain.

But a fair structure to unfold
 To open eye, and ready mind,
 Creation's wonders manifold,
 Which in our daily walks we find.

To show a plan which runs throughout
 The whole of Nature's broad domain,
 And indicates, beyond all doubt,
 Wisdom and truth shall ever reign.

What e'er we do for truth and right,
 By work or gift, by will or deed,
 Can never fail while "right is might,"
 In Truth's great cause we must succeed.

The God of truth we now invoke,
 To crown our work—but just begun;
 We wait to hear the plaudit spoke
 From out the topmost stone—"Well done!"

A leaden box containing the following articles was then placed in the cavity of the stone by Prof. W. H. Pratt, Curator :

- Proceedings of Davenport Academy of Natural Sciences, Vol. I.
- Proceedings of Davenport Academy of Natural Sciences, part 1 of Vol. II.
- List of subscribers to the building fund to this date.
- Manuscript copy of the address of the President, Rev. S. S. Hunting.
- Programme of the exercises.
- Constitution and by-laws of the Art Association of Davenport.
- List of officers and members of Davenport Lodge, No. 37, A. F. & A. M.
- Constitution and by-laws of Davenport Library Association.
- Davenport City Directory, 1876.
- Programme of Centennial Fourth of July Celebration, Davenport.
- Daily Davenport Gazette, July 6th, 1876.
- Centennial Supplement to Gazette, July 4th, 1876.
- Carriers' Address, Davenport Gazette, January 1, 1877.
- Centennial Art Catalogue, Ladies' Centennial Art Association Fair and Exhibition, February 22d to 28, 1876.
- Davenport Weekly Gazette, Oct. 3d, 1877.
- Davenport Daily Gazette, Oct. 4th, 1877.
- Davenport Weekly Democrat, Oct. 4th, 1877.
- Davenport Daily Democrat, Oct. 3d, 1877.
- Davenport Weekly Demokrat (German), Oct. 4th, 1877.
- Davenport Daily Demokrat (German), Oct. 4th, 1877.
- A copy of "The Sunbeam," Hastings, White & Fisher.
- Hastings, White & Fisher's photographed business cards.
- Circular descriptive of Harrison & Holman's new drug store.
- Historical address by Dr. C. C. Parry on the early exploration and settlement of the Mississippi Valley, delivered Jan. 21, 1873.

Davenport and Vicinity in the War of 1812, by W. C. Putnam.

List of Presidents and Vice-Presidents of the United States of America.

Three cent piece of United States fractional currency.

Fee Bill of Iowa and Illinois Central District Medical Association, Jan. 11, 1877.

List of members elected since the last published Proceedings.

List of articles deposited in the corner-stone.

Laying of the Corner-Stone.

The corner-stone was then laid by the Grand Master and his assistants with Masonic ceremonies.

Song by Quintette.

Address by Prof. T. S. Parvin.*

The Professor remarked that all Masons and Templars were, or should be, gentlemen, and observing a crowd of boys and girls among his audience, he said:—

Ladies and Gentlemen, Boys and Girls, and congratulated the children upon so interesting an occasion, and as they were the material out of which the future ladies and gentlemen of Davenport were to be made, he hoped in their progress and development into noble manhood and womanhood, many of them would be found studying the sciences and arts in the Academy whose corner-stone they had just seen laid with masonic ceremonies.

The Free Masons of to-day were the successors of those operative masons of the middle ages, who associated together in guilds, traversed Europe from the Adriatic to the Baltic seas and the German Ocean, and erected those magnificent cathedrals, abbeys and castles, whose magnificence even in ruins commanded the admiration of a world unknown in their day.

As speculative Masons, those present were so far connected in operative work with those of the past that they with appropriate ceremonies and historical surroundings, laid the corner-stones of public edifices designed in their structure to promote the welfare of men.

He had himself, he said, as an officer of the Grand Lodge of Masons, on many occasions officiated in the laying of corner-stones of "temples erected to the worship of the true God," and in this the Masons had shown their reverence for the religion of their fathers. Of "Temples of Justice," thus evincing the Masons' devotion to the principles of right which should govern the social world. Of "School Houses," manifesting in such labors their interest in the youth of the nation, and the means so wisely provided to fit them for honorable and useful citizenship.

*The address of Prof. Parvin was wholly *extempore*, as are all of his public efforts, and being a very rapid speaker, we could catch only the leading topics of his remarks.

And now comes the Grand Lodge for the first time in the history of masonry in Iowa, to show in a three-fold manner the reverence, devotion and interest which the masons of Iowa, in connection with those of Davenport, have in the work to-day, so happily and successfully inaugurated in the laying of the corner-stone of a building owned by the Academy of Sciences of Davenport, and consecrated to the advancement of science and instruction in those arts which are ennobling to our nature.

This is not the first Academy of Science organized in the State. But its history illustrated the truth of the Darwinian idea, that in the struggle of life it was the strong, the swift, and the most fitting alone that survived. At an early period in our history, every pretty site for a town from the Des Moines to the Wapsipinicon rivers was staked off for a future city, but the march of commerce, the introduction of railroads and advancing civilization of the age, had led to the pulling up of the stakes and the consecration of their virgin soil to the holier purpose of the agriculturist, whose fields of waving grain testified to the great improvements, as well as great changes wrought thereby. So too, many towns, real and imaginary, provided for or organized Academics of Science, but like many other things of the past, they have departed and are no more. Better have one institution the pride and glory of the State, commanding the admiration of scientists and the lovers of science everywhere, than a number existing only in name.

The corner-stone has been adjusted in its place by the "square," the "level," and the "plumb," the working tools of both the operative and speculative mason. They had their moral as well as physical use. The *square* was an emblem of space, and within these walls he hoped to see cultivated the wide range of science studied everywhere in the interests of humanity. The *level* is to teach us that all science has its uses, and is designed and calculated to advance its votary in the path of usefulness, and make him an honor to the age and country in which he lives and labors, while the *plumb* should ever admonish the student that the science he most dearly cultivates is in harmony with every other science. Indeed, said the speaker earnestly, all the sciences are ever in harmonious relation with each and all others, natural and revealed. The God of Revelation and the God of Nature is the one God, our common Father, "in whom there is no variableness neither shadow of turning." The God of the devout Christian is our God, and we worship in sincerity and truth at the common altar which He has created for all his followers. There is truth, in the language of the Mason, "We meet upon the level and part upon the square," because our great Teacher has "set a plumb line in the midst of his people," of every name and profession, and in following him they walk by it.

Upon this corner-stone we have poured the "*corn, wine and oil*," fit emblems of the occasion and of the objects had in view. Science in its onward march has not only developed new and before unknown articles of "nourishment" and food, of which corn (or the wheat of the olden

time) is but the emblem, but has given increased supplies and potency to those before known. So, too, has it done much to "refresh" and gladden the heart of man as he wearily plods his way in search of food or pleasure, and in combining pleasure with profit to himself and the world, has added new "joys" to the crown of honored bliss and earthly happiness shadowed forth so beautifully in the wine and oil, the symbols used upon this and all similar occasions.

In this, then, the work of the man as a mason is completed; as a scientist only begun. The Masons, in common with the citizens of the State, will, during the revolving years of the future, look forward with interest and hope to the success of your labor, fellow-members of the Academy, labor which we and they fully trust will redound to the honor of the members, and the substantial benefit of the people.

Prof. Parvin paid a glowing and fitting tribute to the ladies of the city, to whose labor of love the Academy was so greatly indebted for the success of the present enterprise, and could he, he said, but reach the ears of the men of wealth in which Davenport abounds, and properly touch their inward conscience, he would prove to them that the highest and truest development of manhood was to be found only when the large purse was brought into liberal and harmonious relations with the cultivated mind, and the noble and generous soul. To all such he would say, go and do as the noble patrons of the Academy had already done, and further endow it for usefulness.

As a citizen of Iowa, having grown to a ripened age with the growth and strength of the State, and in behalf of its citizens, known for their love of a wide-spread knowledge, he congratulated the members of the Academy upon what they had done, and in the fullness of time would do, if properly encouraged and cheered on their way.

As a Mason, identified somewhat prominently with the order from its introduction into the territory of Iowa, and as a band of brethren always friendly to science, its progress and development, he was happy to extend in their name his most hearty congratulations. As an humble student of science from his boyhood up, ever finding, as he treaded its paths, new pleasures and increased delights, he was profoundly impressed with the earnest manner and the success thus far attending the labors of his associates, young and old, in the work before them, regarding it as an augury of the larger success in store and sure to reward the labors so happily begun.

In the conclusion of his remarks the Professor said, that it was a day memorable in the history of the Academy, of the city, the state, and the fraternity. The laying of a corner-stone of an institution devoted solely to the instruction, progress and development of *Science* and *Art* is a "new departure" in the State, and from which we have much to hope.

The honored names of citizens, not directly connected with the pursuits of science, yet laboring in common with those who are, is an evidence that the enterprise is in the hands of those who mean success as their watchword. In the future, when the names of the politicians who have filled our governmental and senatorial chambers are forgotten, the

names of Newcomb, Putnam, and other active promoters of this great work with that of Cook, who has endowed another worthy enterprise near by,* will be held in grateful remembrance by your children's children, who in later years shall tread these halls, sacred to science and art.

The worthy lady whose generous gift to the Academy is a fitting memorial of her conjugal love for the departed, has in this wise step erected a monument which shall testify her devotion when the centograph erected in yonder cemetery shall have crumbled and mingled with the dust. And the same sun which smiles upon us in glory to-day in token of approval, will continue to shine upon the Academy during all its future labors and years.

The exercises closed with a benediction by Rev. W. H. Barris, D. D.

OCTOBER 12TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Forty persons present.

Mr. A. S. Tiffany presented, on behalf of Stephen Sammons, an interesting and valuable collection of old documents, including an original army account of Volcart Veeder, of Johnstown, 1772; the notice of election, as Senator, of Major Fonda, 1787; commission of Peter Rills, Ensign, with the signature of De Witt Clinton and J. W. C. Yates, 1820; a copy of the *Ulster County Gazette*, January, 1800, giving an account of the death of Washington, etc.

Mr. J. M. DeArmond read a very able and interesting sketch of the life, character and adventures of the renowned Sac and Fox warrior, Black Hawk. He spoke of the respective characteristics of Pontiac, Tecumseh and Black Hawk; of the Sacs and Foxes, and kindred tribes in the North-west; and of the birth and early career of Black Hawk; the memorable Black Hawk War; his final overthrow and death. He called particular attention to the inaccuracies of historians in their accounts of Black Hawk and the troubles caused by him.

[*Mrs. Clarisa C. Cook has presented the DAVENPORT LIBRARY ASSOCIATION with a building costing \$12,000, erected for its especial use.—ED.]

OCTOBER 26TH, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Twenty members present.

The Corresponding Secretary reported numerous letters received and answered, mainly in reference to exchanges.

The Curator reported many additions to the Museum and Library.

The following persons were elected regular members: Mr. A. Burdick, Mrs. A. Burdick and Mr. C. E. Pickering. Mrs. E. P. Kirby, Jacksonville, Ills., and Prof. L. G. Olmstead, Fort Edward, N. Y., were elected corresponding members.

Mr. C. H. Truax, of Maquoketa, presented a fossil *Orthoceras* from the Niagara limestone, especially interesting as showing in the fracture a portion of the siphuncle, unusually well preserved.

The following paper was read and referred to the Publication Committee:

The Local Geology of Davenport and Vicinity.

BY PROF. W. H. BARRIS, D. D.*

NOVEMBER 3D, 1877.—BIOLOGICAL SECTION.

Six members present.

Mr. J. D. Putnam exhibited various specimens of the *Chernetidae* and *Solpugidae* of the United States. Special attention was called to the specimens of *Galeodes pallipes* and *G. subulata* collected by Prof. F. H. Snow in Colorado, and Mr. G. W. Belfrage in Texas, showing beyond a doubt that they are the two sexes of but one species—*pallipes* being the female, and *subulata* the male. Three specimens of another species, collected in Texas by Mr. Belfrage, correspond perfectly with the description and figure of *Gluvia geniculata* Koch, hitherto known only from the vicinity of the Orinoco in South America.

[*At the time of going to press with this sheet, Dr. Barris is so ill that he is unable to revise his paper for publication. It is therefore omitted in this place, and will be inserted later.—Ed.]

NOVEMBER 9TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Five members present.

Mr. H. C. Fulton read a second instalment of his "History of Davenport," giving an account of the city during the eventful years of 1837-38, the establishment of the first school, founding of the first church, building of the first brick house, starting of the first newspaper—the *Iowa Sun*, the holding of the first court, etc. It was during the first of these years that Scott county was organized, and during the second that Iowa was made a separate territory.

At a meeting of the Trustees, held November 30th, 1877, the following resolution, presented by Dr. Preston, was adopted :

Resolved, That the Scott County Medical Society be offered the privilege of depositing books and articles appropriate to a Museum in the new Academy building, subject to the will of the Medical Society; also, the privilege of holding their meetings in said building, provided that mutually satisfactory arrangements can be made as to room and current expenses.

Dr. C. H. Preston, Dr. E. H. Hazen and Rev. W. H. Barris were appointed a committee to confer with the Medical Society.

NOVEMBER 30TH, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Fifteen members present.

The Curator reported the receipt of a large number of stone and flint implements, obtained by Capt. W. P. Hall from various places in Illinois and Missouri, along the Mississippi River. Also two barrels of geodes from Mrs. C. H. Perry, of Keokuk.

Mr. A. S. Tiffany offered to donate, upon certain conditions, a large number of fossils and corals from various geological horizons in the States of New York, Connecticut and Massachusetts. The offer was accepted with a vote of thanks.

Mr. T. T. Dow was elected a regular member.

Dr. C. C. Parry, being about to depart on a prolonged trip

to Mexico, tendered his resignation as Recording Secretary, and Mr. J. G. Haupt was chosen to fill the vacancy.

Mr. Pratt called attention to the frequent and permanent injury of the eye-sight, by faulty light and lack of care of the eyes, and presented the following resolution, which was adopted :

Resolved. That in view of the importance of the subject of the influence of study, and of the lighting and seating arrangements in the schools, as affecting the eyes of the pupils, Dr. E. H. Hazen be requested to make such an investigation of the condition of the eyes of the pupils in our city schools as he may be able to do, as extensive as practicable, and report the results in a paper to the Academy.

The following papers were read :

On the Prevalence of Left-Handedness in the City Schools.

BY W. H. PRATT.

I have recently taken the opportunity afforded by my connection with the city schools to make some investigations regarding the amount of left-handedness existing among the portion of the community there assembled, and some of the circumstances connected therewith.

The whole number attending the public schools during the month of November (including 93 teachers), was 3,971, a sufficient number to furnish a pretty fair index to the whole community. Among these I found 126 who were naturally, or primarily, left-handed, a trifle over 3 1-6 per cent—3.17. • It was in no case, so far as I could learn, occasioned by any injury or disability of the right hand, and seems to have been just as natural to those persons as was right-handedness to the rest. Of these, 75 are males and 51 females. Of the males 34 and of the females 29, (just one half), report some of their relatives left-handed. It is probable that there may be more than are reported, as the small children, especially, would doubtless be unable to report some cases of left-handedness among relatives beyond the immediate range of their personal acquaintance. The left-handed relatives reported are, males 53, females 39, as follows :

Fathers.....	13	Mothers.....	11
Grandfathers.....	6	Grandmothers.....	5
Uncles.....	14	Aunts.....	4
Brothers.....	16	Sisters.....	14
Cousins.....	4	Cousins.....	4
		Great-aunt.....	1
	—		—
	53		39

Of the whole attendance we have, males 1,905, females 2,066—3,971. Per cent. of males left-handed, a little over 3 1-6—3.88 ; per cent. of females left-handed, not quite 2 1-6—2.46, which does not accord with Mr. Buchan-

an's opinion,* that left-handedness is more prevalent among females than among males.

We also have 24 parents, and only 18 uncles and aunts, left-handed, which again does not tend to corroborate the remark by Dr. Daniel Wilson,† that "it appears more generally to manifest itself collaterally than in direct line of descent."

It is true that children might be less likely to be aware of the existence of this condition among more distant relatives than in the case of their own parents, though I usually caused them to make inquiry at home, but we should also remember that children have *more* uncles and aunts than parents, and one of these considerations may fairly offset the other.

I did not make the inquiry, which would be an interesting one in this connection, how many of the right-handed persons had relatives who were left-handed.

Almost all of the teachers included in the list (of whom there are eight), and also several of the pupils, are ambidextrous, as it is termed, or using one hand about as readily as the other; but this ambidexterity, as far as I can learn, is the result of primary left-handedness and cultivation of the use of the right hand on account of its greater convenience. Only seven of the whole 126 are in the habit of writing with the left hand, as I, with the co-operation of the other teachers, have guarded against the acquirement of that habit as far as possible. In each case, except one, it appears that the original left-handed bias, or at least the early *habit* of using that hand in preference, was quite decided. In one instance the boy was deliberately *made* left-handed. His mother's sister was left-handed, and his mother said it was "lucky to have one left-handed in the family, and it might as well be he as any," so he was made the victim. It would seem that the "good luck" was confined to those who escaped such a conclusion.

How much is usually due to a natural bias (if there be any such bias), and how much to accident, determining the use of either hand by the infant, it is impossible to determine, but there seems to be good reason to conclude that in all ordinary cases the parents, by a little attention, can easily cause the child to grow up left-handed or right-handed, as they may choose, and hence, when a person is left-handed, it is almost always the fault of the parents, and a very grave fault it certainly is, to entail a life-time awkwardness upon the child, while he is incapable of judging and choosing for himself.

*"The Center of Gravity in Man," Proc. Phil. Society of Glasgow, Vol. X, page 413.

†"Left-handedness," Canadian Journal, Vol. XV, page 481.

A New California Lily.

BY DR. C. C. PARRY.

On one of my last botanical excursions in the vicinity of San Bernardino, Southern California, in the early part of July, 1876, I improved the opportunity to accept an often repeated invitation to visit the intelligent brothers, J. G. and F. M. Ring at their mountain retreat near San Geronio Pass. Leaving the broad and picturesque basin of the Santa Anna Valley, near the emergence of this stream from the rugged mountain wall of the San Bernardino range, our route, after crossing Mill Creek, one of its largest eastern affluents, hugged close to the foot-hills bordering the upper Yucaipa valley, thence by a more rapid ascent in a nearly direct easterly course, we reach an elevated bench, variously scattered with pine and oak groves, overlooking the broad sweep of San Geronio Pass, now traversed by the eastern extension of the Southern Pacific Railroad. In one of these mountain nooks the Messrs. Ring have located a potato ranch, the elevation of over 4,000 feet above the sea level giving a sufficiently cool moist climate, while the adjoining mountain slopes afford an extensive summer cattle range long after the herbage of the lowlands has dried up.

Owing to the lateness of the season, the early vegetation of this district had already given place to a more sparse mid-summer growth. In scattering groves of *Pinus Coulteri*, the ground was abundantly strewn with the massive cones of this peculiar species, its dense scales armed with formidable hooked spines; many of the largest cones were fully six inches in diameter, with a length of nine inches. At lower elevations throughout this district we find the large fruited Douglas spruce quite common, this well marked variety in other particulars exhibiting the specific characters of this species in more northern and eastern localities. Among the rarities of this district we were able to secure a few specimens of *Habenaria elegans* Bolander. The occasional perennial water courses here met with are mostly confined within deep and inaccessible ravines, but more frequently scant springs ooze out from beneath deep layers of porous strata, and spread out into boggy marshes generally choked up with rank willow and older growths, and occasionally expanding into small meadows of coarse grass and sedges. Near one of these largest expanses of moist, rich soil, is located the potato ranch of Messrs. Ring, the special object of our visit. It is quite unusual, though none the less agreeable, to find in such secluded and unpretentious residences indications of a refined taste exhibited in an excellent library, largely composed of scientific works, and books of exploration and travel, besides the necessary instruments for keeping up a meteorological record! No doubt from such resources the bachelor brothers find some relief from the tedium of their isolated location, and after the excitement and hardships of extensive travels on the north-west coast, seem reconciled to the independent solitude of a mountain ranch.

Succeeding a cordial welcome, and the necessary care of our riding animals, the vegetation of this curious nook engaged our attention. On

all the steep, gravelly slopes adjoining there was the usual display of California evergreen shrubbery, including conspicuously the heath-like *Adenostoma*, which, under the common name of *Chamisal*, is largely used for fuel; the holly leaved cherry *Prunus ilicifolia*, exhaling a strong odor of bitter almonds; the *Heterorneles arbutifolia*, with glossy varnished leaves, and a prevalent form of "California lilac" (*Ceanothus crassifolius*), with thick leathery foliage; the dull, green hue which everywhere characterizes the moorish growth is at this time of year partly relieved by brilliant scarlet festoons of *Pentstemon cordifolius*, trailing over adjoining bushes, or the less showy blossoms of *Pentstemon ternatus*. What, however, soon attracted more exclusive attention was a conspicuous yellow lily, growing abundantly in the boggy ground adjoining the house, and sharing with the potato patch the care and attention of the undisputed proprietors of the soil. Though not as showy as some other members of the lily family in this region, there is a grace displayed in its large drooping flowers, surmounting a slender stem, beset with narrow scattered leaves, which occasionally are crowded at base into a distinct whorl; the plant varies in height from three to five feet, the number of flowers regularly unfolding from it is also variable, ranging from three to nine. The specimens then collected, together with later material, obligingly furnished by Mr. Ring, has supplied the necessary means for a complete description, and the whole having been placed at the disposal of Mr. Sereno Watson, who is now elaborating the endogenous flora of California, he has determined the same as an undescribed species, which he has complimented the discoverer by naming *Lilium Parryi* Watson. At my request Mr. Watson has kindly furnished the following characterized description:

"*Lilium Parryi* Watson, *Bot. Calif.* ined.

"Bulb somewhat rhizomatous, of numerous crowded scales, fleshy and jointed, about an inch long, the upper joint broadly lanceolate; stem slender, glabrous, two to five feet high, 2-10 flowered; leaves usually scattered, occasionally the lower ones in a whorl, linear, oblanceolate, four to six inches long, and half an inch wide or less, mostly acuminate; flowers horizontal, pale yellow, sparingly and minutely dotted with purple; segments three and one-half inches long, and five or six lines wide, with long, narrow claws, slightly spreading from the base; stamens and style a half inch shorter, equal; anthers oblong, brownish, three lines long; capsules narrowly oblong, acutish, two inches long by half an inch in breadth.

"Of the section *Enlivion*, to which also belongs the Californian *L. Washingtonianum*. It is distinguished from the latter especially by its small bulbs, with jointed scales, its more scattered and narrower leaves, its smaller yellow flowers with less spreading segments, and its longer, narrower and acuter capsules."

In farther illustration of this species, by the kindness of Mr. W. O. Gronen, I am enabled to present an excellent figure with some of the more important specific details.*

*Plate V, fig. 1, *Lilium Parryi*, general view, one-third natural size; fig. 2, bulb, three-fourths natural size; fig. 3, pod, three-fourths natural size; fig. 4, diagram of pod, three-fourths natural size. Plate VI, full size view of the top of plant, showing flowers and buds.

DECEMBER 1ST, 1877.—BIOLOGICAL SECTION.

Four members present.

Mr. Pratt exhibited a mouse presented to the Academy by Mrs. Orr, and made the following remarks on its habits: It is a female of the common species—*Mus musculus*—and is remarkable for its almost constant singing or chirping. The key note is A sharp, one octave above the middle A of the piano, changing frequently to A sharp one octave higher, and to D sharp between and probably touching other intermediate notes, but so rapidly as to be difficult to distinguish. During the night, if not cold, its chattering is continued without cessation, usually loud enough to be heard distinctly throughout a good sized room, and is a clear musical tone. It consists of about four notes per second, with a frequent trill many times more rapid, and running up and down the scale to the extent above mentioned. During the day it is often still, or sounding so faintly as to be heard at a distance of a few inches only, and resembles the pattering of drops of water.

Several specimens of the Eel Pout (*Lota lacustris*, Gill) were reported as having recently been taken in the Mississippi. Two specimens have been presented to the Academy by John Hume and Wm. Gray.

A finely mounted specimen of "Tarantula" was received from Dr. L. N. Dimmock, of Santa Barbara, Cal. Mr. J. D. Putnam remarked that it appears to be undescribed, and to belong to the section *Eurypelma* Koch, of the genus *Mygale*, which is represented in the south-eastern parts of the country by *Mygale avicularia* DeGeer, *M. hentzii* Girard, and other species. Under the latter name several species from Colorado, Utah, etc., seem to have been confounded. Specimens of all these species are in the collection of the Academy. The true *Tarantula* is a species of *Lycosa*, and belongs to an entirely different group of spiders from *Mygale*, though the habits are somewhat similar.

Mr. Putnam, on behalf of the author, presented the following paper:

List of the Lepidoptera of Muscatine County, Iowa.

BY MISS ALICE B. WALTON.

RHOPALOCERA.

Papilio philenor <i>Linn.</i>	Grapta progne <i>Cram.</i>
Papilio asterias <i>Drury.</i>	Grapta comma <i>Harris.</i>
Papilio troilus <i>Linn.</i>	Vanessa antiopa <i>Linn.</i>
Papilio turnus <i>Linn.</i>	Pyrameis cardui <i>Linn.</i>
Papilio var. glaucus <i>Linn.</i>	Pyrameis hunteria <i>Drury.</i>
Papilio cresphontes <i>Cram.</i>	Pyrameis atalanta <i>Linn.</i>
Pieris protodice <i>Boisd. & Lec.</i>	Junonia lavinia <i>Cram.</i>
Colias caesonia <i>Stoll.</i>	Limenitis ursula <i>Fabr.</i>
Colias erytheme <i>Boisd.</i>	Limenitis misipus <i>Fabr.</i>
Colias keewaydin <i>Edw.</i>	Apatura celtis <i>Boisd.</i>
Colias philodice <i>Godart.</i>	Euptychia eurytus <i>Fabr.</i>
Terias lisa <i>Boisd.</i>	Chrysophanus hyllus <i>Cram.</i>
Danais archippus <i>Cram.</i>	Lycæna neglecta <i>Edw.</i>
Argynnis idalia <i>Drury.</i>	Lycæna pseudargiolus <i>Boisd.</i>
Argynnis cybele <i>Fabr.</i>	Lycæna comyntas <i>Godt.</i>
Argynnis aphrodite <i>Fabr.</i>	Epargyreus tityrus <i>Fabr.</i>
Argynnis myrina <i>Cram.</i>	Thorybes pylades <i>Scudd.</i>
Argynnis ———.	Hesperia hobomok <i>Harr.</i>
Phyciodes tharos <i>Boisd.</i>	Hesperia vialis <i>Edw.</i>
Grapta faunus <i>Edw.</i>	Hesperia numitor <i>Fabr.</i>
Grapta interrogationis	Hesperia tessellata <i>Scudd.</i>
var. Fabricii <i>Edw.</i>	Hesperia ———.
Grapta interrogationis	
var. umbrosa <i>Lint.</i>	

SPIINGID.E.

Macroglossa diffinis <i>Boisd.</i>	Philampelus achemon <i>Drury.</i>
Macroglossa thysbe <i>Fabr.</i>	Smerinthus geminatus <i>Say.</i>
Thyreus abbotii <i>Swain.</i>	Macrosila carolina <i>Linn.</i>
Thyreus nesus <i>Cram.</i>	Macrosila quinquemaculata <i>Hav.</i>
Darapsa myron <i>Cram.</i>	Sphinx cinerea <i>Harr.</i>
Chærocampa tersa <i>Linn.</i>	Sphinx gordius <i>Cram.</i>
Deilephila lineata <i>Fabr.</i>	Ceratomia amyntor <i>Hubn.</i>
Philampelus pandorus <i>Hubn.</i>	

ZYGÆNID.E.

Eudryus unio <i>Hubn.</i>	Scepsis fulvicollis <i>Hubn.</i>
Eudryus grata <i>Fabr.</i>	

BOMBYCID.E.

Hypoprorepia fucosa, <i>Hubn.</i>	Actia decorata <i>Saunders.</i>
Utethesia bella, <i>Linn.</i>	Arctia persephone <i>Grote.</i>
Callimorpha Lecontei <i>Boisd.</i>	Arctia arge <i>Drury.</i>
Arctia nais <i>Drury.</i>	Pyrrharetia isabella <i>Smith.</i>

BOMBYCIDÆ (CONTINUED.)

<i>Lencaretia aerea</i> <i>Drury</i> .	<i>Telea polyphemus</i> <i>Linn.</i>
<i>Spilosoma virginica</i> <i>Fabr.</i>	<i>Actias luna</i> <i>Linn.</i>
<i>Spilosoma latipennis</i> <i>Stretch.</i>	<i>Samia cecropia</i> <i>Linn.</i>
<i>Euchaetes egle</i> <i>Drury</i> .	<i>Clisocampa americana</i> <i>Harr.</i>
<i>Nerice bidentata</i> <i>Walk.</i>	<i>Xyleutes robinix</i> <i>Peck.</i>

NOCTUIDÆ.

<i>Acronycta obliterata</i> <i>Smith.</i>	<i>Plusia aerea</i> <i>Hubn.</i>
<i>Microcœlia obliterata</i> <i>Grote.</i>	<i>Plusia balluca</i> <i>Geyer.</i>
<i>Jaspidea lepidula</i> <i>Grote.</i>	<i>Plusia simplex</i> <i>Guen.</i>
<i>Agrotis c-nigrum</i> <i>Linn.</i>	<i>Chamyris cerintha</i> <i>Treits.</i>
<i>Agrotis subgothica</i> <i>Hew.</i>	<i>Erastria carneola</i> <i>Guen.</i>
<i>Agrotis messoria</i> <i>Harr.</i>	<i>Erastria nigrifula</i> <i>Guen.</i>
<i>Agrotis clandestina</i> <i>Harr.</i>	<i>Drasteria erectea</i> <i>Cram.</i>
<i>Mamestra adjuncta</i> <i>Guen.</i>	<i>Euclidia cuspidata</i> <i>Hubn.</i>
<i>Mamestra subjuncta</i> <i>Grote.</i>	<i>Catocala meskei</i> <i>Grote.</i>
<i>Mamestra renigera</i> <i>Stephens.</i>	<i>Catocala ultronia</i> <i>Guen.</i>
<i>Perigea xanthioides</i> <i>Guen.</i>	<i>Catocala neoparta</i> <i>Guen.</i>
<i>Dipterygia pinastri</i> <i>Linn.</i>	<i>Catocala innubens</i> <i>Guen.</i>
<i>Hyppa xylinoides</i> <i>Guen.</i>	<i>Catocala neogama</i> <i>Guen.</i>
<i>Hydrœcia nictitans</i> <i>Linn.</i>	<i>Catocala paleogama</i>
<i>Gortyna rutila</i> <i>Guen.</i>	<i>var. phalanga</i> <i>Guen.</i>
<i>Arzama obliquata</i> <i>G. & R.</i>	<i>Homoptera lunata</i> <i>Drury.</i>
<i>Heliophila pallens</i> <i>Hubn.</i>	<i>Pseudoglossa lubricalis</i> <i>Geyer.</i>
<i>Heliophila pseudargyria</i> <i>Grote.</i>	<i>Plathypena scabra</i> <i>Fabr.</i>
<i>Pyrophila pyramidoides</i> <i>Grote.</i>	

GEOMETRIDÆ.

<i>Petrophora diversilineata</i> <i>Hubn.</i>	<i>Acidalia enucleata</i> <i>Guen.</i>
<i>Eutrapela transversata</i> <i>Drury.</i>	<i>Angerona crocataria</i> <i>Fabr.</i>
<i>Heterophelps triguttata</i> <i>Her. Sch.</i>	<i>Endropia effectaria</i> <i>Walk.</i>
<i>Hæmatopis grataria</i> <i>Fabr.</i>	<i>Endropia marginata</i> <i>Pack.</i>

PYRALIDÆ.

<i>Botys verticalis</i> <i>Albin.</i>	<i>Desmia maculalis</i> <i>West.</i>
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TORTRICIDÆ.

<i>Argyrolepis quercifolia</i> <i>Fitch.</i>
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PTEROPHORIDÆ.

<i>Pterophorus periscelidactylus</i> <i>Fitch.</i>
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DECEMBER 14TH, 1877.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Twenty-five persons present.

This evening being the tenth anniversary of the founding of the Academy, Mr. Pratt read the following paper:

Reminiscences of the Early History of the Academy.

BY W. H. PRATT.

The occurrence of another anniversary of the organization of the Academy, and the completion of the first decade of its existence, recalls to mind some reminiscences which may not be out of place here in the meeting of our Historical Section.

Ten years ago this evening, four persons met in a small real estate agency office in this city, and agreed and pledged themselves to each other and to the community, that their efforts, feeble as they might be and must be, should be united and directed towards the acquirement and dissemination of scientific knowledge, and that the limited means at their command should be used to the best of their knowledge and ability, to awaken an interest in such studies, to unite the influence of those who were already interested, to encourage scientific research and scientific reading, and to promote the introduction of practical scientific instruction in the public schools. In this attempt they were merely taking the initiatory steps, relying upon the co-operation of others of equal earnestness and greater ability, who should join in the good work and carry it forward.

During several years this matter had been discussed from time to time between Mr. Barler, Mr. Alfred Sanders, Mr. Riepe, Prof. D. S. Sheldon, Dr. Parry, Mr. Tiffany, and myself, and perhaps some others whom I do not now recall, with the rather vague determination of doing something sometime, and a full conviction that something ought to be done by united effort.

We had been gradually forming private geological and natural history collections, those of Prof. Sheldon and Mr. Sanders being the principal ones. With a rich field for study and collection of specimens in the several branches of natural history; situated in a flourishing city, surrounded by a rapidly increasing population, and at a time when a growing interest in scientific subjects was everywhere manifested; it seemed as if something more might and ought to be accomplished than had been or would be by such scattered and desultory action, and there was encouragement in the work already done. We were, of course, entirely unaware of the rich mine of archaeological treasures hidden almost at our feet, as scarcely any attention had at that time been given to the subject in this region, and comparatively little anywhere.

Prof. Sheldon had scoured the woods and fields and explored the rivers and ponds in a very assiduous and successful search for plants,

insects and shells, and by example, advice and instruction, had been gradually and faithfully sowing the seeds of scientific progress, and promoting scientific culture. Mr. Alfred Sanders had, during several years, made large collections in the same lines, and had then recently retired from business, and determined to devote his time largely to scientific pursuits, and was much engaged in the study of systematic geology especially. Mr. Barler had become an assiduous and persevering collector and student.

Mr. Riepe, always a naturalist in his tastes and habits, was constantly finding something new and interesting, and leading the attention of his pupils and friends in the direction of natural knowledge, and chiefly through my acquaintance with him, and through his influence, my attention was turned that way more than ever before. He and I, with, sometimes, one or two others, and usually some of our children, spent many a pleasant, and I believe profitable, day on a private pic-nic upon Credit Island or over at Rock River, enjoying our dinner with fresh hot coffee, made on the spot, by the side of a little fire in the woods, even on a chill November day, as well as a keen appetite and absence of conventionalities would enable us to do. These explorations always resulted in some desirable additions to our cabinets, and though often physically fatigued with our burdens, we always returned refreshed in spirit and renewed in zeal. Many specimens found on those excursions are now in our Museum.

Dr. Parry had long since acquired a high reputation as a thoroughly scientific botanist, an untiring explorer, and remarkably successful collector; and Mr. Tiffany was delving among the rocks with all the zeal of a new convert.

Such was about the condition in matters of scientific research here in 1865-66. None of us being very sanguine in our expectations of building up a society of much strength or rapid growth, it was still thought that a scientific club or small association in some form might be established, which would afford an opportunity for comparison of observations and interchange of ideas, and by uniting our collections we might form a nucleus for a museum which should ultimately become of some general interest and benefit to the community, by stimulating research and adding something to the sum of human knowledge, and possibly, in time, an institution which should be creditable to our city.

The untimely death of Mr. Sanders, and the loss of his talent, experience and influence before any definite action had been taken, was a serious drawback and discouragement, and doubtless somewhat delayed action in the matter, and Dr. Parry's absence most of the time was a further difficulty. But we realized that the formation of mere private collections was of comparatively trifling importance, having very little influence upon the community, and if pursued with no higher object, rather encouraging, perhaps, a spirit of selfishness or exclusiveness, each being led to work more for his own than for the general good. Personal proprietorship is rather antagonistic to a liberal public spirit and true interest in the increase and diffusion of knowledge.

In the spring of 1867 while spending a few weeks at Ottawa, Ills., I became acquainted with Dr. John Paul, whom some of us here present have since known, and Dr. L. N. Dimmock, now of Santa Barbara, Cal., and some other leading members of the Ottawa Academy of Natural Sciences, an institution which had then a name but no local habitation. They had, however, some good working members, had already in their locality awakened a fresh interest in scientific subjects, and had a prospect of soon establishing the society in good rooms, and by uniting their private collections, which were of considerable value, making a very good beginning in the building up of a museum. By their example and advice we were encouraged to attempt something more systematic than we had at first thought of venturing.

Mr. L. T. Eads having become interested in the subject, joined in our consultations, and offered the use of his real estate office in the Post Office block, south-east corner of Third and Perry streets, third room from the corner, in the second story, fronting on Perry, for our cabinets and meetings, as long as it would answer these purposes. It was probably mainly due to Mr. Barler's energy and enthusiasm that decided action was taken at this particular time, and on Saturday evening, December 7, 1867, Mr. Barler, Mr. Eads and myself met by appointment at Mr. Eads' office to consult upon the ways and means, the possibilities and probabilities, and as to what we would dare to undertake, thinking that its success might depend somewhat upon the character of the first movement made. We had been unable to enlist men of means in the enterprise; we had no direct assurances of aid from any source; we knew that in a majority of cases where such a project was attempted, the interest died out after a short time, and the enterprise failed for want of internal energy and persistence, and outside recognition and support. We determined to procure a copy of the constitution of the Ottawa Academy, and to call a meeting of those interested on the next Saturday evening. We did not venture to advertise the meeting, however, fearing that too much might be expected at the beginning, but invited personally those whom we knew to be desirous of joining in co-operative work. During the week Dr. Paul promptly complied with my request, and sent us the copy of their constitution and by-laws, and on Saturday evening, December 14th, 1867—ten years ago to-night—we found "present Messrs. Barler, Eads, Tiffany and Pratt." Mr. Sanders was deceased, Dr. Parry absent at the far West, Prof. Sheldon in poor health, and Mr. Riepe could not attend that evening, though he was present at the next meeting and regularly thereafter.

It was then decided to proceed to the organization of an association without further delay, and this was done then and there, by the adoption of the form of constitution and by-laws of the Ottawa Academy, and by the election of officers for six months. Some embarrassment was experienced in filling up the Board of ten Trustees required by the constitution, but the full number were chosen, subject to the acceptance of the position by those who were not present. They all accepted, however, except one—Mr. C. S. Ells, and his place was filled after a reasonable time by the

election of Hon. John L. Davies. After about six weeks the following encouraging notices, which I give *verbatim et literatim*, appeared in the daily papers, viz : in *Gazette*, January 24, 1868 :

SCIENTIFIC SOCIETY.

An organization has just been completed which takes the somewhat ambitious title of the Davenport Academy of Natural Sciences. Its object is the collection and dissemination of scientific knowledge, and we understand that especial attention will be paid by this Society to the geology of our State. Specimens of the various fauna and flora of the coal formations will be gathered into cabinets, which the members will endeavor to make as complete as possible, a beginning of which cabinets have been made. Peat will also occupy a prominent place in their inquiries for informations, and in fact all scientific subjects will claim a share of their attention. We wish the Society prosperity, as well as a long existence. The officers are :

President—S. Sheldon, of Griswold College.

Vice-President—A. U. Barler.

Secretary—W. H. Pratt.

Treasurer—L. T. Eads.

The Library Association has offered the new Society a habitation in its room, we learn.

In *Davenport Democrat*, January 23, 1868 :

DAVENPORT ACADEMY OF NATURAL SCIENCES.

A Society bearing the above name has been organized in this city for the purpose of disseminating useful knowledge and investigating subjects of a scientific character. The officers of the Society are at present :

President—Prof. D. S. Sheldon, of Griswold College.

Vice-President—A. U. Barler.

Secretary—W. H. Pratt.

Treasurer—L. T. Eads.

In addition to these there is a board of ten Trustees. The Society has one large cabinet filled with natural curiosities, and specimens enough to fill another, which is now being constructed. The specimens consist of a large variety of river shells—some seventy-five kinds—mineral productions, geodes, fern fossils, coal blooms, and various other geological curiosities. Also, antiquities and rare articles. The headquarters of the society are now in Mr. L. T. Eads' office, where the cabinet and its contents can be seen. An invitation has been extended by its members to share quarters with the Library Association, and it is likely that the invitation will be accepted, as more room will be needed as soon as the other cabinet is finished. The principal object of the Society is to make geology a specialty, and to that end the coal and peat beds of the State are to receive a due share of its attention. The gathering of valuable specimens will be continued, and new cabinets provided as occasion requires. Donations of curiosities, antiquities, books, etc., are respectfully solicited.

We are glad to notice that a movement of this kind has been inaugurated by our citizens. It is a step taken in the right direction, a move worthy of all commendation, and we sincerely hope that those who have made the beginning, will see the project grow to the extent it deserves. Cabinets filled with geological and mineralogical specimens, gathered for the most part in our own State, and open for public inspection, will incite inquiry and promote research, and the cause of science must naturally prosper when its votaries increase in number and intelligence. Success to the Davenport Academy of Natural Sciences.

As soon as possible one case for specimens was procured—the old

larger case now in the back room—made by one of the first members who joined after the organization, and a considerable number and variety of specimens, contributed by Messrs. Barler, Tiffany, Eads, Sheldon, Riepe and myself. I find in my diary on January 18th, 1868: "Carried specimens from home and put them up at the Academy all day." Mrs. Alfred Sanders also contributed a large collection of minerals, fossils and recent shells, which alone occupied the second cabinet case we procured, and others soon began to hand in such specimens as they happened to have.

We were proud on the occasion of the receipt of the first donation from abroad, which was that of a collection of *Crinoids*, now in our collection, from Mr. Enoch May, of Burlington, January 18th, 1868. These were sent in response to our notice of his election as an honorary member. We were rather free, if not hasty, in our distribution of such "honors" at first, while as yet we were receiving, rather than conferring, honor by such connections. Our notifications were, however, usually very well received and kindly responded to.

The first lot of specimens received in response to our propositions for exchange, was a collection of marine shells, sponges, etc., from the Portland (Me.) Natural History Society. We still have the specimens, but we have outlived the institution.

Our first appearance before the public was upon the occasion of a lecture delivered before the Academy by Prof. Hinrichs, of Iowa State University, at the German Theatre on the 15th of February, 1868, on the subject of "Pantogen, or the Element of Elements." It was well attended and well received, and we "thanked God and took courage."

The first paper read in Academy meeting was on May 1, 1868, by W. H. Pratt, on "The Relations of the Outer World to our Senses."

Our meetings were held at Mr. Eads' office until a liberal offer was received from the Young Men's Library Association to give the use of a portion of its room, north-east corner of Second and Brady streets, third story, for our cabinets and for meetings, free of rent. The offer was accepted, and I find in my diary, March 21, 1868: "Began to remove specimens from Mr. Eads' office to the Library rooms," and the meeting on April 3d, 1868, was the first held there. The old case, being of an odd size and form, was left.

Our first enterprise out of the routine contemplated in the original plan was the purchase from Mr. Thomas Lighton, of Rock Island, of a telescope, made by him, for the sum of \$100, which we raised by subscription. The instrument is still with us, in good order, and has been the source of much pleasure and some benefit.

During the summer of 1869 preparations were made for securing photographs during the progress of the total eclipse of the sun, which was to occur on the 7th of August. This project was carried into effect with quite as good results as could reasonably have been expected with such limited skill and appliances as were at our command. Twenty pretty fair photographs were made. We were much disappointed in the failure to obtain a negative during the time of totality, not being aware at that

time of what we afterwards learned, that it was necessarily totally out of the question in any case, being simply impossible to take one during the short time—sixty-three seconds of totality.

The meetings were held quite regularly at the Library room for three years, with an average attendance of about 8 members, and usually considerable interest was manifested, though sometimes the meetings were rather thin. For example—on June 2, 1869, only Mr. Jas. Thompson and myself were present, but the business had to be done or lie over one month, with poor prospect of a larger meeting next time, as it was difficult to secure a good attendance during the heated term. The constitution prescribed no quorum for the transaction of business, and we thought it best to proceed and dispose of it at once. Small as was this meeting in numbers, yet estimating it by results, it was the greatest meeting the Academy ever held. The original minutes read as follows :

REGULAR MEETING.

Very few members present. Mr. Thompson was called to the chair. Minutes of last meeting read and adopted. Mr. Thompson reported donation of some glacier-scratched boulders by Mr. Fejervary. The proposition to amend the by-laws by substituting the last Friday for the first Wednesday of each month for the date of monthly meeting, was then taken up and unanimously adopted. Miss Dr. Irish having withdrawn her name on account of leaving the city, the other names proposed for membership, viz: Mrs. Charles E. Putnam, Mr. J. D. Putnam, and Mr. Henry Tourtillotte were then balloted for and unanimously elected. Academy adjourned to Friday evening, 25th inst.

W. H. PRATT, Secretary.

Here the Secretary was obliged to "cast the vote of the meeting," as nobody else was there to vote. We little realized then what we had done. We "builded better than we knew." The time for meetings then fixed has never since been changed. Mr. Tourtillotte died a year or two after, but the other two members then elected are still with us, and were it not so the Academy would not now be what it is. Mrs. Putnam was the first lady elected to regular membership. Mrs. M. A. Sanders was the first lady elected as honorary member, January 4, 1868—afterward transferred with the rest to the list of corresponding members upon a change of the constitution, and since become an active regular member. Mr. John Hume was the first regular member elected, January 4, 1868.

In the fall of 1872, some changes in the arrangements of the Library and their time of meetings rendered it inconvenient for us to hold our meetings there, and by the kindness of Messrs. Putnam & Rogers, their commodious law office was our place of meeting from Nov. 29th, 1872, until the next May. On May 30, 1873, the regular meeting was held in Dr. Hazen's office. On July 15, 1873, the Academy rented a small room in the rear of Mr. Eads' new office, second story, south side of Third street, next door east of the Bank on the south-east corner of Brady and Third, which we occupied until April 1, 1874, at \$6 per month. This was the first rent paid by the Academy. The room not being ready for occupancy, our regular meeting, July 25, was held in Mr. Eads' office, front room of same place. Referring again to my diary, I find, Monday, August 4: "Moved the specimens out of Mr. Eads' office into

our Academy room this afternoon." This was the old case and its contents which had never been taken from Perry street to the Library. On July 28th I find: "Worked at the Academy rooms moving the books in and arranging them as before in the case." Our Trustees' meeting was held there that evening, and the first regular meeting there on August 20, by a little kerosene lamp, which some of us may remember.

March 31, 1874, the diary says: "Commenced carrying our Academy things to Odd Fellows building." This room we rented from that date at \$75 a year. On our removal here we brought only the original wide case, two of the regular six foot cases, three of the closed botanical cases, and the old narrow book-case, formerly belonging to the Workingmen's Library Association. All of these and twice as many more since added, are now in our west room, and all in this room—ten large cases—have been added during the three and a half years of our residence here. This room was not half filled. More cases were soon needed, and by a special effort, principally on the part of some lady members and friends, a "ladies' furnishing fund" was raised, which soon provided several cases, matting for the floor, curtains, etc.

At the Trustees' meeting, September 18, 1875, it was decided to rent an additional room, in the rear of this, at \$50 a year, which we did from September 1st of that year, and have occupied it until both rooms are filled to overflowing. We are compelled to enlarge our borders, and are happy in the prospect. Several attempts have been made, and with, at first, some apparent prospect of success, to unite the Academy and other associations of kindred aims and interests, in an Association building, but have each time failed from want of funds, as those who possessed the means, without which it could not be accomplished, did not step to the front. The failure was, possibly, a blessing in disguise to all the parties concerned, as each will go on independently, and their several views and interests may be less likely to conflict than if more closely connected. All are harmonious now. Let us hope it may always continue so, for the best good of each and all.

This little sketch of our migrations brings us to the present time and place, and one more move, we hope, will locate the institution, permanently, or at least for many years. This move we expect to make within a few weeks, and are enabled to do so through the large-hearted munificence of our respected benefactress, Mrs. P. V. Newcomb, and the liberality and public spirit of a part of the members of the Academy, and some of our fellow citizens, and the sympathy and encouragement of many others unable to contribute largely in money, and the indefatigable zeal, energy and persistence of the two living members whom Mr. Thompson and myself are so proud of having added to the roll of members on that auspicious night.

Of discouragements we have certainly had no more than a reasonable share; have been seemingly almost eclipsed sometimes, but like other eclipses, these have been but temporary, and never total. We have often failed to accomplish quite what we had planned, but on the whole

cannot complain. Unexpected successes have more than counterbalanced all our disappointments.

Of our dissensions and lukewarmness where enthusiasm and unchanging faithfulness were expected, I do not like to say much, but so much I may and ought to say—they have been less, and have been less bitter, less injurious, less discreditable, less lasting, and of less importance than in any institution of any kind whatsoever with whose internal history I have been acquainted. May they be even still less in the future.

Of the causes or circumstances which have contributed to such measure of success as has been achieved thus far, I think we may say that :

First. The society has been what may be termed fortunate. We found ourselves in the midst of mines of archaeological wealth, of which we were quite unaware, and were fortunate enough to secure for our labors, and especially through the true scientific and liberal public spirit of Rev. Mr. Gass, the most unique and valuable relics of the mound age in America. Within two miles of the rooms we occupied was the richest group of mounds yet found, and Mound No. 3 of the Cook Farm group has proved to be, without exception, the richest mound ever yet explored.

Second. The hopes of the founders have been fully realized in the cooperation and disinterested labors of new workers, and work is here, as elsewhere, the secret of success.

Third. The wise determination to commence the publication of Proceedings at the earliest practicable date, thus bringing the Association into favorable notice, and giving it strength at home and abroad. Our library is becoming valuable and is rapidly increasing, and this is due largely and directly to the returns made for our own publications, and to the standing the Academy takes as a publishing society. The Museum is also largely increased from the same cause. A letter received this very day is a good illustration of this, and similar cases are now by no means uncommon. The liberal contributions we receive for building and furnishing are also largely influenced by the same considerations. It must be borne in mind that the publication could not have been carried through but by the noble work of the Ladies' Centennial Society, whose labors in the cause have been commended and held up as a bright example, by those interested in the cause of scientific progress, far and near, and our "somewhat ambitious title" has been placed on the exchange list of many first-class scientific institutions, American and foreign, whose publications are very valuable, and has brought the name of our city to the favorable notice of many communities whom otherwise it had never reached.

But, Fourth. The chief element of success, and that which made all the rest possible, was, as it seems to me, our remarkably favorable financial condition at the beginning. We were happily entirely free from the incubus of money to be invested or expended, and thus escaped the rock on which so many have split in the attempt to build up scientific societies and museums. We had not a dollar beyond the small initiation fee, established at first and still unchanged; we were compelled to depend

absolutely upon work or nothing. We realized that, and want of funds was no disappointment.

The amount of labor represented by the collections here, crude and imperfect as the arrangement still is, and by the publications, so far as issued, is known only to those who have done it, or who have done similar work elsewhere. I could readily give several examples of scientific societies which commenced by raising a fund to provide cases, etc., and furnish rooms in good style, and after expending that the excitement subsided, they did nothing more, or dragged along with a constantly decreasing interest until it reached the vanishing point, and the project has been virtually abandoned. *The money ought not to be had until the solid work brings it.*

There is still plenty of work to be done both for and by the Academy. In many directions we have scarcely made a beginning. We must labor to round it into full and symmetrical proportions. I need not now particularize the points requiring especial attention and effort.

Whether our Association has contributed much to it or not, it is gratifying to note that the city schools have made a great stride within the last ten years in the introduction into several grades of the natural sciences, physics, botany, zoology and physiology. That much remains to be desired and hoped for in the same direction, is indicated by the record of the last School Board meeting, that "the motion to introduce geology into the High School was lost." This is not very discouraging, however, as it was only postponed for a time, and will probably be done ere long. We may also note the marked absence of natural science in the Normal Institutes, and the lukewarmness of teachers generally.

If the few who began the work shall be able, as they drop off, to leave our institution in abler hands, with sufficient vitality to ensure its permanency, continued growth and increasing usefulness, it will be the height of our ambition, and even more than we dared expect or scarcely to hope for at the beginning. I, for one, do now confidently expect this, so much interest is already manifested, and so good a foundation laid, thanks to those who have so earnestly taken up and so nobly borne the burdens of these latter days. It is assured by the increased and increasing sympathy and appreciation on the part of the community. Indeed, I am happy to say that for my own part, I never for an hour lost my confidence in the Academy and its future prosperity and usefulness.

Let us hope that the close of another decade, during which time some more heads will be laid low, and some more names will disappear from the original roll of members, or be marked with the *, may find the Academy situated in its own *completed* building, with a good lecture room and valuable museum, an institution whose regular meetings, lectures and publications, whose labors in the cause of human progress, whose connection with the public educational system, and influence upon the community, may command respect at home and abroad, may be a source of pride and of real benefit to every citizen.

After the reading of the above paper further remarks were

made by Dr. Hazen, Mr. Tiffany, Mr. Thompson and others of the older members.

During this month Dr. John Lord delivered a course of six historical lectures under the auspices of the Academy. The subjects were as follows: Dec. 14th, "Michael Angelo;" Dec. 5th, "Queen Elizabeth" in the afternoon and "Hildebrand" in the evening; Dec. 17th, "Galileo;" Dec. 18th, "Madame Maintenon" in the afternoon and "Alexander Hamilton" in the evening. The lectures were delivered in the Presbyterian church, and were well attended. The net receipts were \$140.

DECEMBER 28TH, 1877.—BIOLOGICAL SECTION.

Three members present.

Mr. J. G. Haupt reported the extraordinary fact of the blossoming in open air of the following plants during the past week, viz: *Viola cuculata*, *Viola concolor*, *Capsella bursa pastoris*. Other species were in bud. Such an event has not before been observed in this region since its settlement by the whites.

DECEMBER 28th, 1877.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Nineteen members present.

A large number of valuable donations to the Library and Museum were reported, including a fine collection of Florida shells and corals from Mr. W. W. Calkins, of Chicago, and forty volumes of books from Dr. E. Palmer. The thanks of the Academy were voted to the donors.

The following persons were elected regular members: Jos. Parry, jr., W. O. Gronen, J. B. Young, Frank O. Davis, F. H. Miller, Chas. Beiderbecke, Chris. Mueller, B. W. Gartside, Conrad Kruse. The following were elected corresponding members: S. A. Miller, Cincinnati, Ohio; Mrs. J. M. Milligan, Jacksonville, Ills.; M. Tandy, Dallas City, Ills.

Mr. Pratt made some remarks on a new process of cleaning clocks by steam.

The Secretary read a paper by Mr. Calkins, describing the habits of many of the Florida shells and corals presented to the Academy.

JANUARY 2D, 1878.—SPECIAL MEETING.

Rev. S. S. Hunting, President, in the chair.

Twenty members present.

The President stated that by order of the Trustees he had called this special meeting of the Academy, to consider and act upon certain proposed amendments to the articles of incorporation.

Mr. Chas. E. Putnam presented the following resolutions :

Resolved, That Article IV of the Articles of Incorporation of the Davenport Academy of Natural Sciences be amended so as to read as follows, viz :

ARTICLE IV. The business affairs of the Academy shall be managed by a Board of twelve (12) Trustees, who shall be elected at the first regular meeting after the adoption of this Article, four (4) to serve one (1) year ; four (4) to serve two (2) years, and four (4) to serve three (3) years, and at every annual election thereafter four (4) Trustees to serve three (3) years. The President, Treasurer and Recording Secretary of the Academy shall be *ex-officio* members of the Board of Trustees, and entitled to vote ; and a majority of said Trustees (including the officers above named) shall constitute a quorum for the transaction of business. The officers of the Academy shall consist of a President, two (2) Vice-Presidents, a Corresponding Secretary, a Recording Secretary, a Treasurer, a Librarian, and a Curator. The Officers and Trustees must be residents of Scott county, Iowa, and shall be elected by ballot at the annual meeting on the first Wednesday in January in each year, or if the annual meeting is not so held, at any subsequent meeting, of which at least two (2) weeks notice shall be given in a newspaper, published in the city of Davenport. Each Trustee or officer must receive a majority of the votes cast, only one being elected at each balloting. The membership of the Academy shall consist of regular, corresponding, and honorary members. The right of voting and holding office shall be confined solely to regular members, but corresponding and honorary members shall be entitled to all other privileges. In case of a vacancy caused by the death, removal or resignation of any officer or Trustee, an election to fill the vacancy shall be held at the next regular meeting after the announcement thereof. The President of the Academy shall also be President of the Board of Trustees, and preside at its meetings, and the election of any Trustee as President, Recording Secretary, or Treasurer, shall cause a vacancy."

Resolved, That Article VII of the Articles of Incorporation be amended so as to read as follows, viz :

"ARTICLE VII. These Articles of Incorporation may be altered or amended at any regular meeting of the Academy by a vote of two-thirds of the members present, *provided*, the proposed amendments have been

presented to the Board of Trustees in writing at least one month prior thereto, and notice thereof published in some newspaper in the city of Davenport, stating the substance of the proposed amendments. The Board of Trustees shall present to the Academy any amendments thus offered, with a report on the question of its adoption, and with such modifications as they may see fit to recommend."

Resolved, That the President and Secretary be authorized and instructed to certify to the adoption of the foregoing amendments to the Articles of Incorporation, and to have the same recorded as required by law.

After due discussion the above resolutions were separately voted upon, and were unanimously adopted.

The business of the special meeting having been concluded, the President stated that this was the time for holding the regular

ANNUAL MEETING

for the reception of reports and election of officers. Mr. C. E. Putnam presented the following resolution, which was adopted:

Resolved, That the reception of reports and election of officers be postponed until the regular meeting on the last Friday of this month, and that when this meeting adjourns, it be to meet in the new building at that time for those purposes.

Mr. Chas. E. Putnam, Dr. R. J. Farquharson and Dr. C. H. Preston were elected a committee to report at such meeting the names of suitable persons to be put in nomination and voted on for officers.

The following persons were appointed a committee to make arrangements for an opening of the new building, viz: Dr. M. B. Cochran, Mrs. Chas. E. Putnam, Dr. C. H. Preston, H. C. Fulton, John Hume, S. S. Hunting and Mrs. D. S. True.

At a meeting of the Board of Trustees, held January 2, 1878, the following resolution, presented by Dr. C. H. Preston was adopted:

Resolved, That the Davenport Academy of Natural Sciences offer to the Scott County Medical Society the joint occupancy of one or other of the first floor front rooms in the new Academy building. The Medical Society to be privileged to hold its sessions therein, pay in consideration of fuel, lights and janitor's service one dollar for each evening session, and twenty-five cents for each day session, and to be allowed case room for two cases of average size for the deposit of books and articles appropriate to a medical museum, such library and museum to be accessible at all times to the members of the Academy, but that no books shall be removed from the building.

JANUARY 5TH, 1878.—BIOLOGICAL SECTION.

Four members present.

Mr. Putnam exhibited some specimens of new bark louse, probably a species of *Aleurodes*, found on a hard maple (*Acer saccharanum*) in Peoria by Miss Emma A. Smith.

Prof. Sheldon presented a fine series of hermit crabs (*Eupag-nus longicarpus*, Stimp.) from Chatham, Mass., in the shells which they were inhabiting.

JANUARY 11TH, 1878.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Thirteen members present.

Mr. W. C. Putnam read a paper upon "Old Fort Armstrong," which embraced nearly all that is now known concerning that important military post. The building of the Fort on Rock Island in 1816, a complete description of its plan and appearance, its earlier incidents and later history, together with its abandonment in 1836, were successively described. From 1836 to 1865 the buildings went gradually to ruin, being superseded at the latter date by the present Rock Island Arsenal. Much of the material for the article was gathered from the oldest settlers.

JANUARY 25TH, 1878.—REGULAR MEETING.

Rev. S. S. Hunting, President, in the chair.

Forty-two members present.

The donations to the Library and Museum were reported.

The following persons were elected regular members: H. R. Claussen, C. A. Ficke, Robert Krause, Francis Ochs, H. Lambach, Jens Lorenzen, Dr. J. J. Ohlshausen, Mr. J. M. Parker and Mrs. J. M. Parker—all of Davenport. The following persons were elected corresponding members: W. W. Calkins, Chicago, Ills.; Otto Gunther, Worcester, Mass.; Miss Alice

B. Walton, Muscatine, Iowa ; Mrs. Dwight Merriman, Jackson, Mich.

The Corresponding Secretary presented a letter from Mr. S. A. Miller, acknowledging his election as a corresponding member, and containing the following note :

On the Growth of Paleontology as a Science.

BY S. A. MILLER.

In 1818, the Rev. Mr. Steinhaur, an educated botanist, described species of *Sigillaria*, *Stigmaria*, *Lepidodendron*, etc., in the Trans. Am. Phil. Soc. under the older generic name *Phytolithus*, where others placed fucoids. Very slowly the flora of the Coal Measures was separated into genera and species, but these plants continued to be the oldest known for many years. About twenty years ago, Prof. Dawson astounded the scientific world, by his discovery of land plants, in rocks of Devonian age, and, in 1859, he made the first announcement of the existence of land plants as low as the Upper Silurian. His *Psilophyton* remained solitary and alone the only representative of land vegetation from the Upper Silurian rocks, until within the past year. Now we are met with the statement, that plants have been found in the Niagara Group as large and well marked as the *Lepidodendron* from the Coal Measures,* and Prof. Lesquereux has described several forms from the Lower Helderberg Group more highly organized than Dawson's *Psilophyton*. Nor do our paleo-botanists stop here, for my learned and esteemed friend, Prof. Lesquereux, has come down to the base of the Cincinnati Group, which is the equivalent of the Trenton, and described as land plants *Psilophyton gracillimum* and *Sphenophyllum primævum*, and from the upper part of the Cincinnati Group, he has described the *Protostigma sigillarioides*.† Is it only proper, however, to say, that I believe his *Psilophyton gracillimum* cannot be separated by generic differences from *Graptolithus abnormis* found as low as the Quebec Group, and that it is yet a matter of some doubt, whether *Sphenophyllum primævum* is the recent work of an insect or a graptolite of the genus *Oldhamia*, while Prof. Newberry is positive that his *Protostigma sigillarioides* is a fucoid, without any character resembling a land plant. These differences of opinion between the doctors, however, will fade away in the light of future discoveries, leaving the truth to stand as part of the science, like all our well established facts in natural history, more strongly supported by reason of the contention.

Cincinnati, January 8th, 1878.

*Since published in the April number of the American Journal of Science and Arts, under the name of *Glyptodendron eatonense*.

†Read before the American Philosophical Society in October, 1877, and published in its PROCEEDINGS.

ADJOURNED ANNUAL MEETING.

Mr. Hunting delivered the

President's Annual Address.

BY REV. S. S. HUNTING.

Ladies and Gentlemen of the Davenport Academy of Natural Sciences :

It being my duty to make a report on "the condition and progress of the Academy in all its departments," during the year 1877, I will condense into a few pages what it seems essential for me to say, and will refer you to special reports of the different departments, for interesting details of the work.

The year had scarcely begun when we were happily surprised by the discovery, in a mound on "Cook's Farm," of the "tablets" which have already become celebrated. We may well wait for the solution of the problem as to what they were made for, and what is the interpretation of the writing and hieroglyphics, but we cannot be indifferent to the cavils of skeptics. We are glad to see that candid inquirers grant the force of the testimony showing how and where they were found, and that they are genuine records of the mound-builders.

The report of the Recording Secretary shows a commendable amount of work for the year. Twenty-two trustee meetings were held, thirteen regular and five special meetings of the Academy, besides meetings of Geological, Biological and Historical sections. The increase in regular members has been large; twenty-seven life members and one hundred and twenty-two corresponding members have been elected, and eight honorary members were elected at the annual meeting.

There have been two lectures on the "External and Internal Anatomy of Insects," by Miss Emma A. Smith, and six historical lectures by Dr. John Lord.

The several papers presented to the Academy have been especially interesting, and unusually important, some of which have been already published. The following deserve special mention :

1. A connected account of the exploration of mound No. 3, Cook's Farm Group, by Rev. J. Gass.
2. On the Inscribed Tablets, found by Rev. J. Gass, by R. J. Farquharson, M. D.
3. A paper by Dr. C. C. Parry, descriptive of the lily discovered by himself.
4. Description of a new species of Acrididæ from Arizona, by Dr. Cyrus Thomas.
5. Three new chemical tests, by Dr. M. W. Iles.
6. Utah mounds, by Dr. E. Palmer.
7. Geology of Davenport and vicinity, by Dr. W. H. Barris.

I would also call your attention to the valuable donations which have been made during the year, and mentioned in the report of the Curator.

The Historical Section has had ten meetings during the year, with an average attendance of twelve at each meeting. The donations of valuable historical works and interesting relics have been considerable. The interest of the Academy in this Section is increasing, depending

greatly on the series of historical papers which have already been presented and are yet to come.

The tenth anniversary of the founding of the Academy—December 14, 1877—was very appropriately commemorated by a paper from the Curator, W. H. Pratt, entitled, "Reminiscences of the Early History of the Academy."

It appears that the inspiring motive which led to the founding of this Academy, was the "Acquirement and dissemination of scientific knowledge, to encourage research and scientific instruction in the public schools." A majority of the gentlemen who first united their efforts in this laudable enterprise, still are with us, but some have fallen asleep. When they began they had no other purpose than to work for their cause, unconscious of the rich treasures even at their doors, but hidden from their view. They wanted a scientific club in which they could compare their observations, interchange views, and unite their collections, so that a museum might possibly be developed. Of the first members, one has certainly become distinguished in his department, and we would send greetings to-night to Dr. C. C. Parry on the plains of Mexico. Like all such enterprises, its inception was due to a few hopeful and enthusiastic persons.

The Treasurer's report for the year 1877 shows commendable results. The increase to the general fund has been \$875.41. The expenditure has been \$860.72. The endowment fund has been increased by life memberships and donations, to the amount of \$2,763.50, and by other means \$227.33, making in all about \$3,000, with other sums conditionally subscribed for the building enterprise.

The contract for the new building was \$4,080, but other expenses will make the whole cost \$4,500. Circumstances over which the Trustees had no control have prevented the raising of the whole amount of money needed, and the Trustees have been obliged to resort to a temporary loan, hoping that the new interest in the work of the Academy will bring the needed aid, and trusting that the temporary debt will not be a permanent embarrassment.

Special attention is called to the report of the Publication Committee. The welcome given to the first volume encouraged the committee to go forward with the second, which was to be issued in two parts. A proposition was accepted from Mr. J. D. Putnam, in which the Academy was to have 500 copies free of expense, provided that 150 copies were taken by members of the Academy and other persons at \$3 a copy. To hasten the beginning of the work, the Trustees guaranteed a subscription for 100 copies. Thus the work began, and the first part was produced in good type of 148 pages, illustrated by fifteen woodcuts and three albertype plates of the inscribed tablets. The erection of the new building has delayed the work of publication, but I earnestly recommend that the second part of the volume be printed as soon as possible, as the best means to bring before this community the work of the Academy. Bear in mind that the publication of the first volume has brought the Academy into correspondence with over 300 similar associations in different

countries, and from all those societies there flows into the Academy an endless stream of publications, giving the best information upon all important scientific researches and discoveries. As the object of the Academy is "The increase and diffusion of a knowledge of the natural sciences," I suggest that the committee restrict the published matter to articles of a historic and scientific nature, by leaving out the record of all business which is of simply local interest. In that case we would have a volume of greater value to corresponding members and the societies to which it is sent in exchange.

It cannot be expected that a society so young, with so few members who have leisure for scientific research, can make many original investigations. But we have those who are zealous to do what they can in that direction. The paper already referred to, on "Our Local Geology," is of special interest in this respect, and deserves careful perusal. The question discussed by Dr. Barris is this: "Is the Hamilton Group alone developed in our vicinity?" or "Do we have, in addition, the rocks of the Upper Helderberg?" Certain explorations which have been going on in the quarries west of the city, have been examined and found to present facts new to science. As a result of his investigation, Dr. Barris claims:

1. The discovery of a series of beds of limestone that has never heretofore been described.
2. The determination of their true relation to the disputed rock in the neighborhood of Rock Island and Moline.
3. That these beds have well defined limits, the Hamilton being above, and what the workmen call the "flint rock" below.
4. That they contain a remarkable series of fossils entirely differing from any in the Hamilton Group.
5. That the affinities of these fossils are with those of the Upper Helderberg.
6. Hence, these beds constitute the upper fossiliferous member of the western extension of the Upper Helderberg.

Every member of the Academy must see that it is of great importance to us and to science that such investigations be put in print, so that the conclusions may be either confirmed or refuted by other scientists.

The Director of the Biological section says, "the object of this section is to promote and assist investigation in all that pertains to living beings, both animal and vegetable." The activity of this Section has been commendable, and the results considerable. There have been six meetings and seven papers have been presented, besides verbal communications with exhibitions of specimens. Original investigations have been made requiring patient observation. In entomology, Mr. J. D. Putnam has rendered good service to science by the study of the natural history of two species of bark lice found on the bark or leaves of the white maple. He has observed many interesting facts, and a new species has been discovered. He says: "This is a most interesting case of two insects belonging to the same family and living under similar conditions on the same tree, often in close contact with one another, and yet differing greatly in all their habits and modes of development." A paper upon this subject will soon be submitted to the Academy. Mr. Putnam is also pursuing original investigations in reference to the *Solpugidae* of

the United States of which he says: "Although greatly neglected, this family is one of great interest, as it occupies an intermediate position between the eight legged Arachnidæ (spiders or scorpions), and the true six-legged insects." These studies require not only a habit of accurate observation, but also patience and perseverance. The Academy may congratulate itself that it has members who are determined to push out original investigations in Biology, and with better facilities for work much more will be done. This section is open for the reception of original papers on all animals, from the parasitic insect to the lordly being upon which it regales itself.

The report of the Corresponding Secretary shows that nearly the whole scientific world, extending from California *via* Australia, to Russia, Germany, France and England, is communication with us. The correspondence is voluminous, and the publications received as donations are many and exceedingly valuable. Contributions have been made by individuals in nearly all the States of the Union, and from all the principal scientific societies and institutions of the United States and of foreign countries. In this connection I will direct your attention to the valuable report of the Curator, which shows the exceeding gain of the past year. In view of the constant increase of the valuable contents of the museum, every person will see that the new building was a necessity, and had we turned back from the enterprise when once begun, we should have been recreant to the duty of the hour, and unfaithful to the trust we had accepted.

During the year 1877 two regular and three corresponding members of the Academy have died:

Mrs. Wm. Renwick's sudden sickness and death cast a shadow over a large circle of friends, who mourn her loss as the good and the true are ever mourned.

Mr. U. N. Roberts, a citizen respected and honored for his many services to the community, was a faithful member and a generous friend of reform.

Jared Potter Kirtland, M. D. LL. D., died at his residence in East Rockport, Ohio, December 10, 1877, at the advanced age of 84 years. In scientific research and study he devoted himself especially to general natural history and geology. Dr. Kirtland was elected an honorary member of this Academy, Jan. 3d, 1876.

Timothy Abbott Conrad died on the 9th of August, at the residence of his brother-in-law, W. T. Abbott, of Trenton, N. J. He was a son of the late Solomon Conrad, of the University of Pennsylvania, and was born in 1803. He was one of the most distinguished of American paleontologists, and was elected a corresponding member of the Academy, March 27th, 1877.

Sanborn Tenney, Professor of Geology and Natural History in Williams College, Williamstown, Mass., died suddenly on the 11th of July, at Buchanan, Michigan, while on his way to Chicago, to join a Williams College exploring party to the Rocky Mountains, of which he was the

projector and leader. He was the author of text books on zoology and geology. He was born in Stoddard, N. H., Jan. 13th, 1827, and was elected a corresponding member of the Academy, April 27th, 1877.

When I reluctantly entered upon the office of President, I was told that in 1877 we must have a home for the Academy, but we did not know whence it would come. We began to look around for the desired building and location, and in the midst of our anxiety, we were surprised by the valuable gift of a building-lot from our most worthy friend, Mrs. P. V. Newcomb. That gave direction to our efforts. With a fair prospect the Academy resolved to go into the community and beg the money for a building, and keep out of debt, which was a laudable resolution. The plan was carried into execution. Head winds and side currents checked the motion of our ship, but did not stop it. With genuine pluck and faith our cause has moved on, and the foundation of this building was laid on the original soil. It has been erected as the kitchen or working part of the building yet to come. To build cheaply was prudent. It is the way thrifty people begin to make their fortunes. This is to be a house of industry, a school of the sciences, a garden for culture, a home for all the virtues.

I congratulate you upon the results of the year 1877, the end of ten years of persistent effort. I congratulate the trustees on the harmony and good cheer that have attended your councils, and the unanimity with which you have acted. We welcome the new and rising Art Association under our roof, and tender to it all the hospitality which we can afford for ourselves. While in biology, entomology, conchology, geology, paleontology, archæology, philology and sociology, this Academy is solving the problems which underlie art and history, our sister association will put on the walls of its gallery the delineations of "The Good, the Beautiful, and the True," in color and in photograph, suggestive always of something better yet to come. When we tire of the more material studies, we will ascend and "look aloft." The bridegroom, sturdy *Science*, shall keep steadily at his work, delighted even by studying the habits of an insect, while the bride, *Art*, shall welcome him from the door of her chamber, and with extended hand and a benignant smile, shall bid all her friends "come up higher."

The reports of the various officers of the Academy were then presented and referred to the Publication Committee.

The CORRESPONDING SECRETARY reported that during the year 482 letters were written, and 740 letters were received, the great majority of which were relative to the publications and scientific work of the Academy. The additions to the Library during the year were as follows:

Complete volumes, 168 octavo, 87 quarto,.....	255
Pamphlets and parts of volumes, 331 octavo, 31 quarto,.....	362
Maps, photographs, etc.,.....	41
Total,	658

These have all been received either as donations or in exchange for the first volume of Proceedings, as but few copies of the second volume have been distributed, and no books have been purchased.

The RECORDING SECRETARY reported that there had been held during the year 13 regular and 5 special meetings of the Academy, with an average attendance of 20 members: and 22 meetings of the Board of Trustees. The Geological and Archæological Section have had two meetings, the Biological Section six meetings, and the Historical Section ten meetings, with an average attendance of 12 members. During the year there have been elected 8 honorary, 122 corresponding, and 57 regular members, most of whom have qualified. Twenty-three members have paid their life-membership fees, and four have been made life members by vote of the Trustees.

Treasurer's Report.

M. B. COCHRAN, *Treasurer, in account with Davenport Academy of Natural Sciences, January 3d, 1878:*

Dr.	Cr.
GENERAL FUND.—RECEIPTS.	
To cash from J. Hume, Treasurer:	
General Fund.....	\$ 30 90
Ladies' fund.....	50
Initiation fees.....	\$125 00
Dues, 1875.....	6 10
Dues, 1876.....	75 00
Dues, 1877.....	71 00
Rent Clonian Soc'ty.....	4 00
Rent Dav. Lit'ry Soc'ty..	2 00
Sale of Proceedings.....	3 00
Donations.....	3 25
Declamatory Contest.....	26 06
Dramatic Entertainment	68 00
Lectures.....	407 20
Mound fund.....	53 50— 844 01
	\$875 41
ENDOWMENT FUND.	
To cash from J. Hume, Treasurer.....	\$ 51 76
Life memberships and donat'ns..	2763 50
Interest on deposits.....	35 57
General fund.....	140 00
Bills payable.....	723 50
	\$3714 33
GENERAL FUND.—EXPENDITURES.	
By paid for fuel.....	\$ 21 90
Gas.....	24 90
Printing and advertising	100 05
Freight and express.....	56 52
Insurance.....	30 00
Rent.....	62 50
Postage.....	8 00
Janitor.....	24 00
Librarian.....	3 50
Museum.....	6 00
Lectures.....	260 10
Dramatic entertainment	68 00
Exploring mounds.....	48 50
Expense acct. and miscellaneous items.....	66 85
Transferred to endowment fund.....	140 00— 860 72
Balance.....	14 69
	\$875 41
ENDOWMENT FUND.	
By paid B. W. Gartside.....	\$ 182 00
F. Kirk on contract.....	3285 23
E. W. Baker, sewer.....	68 88—\$3536 11
Balance.....	178 22
	\$3714 33

Report of Auditing Committee.

MR. PRESIDENT:—Your committee appointed to audit the accounts of the out-going Treasurer, Dr. M. B. COCHRAN, would respectfully re-

port that we have performed the duty assigned to us, and find the accounts to be, to the best of our belief, correct in every particular.

We desire to express, also, our high appreciation of the ability and industry which has enabled him to attain this result, despite much harassing, though temporarily unavoidable, irregularity on the part of the Association in the manner of its receipts and disbursements, and we beg leave to recommend the early consideration of methods to secure greater systematization.

Respectfully submitted.

CHARLES H. PRESTON,

E. H. HAZEN,

R. J. FARQUHARSON,

Davenport, Iowa, January 25th, 1878.

Committee.

Librarian's Report.

President and Officers of the Academy of Natural Sciences :

The Librarian begs leave to report that the Library of the Academy is now of such proportions that the accommodations for it in the rooms heretofore occupied by the Academy have been entirely inadequate. The large number of books received in exchange during the year, and reported by the Corresponding Secretary, have not been turned over by that officer to the Librarian. In the fore part of the summer, when he removed the Library to the front room, he commenced a catalogue of the books, as he reported, but he found the cramped space allotted to it made it difficult to handle the books, and as it was expected to move into the new building early in the fall, he concluded to postpone the catalogue until the removal of the Academy. For these reasons he has no catalogue to present, as he fully expected to have. If this Academy sees fit to re-elect the present incumbent to this office, he will take pleasure in carrying out the design he so fondly hoped to do in 1877.

Respectfully submitted.

E. H. HAZEN, *Librarian.*

Davenport, Iowa, Jan. 25, 1878.

Curator's Report.

Mr. President and Members of the Academy :

Upon the growth of the Museum during the past year and its present condition, I beg leave to present the following report :

The increase in extent and value of the collections has far exceeded that during any preceding year. As was stated in my last report one year since, our space was already crowded, and since that time the quantity has about doubled. Scarcely a day passes without the receipt of more or less Museum material. In the meantime the addition of cabinet cases has not kept pace with this increase, and could not, as we have no room for the cases themselves. In consequence of these circumstances, and also from want of time and facilities for proper arrangement, much that ought and might otherwise have been done, has been deferred until our removal to the new building, when it is hoped a more

systematic and permanent arrangement than has heretofore been practicable, may be inaugurated. The large circular glass show case, donated by Mr. Charles Viele, the set of eight upright cases by Prof. Parvin, the small table case for the tablets, and the case for the boa constrictor, are all that have been added.

Although our archaeological explorations have not been as extensive as could be desired, yet the results have been of an importance and value beyond our highest expectations. Owing chiefly to the perseverance, skill and energy of Rev. Mr. Gass, our Museum now contains one of the most valuable known collections of fine copper implements, including the only cloth covered ones known, and in the inscribed tablets from a Davenport mound, we undoubtedly exhibit the most important relics of the mound-builders' age ever yet exhumed. Our archaeological collection is, therefore, in these particulars somewhat in advance of the rest of the world.

We have obtained during the past year 8 copper implements, 3 carved stone pipes, 11 vessels of pottery and many fragments, 300 or more pearl beads, several hundred shell beads of various forms, 5 ornaments or charms made from shells, 6 ornaments or charms made from bears' teeth, and various other relics of bone, horn, etc., from the mounds; and also 1350 flint implements and weapons, 275 stone implements and weapons, 20 hematite implements. The stone and flint implements, beads and pottery have been mostly secured by the untiring energy of Capt W. P. Hall. There are now probably but few more extensive collections of stone and flint implements in the country, and none equalling it in the West. In the departments of Geology, Paleontology and Mineralogy, very considerable additions have been made, the most important of which are the extensive geological and mineralogical collections of Prof. Parvin, the valuable and choice collection of minerals of Dr. M. W. Iles, a case of fine quartz crystals from Mrs. Mandeville, and a large collection of geodes from Mrs. C. H. Perry, of Keokuk.

In Botany the increase has been considerable, and the collection of the ferns of Scotland, 135 species, received from Prof. John Wilson, of Galt, Canada; and that of Cryptogams from Mrs. M. P. Haines, of Richmond, Ind., 80 species; also a collection of 300 species of Southern plants from W. W. Calkins, of Chicago, are of especial interest.

In Zoology, much less work has been done and progress made than was hoped for, and much less than ought to have been done. A few specimens of stuffed birds and mammals, and some fishes and reptiles preserved in alcohol, and a living boa constrictor, comprising all the acquisitions in this line, except some quite valuable collections of marine species, donated by the Chicago Academy of Sciences and Mr. W. W. Calkins, of Chicago. Let us hope for better work in this direction in the near future.

Some time since I commenced a catalogue of specimens in the Museum, but concluded such a work to be impracticable for the present, and perhaps not very desirable until after our removal and some re-arrange-

ment, with enlarged space and better facilities. I have therefore prepared no list of numbers of specimens or species in each department.

It seems probable, and even certain, that our removal to more secure and capacious rooms—the property of the Academy and a permanent home, will be followed by the reception of large and valuable collections of various kinds, which have been awaiting that event, and also by an increased influx of donations from all directions, calling for increased attention and labor on the part of members of the Academy, who feel an interest in its success, stability, and present and future usefulness.

I would defer all recommendations regarding the provision of additional cabinet cases, boxes, labels, bottles, alcohol, etc., until after our removal, when the progress of the work of re-arranging shall show more definitely what we need.

Further I have only to express the earnest hope that more active measures may soon be taken than have seemed practicable during the past year, to prosecute the work of mound explorations, and that of making local natural history collections, with the view of making both as thorough and complete as possible, bearing in mind that in both these directions the conditions are changing, and the best opportunities are fast passing away, and also that aid from without depends upon efficient labor, disinterested zeal, and harmony within.

Respectfully submitted.

W. H. PRATT, *Curator.*

Report of the Publication Committee for 1877.

To the President and Trustees:

The publication of the first volume of the PROCEEDINGS of the Academy by the Women's Centennial Association in 1876 was so well received, and the benefits were so apparent, that many members of the Academy were anxious to have the PROCEEDINGS continued and issued as a regular periodical. The plan was also suggested of issuing these PROCEEDINGS in connection with a monthly journal, to be devoted to the natural sciences, but this plan was not found feasible at the time.

At the meeting of the Trustees, held January 26th, 1877, Mr. J. D. Putnam made a proposition, which was accepted, to print Volume II of the PROCEEDINGS (containing not less than 300 pages of letter-press and 12 plates of illustrations) at his own cost, and to furnish the Academy with 500 copies (for use as exchanges) free of cost; *provided*, that 150 copies were subscribed for by the members of the Academy and citizens of Davenport at \$3.00 per copy, and that all money receipts from the sale of this publication should go to the publisher. On February 10th, about 50 subscriptions having been procured, the Trustees voted to assume the subscription of 100 copies, to complete the number to 150, as required to meet the proposition. Under this guarantee the printing was commenced as soon as the manuscript could be prepared by the chairman, and revised by the other members of the committee. A number of wood-cuts

were engraved from drawings by Messrs. Pratt and Putnam, and are inserted in the text. Three fine Albertype plates, prepared by Mr. E. Bierstadt, illustrate the Inscribed Tablets found by Mr. Gass. These were obtained by the advice and through the instrumentality of Prof. Spencer F. Baird, of the Smithsonian Institution, to whom the Academy is greatly indebted for the lively interest he has taken in its work. The negatives of these plates were prepared in the Smithsonian Institution without cost to the Academy.

Part I of Vol. II of the Proceedings, containing 148 pages, and bringing the record down to the last of June, 1877, was completed, and the first copies issued to subscribers on July 15th. Since that time nearly 200 copies have been distributed, most of them to subscribers. But few copies have yet been sent to exchanging societies, as there has been no funds available with which to pay the postage. The unusual expenses incurred by the Academy in the erection of its building, taken in connection with the great depression of business generally, has rendered it impossible for the Academy to fulfill its part of the contract with the publisher.

Part II of the second volume of PROCEEDINGS, completing the volume and bringing the record down to end of 1877, is in an advanced state of preparation, and contains several very valuable papers by Prof. Barris, Dr. Palmer, Dr. Parry, Mr. Pratt and others, and should, if possible, be printed at once; and arrangements should be made for the speedy commencement of Vol. III, which should be printed regularly and promptly as fast as the material is at hand. If the printing could be done on the premises of the Academy it would be of great advantage, both on the score of economy and convenience. Of the many benefits accruing from the publication, enough has already been said upon other occasions.

Soon after the discovery of the Inscribed Tablets, tracings of the marks upon them were made by Mr. Pratt, and an edition of 300 copies was printed, which has been quite generally distributed. Two sets of photographic negatives of the same tablets were made by Hastings, White & Fisher—one of the full natural size, and the other reduced to about one-third of natural size. A number of sets have been sold, but not enough to pay expenses.

The following statement shows the disposition that has been made of the publications of the Academy:

PROCEEDINGS, VOL. I.

Number of copies on hand, January 3d, 1877.....	301
To subscribers on last year's account.....	3
To exchanges and gifts, etc.....	13
Sold for cash.....	24
Unaccounted for (lost or stolen).....	14
Total distributed.....	54
On hand, January 2d, 1878.....	247

PROCEEDINGS, VOL. II.

Number of copies received from Gazette Company	1018
To subscribers in Davenport (these count towards the 150 on copies pledged by the Trustees of Academy).....	77
To subscribers abroad.....	35
Exchanges, etc., for the Academy.....	35
On sale at bookstores.....	10
Distributed by publisher (his own copies).....	39
Unaccounted for.....	10
Total distributed.....	206
On hand, January 2d, 1878.....	812

FINANCES.

The following statement gives the various sources of receipts and expenditures :

RECEIPTS.	EXPENDITURES.
Cash on hand Jan. 3d, 1877.....\$ 4 26	A. Hagebøeck, lithographs.....\$ 17 25
Sale of photographs..... 35 00	W. L. Knowles, woodcuts..... 31 50
Sale of lithographs..... 6 25	E. Bierstadt, Albertypes..... 140 00
Sale of pamphlets and extra sheets... 14 00	Hastings, White & Fisher, photos.... 38 00
Sale of Proceedings Vol. I..... 66 00	Gazette Co., printing and binding..... 383 46
Subs. to Proc., Vol. II (Davenport).... 202 50	Postage stamps..... 5 00
Subs. to Proc., Vol. II (abroad)..... 106 00	Discount on check..... 25
Dr. C. C. Parry for engr. Lily 2 00	Paid Chas. E. Putnam on note..... 100 00
Interest on deposits..... 43	Cash on hand, Jan. 2d, 1878..... 29 73
Adv'd by J. D. Putnam, postage, etc.. 8 75	
Borrowed of Chas. E. Putnam..... 300 00	
Total.....\$746 19	Total.....\$746 19

In order to meet the bill of the printers when it became due, it was necessary for the chairman to borrow \$300 for the time being, and giving his note, payable on demand, in security therefor ; \$100 had been paid on the note previous to January 2d, leaving \$200 still due.

The following shows the present financial condition of the Committee :

ASSETS, JANUARY 2d, 1878.	
Cash on hand.....	\$ 29 73
Due from subscribers and unsettled accounts.....	76 50
Due from Trustees of the Academy.....	219 00
	<u>\$325 23</u>

In addition the value of the property—books, photographs, engravings, etc., in the hands of the Committee, may be estimated at about \$1,500.

LIABILITIES, JANUARY 2d, 1878.	
Due to Chas. E. Putnam on note.....	\$200 00
Due to 94 subscribers in case Part 2 is not issued.....	141 00
Total.....	<u>\$341 00</u>

This report has been brought down only to January 2d, 1878, the date of the Annual meeting. Since that date the cash on hand has been increased to \$49.33 by the sale of books.

Respectfully submitted.

J. DUNCAN PUTNAM, *Chairman.*

Davenport, January 25th, 1878.

The Secretary of the HISTORICAL SECTION reported that ten meetings had been held, with an average attendance of twelve members. Progress had been made in the formation of a collection of old documents, directories, etc., relating to the early history of this city. Interest in the Section has been steadily but slowly increasing, and seven very valuable and interesting historical papers have been read at its meetings.

The Director of the BIOLOGICAL SECTION reported that six meetings have been held, with an average attendance of six members. Many verbal communications were made and specimens exhibited, and seven papers were presented for publication. Mr. J. G. Haupt has continued his investigations of the local flora, with his usual enthusiasm. Dr. Parry is absent in Mexico, where he will trace the southern continuation of Rocky Mountain flora, and we may expect rich results. Mr. J. D. Putnam is engaged on a study of the North American *Solpugidæ*, of which much valuable material has been brought together. This work has been interrupted by an unusually fine opportunity to study the life histories of two species of bark lice (*Coccidæ*) on the soft maple, in the course of which several interesting and unexpected discoveries were made, which will be reported in a paper soon to be presented.

The election of officers for the ensuing year was held, with the following result :

President—DR. R. J. FARQUHARSON.

First Vice-President—DR. M. B. COCHRAN.

Second Vice-President—DR. C. H. PRESTON.

Corresponding Secretary—J. DUNCAN PUTNAM.

Recording Secretary—CHARLES E. HARRISON.

Treasurer—H. C. FULTON.

Librarian—J. G. HAUPT.

Curator—W. H. PRATT.

Trustees for Three Years—DR. C. C. PARRY, W. H. PRATT, REV. W. H. BARRIS, J. DUNCAN PUTNAM.

Trustees for Two Years—E. P. LYNCH, JOHN HUME, DR. M. B. COCHRAN, DR. C. H. PRESTON.

Trustees for One Year—REV. S. S. HUNTING, DR. E. H. HAZEN, WM. RIEPE, JAMES RENWICK.

The retiring President then introduced the new executive, Dr. R. J. Farquharson, who thanked the Academy for the honor they had conferred upon him. He then announced the following

STANDING COMMITTEES :

Finance—Charles E. Putnam, Wm. Renwick, H. C. Fulton.

Publication—Dr. C. C. Parry, J. D. Putnam, W. H. Pratt, Dr. R. J. Farquharson, Rev. W. H. Barris.

Museum—W. H. Pratt, Dr. C. C. Parry, J. D. Putnam, Rev. J. Gass, J. G. Haupt, Prof. D. S. Sheldon, Capt. W. P. Hall, A. S. Tiffany.

Library—Rev. S. S. Hunting, Dr. C. C. Parry, John Hume.

Furnishing—Mrs. M. A. Sanders, Mrs. C. E. Putnam, Dr. M. B. Cochran.

Special Committee on Ways and Means—Mrs. C. E. Putnam, Mrs. Jennie S. True, Walker Adams, Israel Hall, A. Burdick.

FEBR'Y 15TH, 1878.—GEOLOGICAL AND ARCHÆOLOGICAL SECTION.

Rev. W. H. Barris in the chair.

Twelve members present.

Mr. W. H. Pratt reported that on the 15th of December, 1877, in company with Rev. Mr. Gass, he had opened a low mound by the side of the river road, on the farm of Mr. Heidt, some distance below Rockingham. It was about a half-meter high and the elevation was composed principally of stone. Under these stones they found the usual mixed earth and a few poorly preserved bones, and two flint arrow heads were all the relics found. They went to the depth of about one meter from the surface of the mound.

Mr. John Hume reported that on the morning of January 30th he had made some further examination of Mound No. 4, Cook's Farm group, but without finding any article of interest. He stated, however, that he found much in this mound to confirm his previous views that the mounds were the remains of dwellings rather than places of sepulchre.

Mr. Gass presented the following account of

Mound Explorations in Jackson County, Iowa.

The substance of a few communications received from friends in Jackson county about the explorations of mounds which they have executed at my request and advice, is herewith respectfully submitted as a report thereof, together with the notice of the discovery of a skeleton, and of some copper relics in the same vicinity.

I.

On Mr. Heisig's farm in Jackson County, in an open level field, are found three mounds, which are so situated as to form the points of a nearly equi-lateral triangle. All three mounds are of the same construction. Each one is three feet high, and the diameter is fifteen feet at the base. (a) The first mound consists only of a hard mixed soil down to a depth of five feet (that is two feet below the surrounding surface) to

the hard, undisturbed natural soil. Not the least trace of shells, ashes, human bones, or other relics, were found in this mound. (b) That part of the second mound three feet above the original surface is entirely composed of a light earth, while two feet below the original surface, down to the hard, undisturbed soil, consists of a hard mixed earth. No relics were found here. (c) The third mound resembles the first in every respect.

II.

There is another group of mounds in Jackson County, near Fairfield, of the same number, height, diameter and construction as those on Mr. Heisig's farm. They are erected also in the same triangular position as those of the first group. The mounds of both groups are not burial mounds, but they must have been built for some other purpose.

III.

A single mound, a mile from Spragueville, Jackson county, is situated on a hill near a creek. The height of this mound is only a few feet, and the diameter fifteen or twenty feet. The earth that composed this mound is very light. Four feet down from the top of this mound a human jaw bone was found.

IV.

My friends, in their communications about their explorations, related also as follows: A farmer near by, in digging a ditch, found a human skeleton. Close to it he discovered three copper ornaments, an arrow head, and a small piece of blanket. The ornaments were wrapped up in strings, and consisted not of *hammered*, but of *rolled* copper. These relics are now in the Museum of the Academy.

Respectfully submitted.

J. GASS.

The Corresponding Secretary presented, on behalf of the author, the following paper:

On the Synonymy of two Species of Spirifera.

BY S. A. MILLER, CINCINNATI.

To the Davenport Academy of Natural Sciences:

One of the pioneers of American geology, and, as I shall show, the first who described a Devonian fossil from American rocks, a learned and distinguished archæologist, whose name will forever be remembered in connection with the growth of the sciences in the West, Mr. Caleb Atwater, of Circleville, Ohio, figured and described a fossil shell in 1820, in the second volume of the American Journal of Science and Arts, page 244, under the name of *Terebratula pennata*. Circleville is not far distant from exposures of the Hamilton Group of strata, and he says, "this beautiful specimen is a light drab-colored limestone."

After having carefully examined his figure and description, I entertain no doubt that he had before him the same species which Conrad afterwards called *Delthyris mucronatus*, and which is now so generally known as *Spirifera mucronata*. And I appeal to his work, confident that few spe-

cies had been, even in Europe, at that early day, more accurately figured and described. Conrad's name then must give way to the law of priority, and the fossil so familiar to us all under the name of *Spirifera mucronata* must be called *Spirifera pennata*, Atwater. I overlooked Atwater's species in the preparation of the "American Paleozoic Fossils," and so far as I have ascertained, every other one has overlooked it, but this is no reason why his name should not be reinstated.

In 1852 David Dale Owen, in his report of a Geological Survey of Wisconsin, Iowa and Minnesota, figured and described a fossil shell from the Devonian shell beds of the Iowa river, under the name of *Spirifer pennatus*, which name, as shown above, was preoccupied. I now propose for the fossil shell figured and described by Owen as *Spirifer pennatus*, the name *Spirifera atwaterana*. The specific name is proposed in honor of Mr. Caleb Atwater. The nomenclature will then stand as follows:

SPIRIFERA PENNATA, *Atwater*, 1820 (*Terebratula pennata*), Amer. Jour. Sci. & Arts, Vol. II.

Spirifera mucronata, Conrad, 1841 (*Delthyris mucronata*) Syn. for *Spirifera pennata*.

SPIRIFERA ATWATERANA S. A. Miller, 1878.

Spirifer pennatus, Owen, 1852. The name being pre-occupied, *Spirifera atwaterana* is proposed instead of it.

Very respectfully,

Cincinnati, Feb. 4th, 1878.

S. A. MILLER.

The principal event of the evening was the exhibition of a third inscribed tablet, recently found in a mound on the Cook Farm by Messrs. Gass, Hume and Harrison. Mr. Harrison read the following paper:

Exploration of Mound No. 11 Cook's Farm Group, and Discovery of an Inscribed Tablet of Limestone.

BY CHARLES E. HARRISON.

Having learned from the owners of the land on which the Cook Farm group of mounds is situated, that in plowing the ground late last season some stones had been discovered, which probably indicated the existence of another mound, it was thought desirable to explore the spot, as some of the other mounds of the group had been discovered in the same manner.

Accordingly, on the afternoon of Wednesday, January 30th, 1878, Rev. Mr. Gass, Mr. John Hume and myself proceeded to the place indicated. The mounds had been so nearly leveled by constant cultivation and plowing as to be scarcely discernible. This mound was situated about sixty-five feet north of Mound No. 1, and twenty-five feet south-west of Mound No. 9, and was only a slight elevation. Noticing at one place a number of pieces of limestone and a few bits of decayed shells, which

appeared to have been thrown up by the plow, we commenced to dig there, though it was not the most prominent part.

We opened a place about four by six feet ($1\frac{1}{4}$ to $1\frac{3}{4}$ meters). The frost had penetrated some seven or eight inches (about 20 centimeters), and through this frozen crust our progress was of course quite slow. Below that the earth was comparatively easy to handle, being composed of a dark soil, with some admixture of red clay. At a depth of about fourteen inches (35 centimeters) from the surface we found some rock, large irregular pieces, laid closely together, with smaller stones fitting the places between, all within a not very regular area of about two and a half by three feet ($\frac{3}{4}$ by 1 meter).

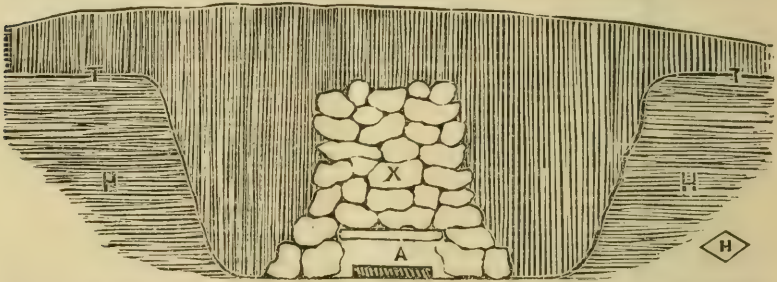


Fig 17.—H, undisturbed earth. T, T, original surface. X, pile of stones. A, cavity in which the tablet was found. Scale, 1-33.

Thus far our curiosity was hardly excited, there being scarcely any appearance of design in the arrangement. On removing these, however, we found a similar layer just beneath, and under that another course, and so on successively as we descended. Our interest grew with increasing ratio, for we were evidently removing a rude pillar of uncemented masonry. We found a few shells among the rock, but these easily crumbled on being thrown out or handled. When about three feet (1 meter) below the surface, we reached a flat, unwrought stone, of rather irregular form, about fourteen inches (35 centimeters) square and one and a half inches (4 centimeters) thick, lying in a horizontal position, at or nearly under the center of the primitive pile. We removed the earth from about this slab, and noticed that it rested on a rude structure of stone, resembling in external appearance that which we had removed. On raising the flat stone, an irregularly rectangular engraved tablet was suddenly exposed to view—as it lay face up in a walled vault, evidently built expressly for its reception. The vault, like the pillar which surmounted it, was rudely constructed, but substantial, and afforded protection from the settling of the earth and descending moisture. The cavity was a little larger than the tablet, and about five inches (13 centimeters) deep; the bottom of the vault being on a line with the floor of the mound. This floor was a level and very compact stratum of yellow clay, such as has been frequently noticed and described in reference to other mounds of this group. The tablet lay with the head directed east-north-east. Four flint arrows were found lying on the tab-

let, with their points directed inwards—one at the top, one at the bottom, and one on each side about midway between the top and bottom. On the upper left-hand corner of the tablet was found a shell (*Unio pustulosus*) containing powdered red ochre, like that used to paint the figures on the tablet. A beautiful quartz crystal was lying upon the center of the tablet over the human figure. Outside of and around the vault were numerous decayed shells, and a few small fragments of pottery. No bones or relics other than those named were found.

DESCRIPTION OF THE TABLET (PLATE VII).

The tablet is a very evenly stratified, non-fossiliferous limestone, apparently resembling the Upper Helderberg limestone composing the mass of the rock of the lower end of Rock Island. It is about twelve and a half inches (32 centimeters) long, seven and a half inches (19 centimeters) wide, and one and a half inches (38 millimeters) thick.

The under side, as it was found lying in the vault, is a surface of natural cleavage, presenting no marks of inscriptions, nor of grinding. The upper side had been roughly rubbed or ground to a somewhat smoother or more even surface.

The principal figure inscribed or graven is an uncouth human figure, seated upon or astride a circle, with radial lines extending from it, apparently intended to represent the sun. Within this circle, which is about two and three-eighths inches (6 centimeters) in diameter, is engraved in outline a face about half that size, but placed nearer the lower edge of the outer circle. Above and rather to the right of this face is a crescent, or arc of rather more than half a circle, which may or may not be intended to represent the new moon. The human figure may represent the sun-god seated upon his throne, the sun. He apparently holds in his right hand some large object—perhaps a thunderbolt, and in his left hand or by the left arm, a long staff or scepter. On the breast of the figure is a very imperfect figure of a face, about five-eighths of an inch (16 millimeters) in diameter. Immediately over his head is cut a figure in the usual form of the copper "axes" found in the mounds, but much smaller. Above this, at each of the upper corners, is cut a complete figure of a bird pipe, such as are found, carved of stone, in these mounds, and of nearly full size. These have each a bit of quartz crystal set in for an eye—like the eyes of the animal figure from Mound No. 3, found last year, and, like those, they were held in place by a white cement of some kind, but which had lost its adhesive quality. Beneath these pipes, and surrounding the head of the principal figure, are a number of inscribed figures, at least five of which are identical with characters inscribed on the tablet from Mound No. 3. These consist of five characters on the left and five on the right side, and on the right side are also two groups of lines and dots.

All these figures were formed by incised lines, which in the small figures are about one millimeter (1-25 inch) in depth, and in the large ones three or four times as deep, and quite wide and coarse. The work has apparently been done with poor and imperfect tools, and in the curved

lines, which of course, are most difficult, it is quite rough and irregular. The principal figure, "sun-god" and "sun," the pipes and axe are all colored a deep bright ochre red: the rest of the stone is unstained.

The stone has evidently been subjected to a great heat, sufficient nearly to reduce the upper edge where the bird pipes are, and especially the right hand corner to a quick lime, so that it has crumbled considerably, and some small fragments crumbled off in removing it from its bed in the earth. It is considerably reddened internally, and when found was already cracked into ten pieces, which entirely separated on removal, besides several other cracks which are visible, but which did not break apart.

The new building of the Academy was opened to the public on the evening of Friday, February 22d, 1878, at which time Rev Dr. Gregory, President of the Illinois State Industrial University, delivered an address on the "Higher Scientific Education of the People." The Museum and Art Gallery were opened next day, and the exhibition continued until March 3d. The exhibition of pictures, under the auspices of the Davenport Art Association, was very fine. In addition to the Archaeological and other collections of the Academy, which had been beautifully arranged by Messrs. Pratt and Harrison, a fine collection of old coins was exhibited by Messrs. H. Spink, G. W. French and others. Professor J. D. Butler, of Madison, Wis., exhibited a selection of the copper implements from the collection of the Historical Society of Wisconsin. Among them were several supposed to have been cast. Four casts of the heads of Indian chiefs, prisoners of war at St. Augustine, Fla., presented by the Smithsonian Institution, attracted much attention. In the entomological room a selection of forty cases from the entomological collection of Mr. J. D. Putnam, was set up on racks, and eight microscopes were arranged on a table, with which to examine a magnificent series of preparations, loaned for the occasion by Mr. H. T. Atwood, of Chicago. On each evening during the opening, there was either a lecture or a musical entertainment. On February 23d, Prof. T. S. Parvin delivered an historical address on "Reminiscences of Iowa Forty Years Ago." Professor J. D. Butler, on February 26th, gave a very entertaining and instructive lecture on "Why the French Came West." February 27th, Professor W. L. Hailman, of Milwaukee, spoke upon the "Law of Childhood," and on February 28th, Col. W. W. Calkins entertained the audience with an account of the "Shell Mounds of Florida." The building was constantly thronged both day and evening. Great credit is due to the ladies for serving refreshments throughout the opening week, which netted fifty dollars. An admittance fee of twenty-five cents was charged, and the net receipts were \$450. During several days the Ferry Company carried ticket holders to and from Rock Island and Moline free.

Some Notes of Personal Investigation Among the Shell Mounds of Florida.

BY W. W. CALKINS.

(Read February 28th, 1878.)

It is only within a few years past that the Florida mounds have attracted the attention of archaeologists. Works or remains of a similar character were known to be abundant all along the Atlantic coast. These for many years hardly excited more than passing attention, being known as "shell heaps," and their origin referred to accidental agencies of tides, winds and waves, which were supposed to have piled them up in the same manner as the *sand dunes* of the coast were formed. The ordinary observer naturally regarded them in this light, and "passed by on the other side." But the man of thought—the inquisitive mind—the archaeologist—ever impatient to delve amid the ruins of the past and seek for the solution of questions affecting the origin of all things, animate and inanimate, paused in wonder. He beheld the large size and extent of the mounds, and found that they were composed largely of edible species of shells—the *Ostrca Virginica* being most abundant; furthermore, that many shells were broken, and that no two valves would match. Thus much being ascertained, we may be sure that further observation lifted the veil of mystery, and dissipated long cherished opinions as to the origin of the "heaps." I will summarize some of the results.

In many instances the mounds are situated at a distance inland, remote from living oyster beds or other abundant shells. In them are found evidences of man, consisting of relics of pottery, flint, bones of men, and certain species of mammals. Needles and awls of bone, vessels made of the large *Pygula* or *Conch*, and ornaments manufactured from shells, also exist. Excavations have revealed all these in more or less abundance. Human skeletons of the mound-builders age are not uncommon, though generally too far decayed for removal. The latest were exhumed by Lieut. A. W. Vogdes, at Tampa, Fla., in 1876, and by the author at Cedar Keys, Fla., in 1877. These lay at five and seven feet below the surface, near the center of the mounds, and with the heads toward the east. Lieut. Vogdes found an abundance of human tibia broken or calcined, which were associated with the bones of the bear, raccoon, etc., and situated near or in the ancient fireplaces, where were also charcoal and calcined shells. It is worthy of note that while stone axes and flints are common in the North, very few are found in Florida, and these were probably imported or obtained in trade with northern tribes, by giving, perhaps, the large marine shells—such as the *Cassis* found in a mound near Davenport, Iowa, and now in the Museum of the Academy. It is evident, then, that these shell mounds are artificial, the work of man. Indeed, the fact is so well established that I need not discuss it. But we find in Florida two classes of mounds—those of the interior and those on the sea coast. The former are made up almost exclusively of fresh water shells, generally of three species, *Paludina*,

Pomus and *Unio*. These species are not intermixed in the same mound, but were used as a general thing separately. The mounds of the sea coast consist entirely of marine shells. They will be noticed hereafter. Those of the interior, large numbers of which exist on the St. John's river and its tributaries, were made a subject of special investigation by the late Professor Wyman, of Massachusetts, and the results are embodied in the "Memoirs of the Peabody Academy of Science, Vol. 1, No. 4." During a recent trip to Florida, in 1877, I improved the opportunity to learn all I could in regard to the mounds. My course of travel was first in the St. Johns country. Through it flows in a nearly north direction the river of that name, and which resembles a vast lagoon of the sea, lying, as it does, but a few feet above its level, and for a long distance only separated from it by a narrow belt of land. Indeed, tide influences are felt 180 miles from its mouth. The borders of the St. Johns, as seen from the deck of a steamer present the unvarying aspect of low, flat country and interminable cypress swamps, with here and there more elevated tracts, covered with live oaks, palmettos, etc. The half tropical vegetation is varied and luxuriant, but most noticeable is the Spanish moss (*Tillandsia usneoides*), which covers every tree in gray apparel, presenting a strange and gloomy appearance. A closer inspection will reveal a dense undergrowth of Saw Palmettoes, scrubs and vines, whose roots permeate the loose soil in every direction. There are several lakes and numerous tributaries, all connected with the main river. These are filled, as formerly, with abundant animal life—fish, shell-fish, turtle, and the noble "gator," as the native Floridian calls him. The adjoining country is not less favored in the way of game, the swamps and hammocks affording shelter and safety to deer, bear, wild turkeys, etc. The upper St. Johns seems to have possessed peculiar attractions for the unknown people who built the hundreds of shell mounds existing there, and to have been the centre of population of the inland country. In this respect, finding a parallel in the Mississippi, Ohio and Illinois valleys, where we know the mound-builders followed the course of our large rivers. Wyman explored more than fifty mounds in the section indicated, some of them containing several acres, and the deposits of shells varying in depth from six inches up to twenty feet. In most cases he found plenty of pottery, bones of men and animals, together with shell dishes and ornaments, and a few rude flints. They were obtained at various depths by digging, a work, as I found myself, of no little difficulty on account of the dense vegetation that now covers the mounds. The researches of Prof. Wyman established beyond all doubt, the origin of the mounds, and he was the first explorer to thoroughly establish their character as artificial, though Count Pourtales expressed such a belief in 1848, while Dr. Brinton, who traveled in Florida in 1856, and published a work called "The Floridian Peninsula," thought otherwise, though he gave them no critical examination so far as I know.

Of several on the St. Johns examined by me, a description of one will give a fair idea of the others. This lay immediately on the bank of the

river, north of Pilatka, and was some 250 feet long, 260 wide, and about seven feet in depth, and made up of the little univalve shell *Vivipara contectoides*, which I may remark now lives there as well as in our northern waters. The top of the mound was overgrown with Saw Palmetto (*Sabal serrulata*): also with live and water oaks (*Quercus*), which seemed to find sufficient nourishment in the scanty soil or sand that had accumulated to the depth of a foot. Many of the trees could not have been less than 300 years old. These are young, compared with some growing on other mounds. I began digging at various points, but found my labor constantly impeded by the intricate net work of roots. I managed, however, to go down five feet, and was rewarded by finding a piece of pottery and flint chip; also, an awl made of the bone of some animal. This was nearly two inches long, and broad at one end, with a hole drilled through it. The other end was narrow and pointed. Below the depth stated, the shells were crushed and disintegrated, showing great age and a tendency to stratification. This is only one of many mounds of the same character on the banks of the St. Johns. In addition to these, broken pottery and shells are found almost everywhere, very frequently on the surface of the soil. Much of the pottery is ornamented, and I have found specimens exactly similar to some from Wisconsin. Very few whole pieces occur, however, having been broken up by the agencies of time, and where buried by the numerous roots which penetrate and destroy everything within reach. At Jacksonville may be seen roads made from the material from the shell mounds.

From the immense deposits then, we may conclude that the population of this section must have been large, and the shells and game of the country far more abundant than now. The shell-fish were used for food, and the empty shells became the foundations of the camps and huts of the natives, and finally mounds of large extent. Successive generations have occupied them as dwelling places, which they would naturally do in a country so low and flat. Tradition speaks of three races having inhabited Florida, and no doubt the earliest of these built the mounds. The human bones found in them in a broken condition preclude the idea of burial in a natural manner. It is almost certain that cannibalism existed, but at what period we cannot tell. From all I could learn, I should not assign an age of less than 600 years to the mounds of the interior. But this is, of course, mere conjecture, and the secret must remain forever buried with the strange people who reared these shell structures.

THE SHELL MOUNDS OF THE COAST.

There are many of these on both the Atlantic and Gulf sides of Florida of large extent. Some are now far inland, others immediately on the shore. I examined one of the largest mounds at Cedar Keys with quite interesting results. I understand that Dr. Brinton examined the same one and published his observations, but I have never seen his work, much to my regret. The mound is situated on Way Key—one of the group known as Cedar Keys. Here, under the shadow of the ancient metropolis, as it may well be called, stands the modern city of Cedar

Keys, though what entitles it to this high sounding name, I could not discover. But that there are plenty of excellent people here besides the mound-builders, and the best oysters in the world, I will not deny. Arriving in the night, I was not prepared for the surprise that awaited me on the next morning, when arising early, I strolled out for a walk, and saw not more than fifty rods from my hotel what seemed an immense hill gradually sloping upwards. This was so unusual a feature in Florida scenery as to arrest attention. It appeared to be fifty feet or more in height, and was surmounted with a dense growth of vegetation, the stately *Chamerops Palmetto* and live oak, with the Saw Palmetto and *Yucca aloifolia* being prominent features in the landscape. This was the famous "Mound." It extends for the distance of a quarter of a mile along the shore of a shallow bay known as "Goose Cove," on which it fronts abruptly, while on the other side it slopes downward towards the town, of which the whole mound may be called a suburb, numerous squalter sovereigns having fixed their residences on its summit, while several gentlemen with whom I became acquainted, are located on the slope. Small patches have been cleared of the underbrush for garden purposes. The whole mound covers at least ten acres, but portions of it have, from the changes of time, been worked down; soil and sand have, with the vegetation, given a modern appearance to these parts. But excavations reveal the fact that underneath is the buried mound. My friend, Lieut. Vogdes, chanced to arrive a few days after myself, and during his short stay we made some examinations on Goose Cove, where there were the best exposures. The mound here has an elevation of thirty to forty feet, with an almost perpendicular face, against which the tides wash. At the base, where they had been casting off shells to make roads in the town, we found some pieces of pottery, plain and ornamented. A little higher up, on digging into the side, more pottery was found; also charcoal ashes and bones of the bear and deer. Some of these were made into awls or needles; others had holes drilled into them as if for ornament. We found some of these relics at about fifteen feet from the base—the bones near the old fire-places. I saw no human bones at this point.

The mound proper, that is without the natural accumulations on its surface, of soil, sand, debris, etc., is composed of marine shells. Two-thirds, perhaps, are the *Ostrea Virginica*, occurring broken and the valves never in pairs. There are plenty, also, of the large clams, *Mercenaria Mortoni*. These and many other species, all common in a living state in the adjoining waters, make up the mound. Among the more noticeable species are *Cassidulus corona*, *Natica duplicata*, *Sycotypus per-versus*, *S. pyrum*, *S. papyraceus*, *Fasciolaria distans*, *Fasc. tulipa*, *Fasc. gigantea*, *Cullista gigantea*, *Pecten dislocatus*, *P. irradians*, *Strombus gigas*, *S. alatus*, *Cancellaria reticulata*, all edible species. Some of these are common to the Post Pliocene also. During my visit I examined every part of the mound, making excavations on the surface at several points. The part fronting on Goose Cove was evidently the kitchen department. Here the mound-builders cooked the oysters.

clams and scallops that made up so large a part of their living. The relics found prove this. I made several excavations on the surface twenty rods back from the cove, in the midst of a jungle of Saw Palmetto, water oak, yuccas, smilax, etc. Near by was an oak tree (*Quercus virens*), of large size, and which could not be less than 600 years old. The first two feet was all sand, except the space occupied by the roots, and to get through the tangled mass required much labor and patience. After this I struck a deposit of shells, and mixed with them was an abundance of broken pottery, human bones and skulls; the latter were badly cracked by the roots running through them, and the pieces were detached. Throwing these aside, I continued to dig to a depth of seven feet, finding all the time more bones and pottery. I obtained as many as twenty varieties of the latter. The ornamented kinds were more abundant than plain pieces, and some showed a high degree of skill and systematic workmanship. Some were covered with figures of squares or diamonds. Others with straight or curved lines, and indented with little holes. Judging from the pieces, the vessels would hold from two to four gallons, but many may have been larger. The same patterns occur in the St. Johns mounds, and, as I believe, in those of the North. Below seven feet I did not go. It requires a good deal of enthusiasm to dig in these jungles on a hot day. At that depth the bodies were evidently buried with heads toward the east, but their positions had become changed, and many of the bones either entirely decayed or dislocated. I found no ornaments with the bones. Pottery seems to have been the only thing buried with them, unless it be shells. No metals of any kind have been found here or elsewhere in the Florida mounds.

My operations occupied parts of many days, and while carrying them on, I took occasion to interview the "oldest inhabitants," of which there are a number hereabouts, but with little satisfaction. Some referred the mound to a period anterior to the flood. Others to a "time whereof the memory of man runneth not to the contrary," while all agreed that it was very ancient, in which view I concurred. Mr. Henry Clark, who lives on Goose Cove, informed me that his father had spent a great deal of time in searching the mound, but had never taken out more than two pieces of pottery entire, all the rest being broken. After months of labor he had also secured a number of skulls, but all badly cracked. These were sent to Europe. The quantity of pottery is simply immense. Future research may bring to light perfect specimens.

As to evidence of cannibalism, I found none here, but it may exist, and probably does. Lieut. Vogdes, in a systematic exploration of the same kind of mounds at Tampa, further down the coast, discovered satisfactory proofs of it. As to the age of this mound, no positive date can, of course, be given. Any one standing at a little distance would be impressed with its aged appearance—not less than 600 years—and closer examinations of the stupendous deposits of shells with the overlaying material and vegetation, would rather increase than lessen this estimate.

MARCH 3D, 1878.—BIOLOGICAL SECTION.

Seven members present.

Dr. Farquharson reported the following :

Post Mortem Examination of a Boa Constrictor.

BY R. J. FARQUHARSON, M. D.

A *Boa constrictor*, 7 feet in length, was received about Sept. 1st, 1877, from Hon. Jas. Thorington, U. S. Consul at Aspinwall. It swallowed a rat shortly before starting on the journey, and another rat was placed in the box to serve for food on the way, but was not eaten. On its arrival here the boa was quite torpid, and spent a considerable time in shedding its skin, which was done in a very gradual and imperfect manner. A rat, which was placed in the cage about a week after its arrival, bit it badly about the head and nose, thus causing the snake much suffering. Numbers of rabbits, pigeons, or other animals, were from time to time put into the cage, but the Boa took no notice of them. It was kept in a room with a fire all winter, and kept itself snugly coiled up in a blanket most of the time. In January it began to appear more active, but only for a short time, as it finally died on February 1st, having eaten nothing for nearly six months. Soon after its death, a post mortem examination was made, with the following result.

In removing the skin and preparing the skeleton, the following observations were made: Near the anus the ducts of two glands were cut across, which were filled with a dark colored semi-fluid matter, with a terribly pungent foetid and musky odor.

The small bones of the rudimentary hind limbs, characteristic of the Boideæ, were not found, being either imbedded in the thick skin, or overlooked from their small size, owing to the immaturity of the specimen.

No sub-cutaneous nor inter-muscular fat was found; but internally fat was quite abundant in the mesentery, and about the kidneys and other organs of the abdomen.

The stomach and a part of the intestines were empty, in the lower part of the latter some masses of the same fœcal matter (consisting principally of the hair of the Peccary), which it had passed for several months, and a large quantity of the peculiar urine, of the color and consistency of partly melted ice cream.

The gall bladder was filled with dark colored bile.

The internal organs appeared healthy, with the sole exception of the lung, the whole of which was inflamed, indicated by the diffused red color, and by its being adherent to the cavity of the body throughout a great part of its surface. Upon the inner or mucous surface of the lung were found quite a large number of tubercles, some of which had softened. The largest of these would not exceed in size that of a No. 6 shot. As in serpents lungs there are no air cells, nor any solid tissue, this observation may be of aid in fixing the site of the corresponding miliary tubercles in man.

About the head, under the skin, and in the mouth were found signs of inflammation and suppuration, the consequence of his injury by the bite of a rat, and his knocking the exposed part against the side of his cage. This local suppuration may have been the starting point of the deposition of tubercles in the lungs. From the remnants of his last meal being found yet in the intestines, and from the abundance of internal fat, it may be inferred that he did not die of starvation.

MARCH 8TH, 1878.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Six members present.

The following papers, formerly belonging to the estate of the late Antoine LeClaire, were presented by George L. Davenport, Esq., executor: United States Patent to Antoine LeClaire, dated November 1st, 1837, conveying all the land on which is now located the city of Davenport; another patent, of the same year, conveying a section of land at the head of the Upper Rapids*; Antoine LeClaire's commission as Postmaster at Davenport, dated October 22d, 1836; letter of instruction to LeClaire from Postmaster-General Amos Kendall, dated April 26th, 1836; letter from Hon. George W. Jones, dated April 20th, 1836; Antoine LeClaire's commission as "Justice of the Peace for Des Moines County, Michigan Territory," dated April 1st, 1836, and signed by John S. Horner, acting Governor of Michigan; a copy of the conveyance of the "original ferry license" from Antoine LeClaire to John Wilson in 1837.

Mr. W. C. Putnam then read some reminiscences of Black Hawk and the Sac and Fox Indians, which had been furnished by Hon. Bailey Davenport, of Rock Island.

MARCH 29TH, 1878.—REGULAR MEETING.

Dr. R. J. Farquharson, President, in the chair.

Eight members present.

Donations to the Museum and Library were reported, and the thanks of the Academy voted to the donors.

The following persons were elected regular members: Capt. T. J. Robinson, Rock Island; Reuben S. Price and Otto Klug, Davenport. The following were elected corresponding mem-

*Now the City of LeClaire, Iowa

bers: S^r Gumesindo Mendoza, S^r Alfonso Herrera, S^r Mariano Barcena, S^r Dr. Manuel M. Vilado, and S^r Jesus Sanches, of the National Museum, City of Mexico; S^r Dr. Eugene Duges, Guanajuato, Mexico; S^r Dr. Gregorio Barroeta, S^r Don Antonio Espinoza y Cervantes; and S^r Dr. J. A. Pier-nas, San Louis Potosi, Mexico.

Mr. Crandall reported that Mr. L. H. Morse, of this city, proposed to photograph, by the new chromotype process, all the officers of the Academy, together with the members who have been most active in building up the Academy, and to donate the same to the Historical Section. This offer was accepted with a vote of thanks.

The following paper was read and referred to the Publication Committee:

Catalogue of the Marine Shells of Florida, with Notes and Descriptions of Several New Species.

BY W. W. CALKINS, CHICAGO.

The material for the following monograph has been mainly derived from my own collections, and observations made during two winters spent in Florida—in 1875 and 1877. The first time as member of an expedition in the interest of the Chicago Academy of Sciences, and in 1877 on my own account. In addition to my personal collections, I have received since my return valuable accessions from my collectors living in Florida. In the determination of species I have been assisted in many instances by Mr. George W. Tryon, jr., of Philadelphia, to whom, and also to Mr. Thomas Bland, I desire to express my acknowledgments for kindly aid. While possessing myself a fine series of Conchological works, I regret my inability to look over the libraries and museums of eastern societies for purposes of study and comparison. I have, however, taken the utmost care to identify species. I am led to prepare this paper from a feeling that even a catalogue, if it be nothing more, is a *desideratum* among students of American conchology, who have been obliged, like myself, to search through hundreds of volumes for information that perhaps a mere list would afford. It is often a satisfaction to know *where* a certain shell can be found. I do not, of course, give all the Florida species. There are many which can only be obtained by dredging in deep water. But a fair representation appears of the littoral faunas of both coasts, and the Keys at the southern extremity of Florida. It will be seen that West Indian forms are quite common. The geographical range of the species is one of interest in connection with geological changes in Florida, which have governed their distribution. Dr. Stimpson refers to this in the American Naturalist, Vol. 4. It

seems that a comparatively small number are common to both the Atlantic and Gulf coasts of Florida. Some species abundant at St. Augustine do not occur at all on the other side, but when the vicinity of Galveston is reached are again seen.

On the other hand we look in vain for the sub-tropical species, found even so far north as Cedar Keys on the Gulf. I found at the latter point for the first time, *Ranella clathrata*, Gray, heretofore known only from the Pacific coast. I also secured the South American shell, *Auricula pellucens*, Menke. This shows a wide range, and suggests the powerful agency of the Gulf stream in the migration of species from the south, and their colonization where its influences are felt. Beyond these influences many species do not extend. The same agency also presents an insuperable barrier to northern forms. Hence, Dr. Stimpson argued the former connection of the colder waters of the Atlantic with the northern part of the Gulf of Mexico by means, perhaps, of straits or lagoons across the northern part of Florida, and accounts in this way for the occurrence of South Carolina shells on the Texas coast. These facts are interesting and worthy of more study. I do not propose to give a full synonymy of the species mentioned. When so common a shell as *Lucina dentata* rejoices in more than a dozen names bestowed upon it at different times by enthusiastic or ambitious naturalists, it is about time to cut down the list, and save labor as well as expense. In classification I have followed Woodward mainly. The largest part of the species enumerated are in my cabinet. A number are in the Museum of the Chicago Academy and in that of the Davenport Academy of Sciences. Other species will be deposited from time to time.

CLASS, CEPHALOPODA.

ORDER, ARGONAUTIDÆ.

Family, ARGONAUTIDÆ.

Genus, ARGONAUTA, L.

1. A. ARGO, L. Very frequently cast by storms upon the Florida coast. My collection.

ORDER, OCTOPODA.

Family, OCTOPODIDÆ.

Genus, OCTOPUS, Cuvier.

2. O. RUGOSUS, Bosc. Synonyms, *Sepia granulatus*, Lam. 1799; *Octopus Barkeri*, Fer. 1826; *Octopus Americanus*, Blain 1826. From the Gulf stream, and occasionally cast on shore. My collection.

3. O. VULGARIS, L. Common around the coral reefs. The natives sometimes eat this species. My collection.

ORDER, DECAPODA.

Family, ONYCHOTEUTHIDÆ.

Genus, ONYCHOTEUTHIS, Licht.

4. O. BARTLINGII, Lesueur 1821. (*Loligo*.) Syn. *O. Lesueurii*, Fer. Found in the Gulf stream. My collection.

Family, SPIRULIDÆ.

Genus, SPIRULA, *Lam.*

5. *S. PERONII*, *Lam.* 1822. Syn. *S. fragilis*, *Stimp.* 1860. The only recent species known. I have observed this shell by thousands on the beaches, cast up by storms. The animal is seldom seen or taken alive.

CLASS, GASTEROPODA.

ORDER, PROSOBRANCHIATA.

Family, STROMBIDÆ.

Genus, STROMBUS, *L.*

6. *S. BITUBERCULATUS*, *Lam.* Tortugas Keys.
 7. *S. PUGILIS*, *L.* West Coast.
 8. *S. ALATUS*, *Gmelin.* West Coast.
 9. *S. GIGAS*, *L.* Very abundant. The animal affords an excellent article of food, while the shells are imported by thousands for manufacturing into articles of jewelry.
 10. *S. ACCIPITER*, *Lam.* By no means common. Found off the Keys.

Family, CONIDÆ.

Genus, BELA, *Leach.*

11. *B. PLICATA*, *Adams.* Loc., Indian Pass, Fla. (*Jewett*). Cedar Keys (*Calkins*).

Genus, CLATHURELLA, *P. P. Carpenter.*

12. *C. JEWETTI*, *Stearns.* Tampa Bay.

Family, MURICIDÆ.

Genus, MUREX, *L.*

13. *M. POMUM*, *Gmelin.* Abundant around Cape Sable.
 14. *M. SPINCOSTATA*, *Valenc.* Same locality.

Genus, UROSALPINX, *Stimp.*

15. *U. TAMPAENSIS*, *Con.*
 16. *U. CINEREUS*, *Say.*
 17. *U. FLORIDANUS*, *Con.* All abundant from Cedar Keys southwards.

Genus, TRITONIDEA.

18. *T. RINGENS*, *Reeve.* Loc., the Keys.

Genus, RANELLA, *Lam.*

19. *R. CAUDATA*, *Say.* Both coasts.
 20. *R. TAMPAENSIS*, *Con.* Abundant from Cedar Keys to Cape Sable.
 21. *R. CLATHRATA*, *Gray.* This elegant shell—the *R. muriciformis*, *Brod.*—was determined for me by Mr. Tryon. It is a Pacific coast form, and has not, I believe, been before detected in our waters. I collected a

dozen specimens near Cedar Keys, which I found in dead shells, and on the pretty little coral, *Oculina diffusa*, Lam.

Genus, TRITON, Lam.

22. TRITON VELIEI, n. s. Plate viii, Fig. 1 and 2.

Shell has six whorls, two prominent ribs encircling all but the two first : small ribs between ; color amber or chestnut ; on last whorl in front from top to bottom is a large fold, ridge or plait, marked with white blotches ; two other plaits on fifth whorl, and one on fourth behind, each marked with white ; beneath the two ribs on last whorl are others, the upper one white and extending entirely around the circumference ; shell longitudinally striate and granulate ; aperture elongate oval ; lips denticulated ; the outer one strongly folded and ribbed, with two prominent white spots ; a deep sinus within caused by the fold, the edge of which is also denticulated ; canal short ; aperture purplish within, and deeply grooved parallel with the ribs ; length of largest shell, 43 mill., breadth, 22 mill. ; length of small shell, 26 mill., breadth, 14 mill. Loc. Southern Florida. My cabinet.

Remarks.—This species possesses peculiar interest. The largest specimen was found by Dr. J. W. Velie at Key West in a fresh condition, not worn. The small shell was collected by the Messrs. Colliers near Marco on the Gulf coast. The late Dr. Stimpson was in Key West at the time of the discovery in 1872, and to him Dr. Velie submitted the shell, which he unhesitatingly pronounced to be a new species. And he remarked that it was even more valuable than *V. Junonia*, hitherto considered our rarest species. Dr. Stimpson intended to describe and name this shell, but his death a few weeks afterwards prevented his giving this new species to science, therefore the task has fallen upon me. Following out the intention of Dr. Stimpson, I have the pleasure to name the species in honor of its discoverer, Dr. Velie. Besides these two specimens, I know of no others having been found. For the very accurate figures of the shells, I am indebted to Mr. A. F. Gray, of Massachusetts.

Genus, FASCIOLARIA, Lam.

23. F. GIGANTEA, Kiener.

24. F. DISTANS, Lam.

25. F. TULIPA, Lam. These three species are very abundant from Cedar Keys southwards. The first is sometimes nearly two feet in length.

Genus, TURBINELLA, Lam.

26. T. MURICATUM, Born. Abundant at Key Vaccas.

Genus, CANCELLARIA, Lam.

27. C. RETICULATA, Dillwin. Quite common on the west and southern coast.

Genus, SYCOTYPUS, Browne.

Synonyms, *Busycon*, Boltzen ; *Fulgur*, Mont. ; *Pyrula*, Lam.

28. S. PYRUM, Dillwin. Abundant on the west coast southwards.

29. *S. PAPHYRACEUS*, *Say*. Abundant.
 30. *S. PERVERSUS*, *L.* Abundant.
 31. *S. CARICA*, *Gmelin*. Peculiar to the east coast. Synonym, *Fulgur eliceans*, *Mont*.
 32. *S. CANALICULATUS*, *L.* Peculiar to the east coast.

Genus, *CASSIDULA*, *Humph.*

33. *C. CORONUS*, *Lam.* Abundant on west coast and among the Keys.

Genus, *FUSUS*, *Brug.*

34. *F. BICOLOR*, *Say*. East coast.

Family, *BUCCINIDÆ*.

Genus, *ACUS*, *Humph.*

(*TEREBRA*, *Lam.*)

35. *ACUS DISLOCATUS*, *Say*. Abundant.

Genus, *NASSA*, *Lam.*

36. *N. VIBEX*, *Say*.
 37. *N. TRIVITTATA*, *Say*.
 38. *N. OBSOLETA*, *Say*.
 39. *N. LUNATA*, *Say*.
 40. *N. ACUTA*, *Say*.
 41. *N. ALBA*, *Say*.

The three first are abundant species.

Genus, *PURPURA*, *Lam.*

42. *P. UNDATA*, *Lam.* A West Indian species, found by me among the Keys. Emits an elegant coloring fluid, as well as the next species.
 43. *P. DELTOIDEA*, *Lam.* Same locality.
 44. *P. FLORIDANA*, *Con.* Same locality. A large well marked species, as well as the preceding ones.

Genus, *MONOCEROS*, *Lam.*

(*LEUCOZONIA*.)

45. *M. CINGULATA*, *Lam.* A Panama species, found by me at the southern extremity of Florida.

Genus, *PLANAXIS*, *Lam.*

46. *PLANAXIS* — ? *sp. indet.* From the Keys.

Genus, *CASSIS*, *Lam.*

47. *C. CAMEO*, *Stm.* Syn., *C. Madagascarensis*, *Lam.* Found at Tortugas.
 48. *C. TUBEROSA*, *L.* Same locality.
 49. *C. GRANULOSA*, *Brug.* Loc., east coast.

Genus, *ONISCIA*, *Sowerby*.

50. *O. ONISCUS*, *Sowerby*. Loc., the Keys.

Genus, *DOLIUM*, *Lam.*

51. *D. GALEA*, *L.* Loc., east coast.
 52. *D. PERDIX*, *L.* Most abundant southwards, but plentiful at St. Augustine.

Genus, *COLUMBELLA*, *Lam.*

53. *C. MERCATORIA*, *L.* Common.
 54. *C. SIMILIS*, *Ravenel*. Quoted as from Massachusetts to Georgia. I collected this species at Cedar Keys.
 55. *C. LEVIGATA*, *L.* Loc., the Keys.
 56. *C. LUNATA*, *Say*. Eastern coast.

Genus, *ANACHIS*.

57. *A. SEMPLICATA*, *Stearns*. Loc., west coast.
 58. *A. ACUTA*, *Stearns*. Same locality as the preceding species.
 59. *A. AVARA*, *Say*. From the east coast.

Genus, *NITIDELLA*, *Swainson*.

60. *N. FILOSA*, *Stearns*. Loc., Tampa Bay.

Genus, *OLIVA*, *Lam.*

61. *O. LITERATA*, *Lam.* Abundant on both coasts.
 62. *O. MUTICA*, *Say*. Abundant.

Sub Genus, *OLIVELLA*, *Swain*.

63. *O. PELLUCIDA*, *Gray*.
 64. *O. FULGENS*, *Kiener*.
 65. *O. ZONALIS*, *Lam.*
 66. *O. ORYZA*, *Lam.*

These four species were dredged by me at Cedar Keys and southwards in six fathoms.

Family, *CONIDÆ*.Genus, *CONUS*, *L.*

67. *C. LEONINUS*, *Hwass*. West coast; abundant.
 68. *C. FLORIDANUS*, *Gabb*. Same locality.
 69. *C. STEARNSII*, *Con*. Loc., west coast.

These three species seem to be well marked.

70. *C. MUS*, *Lam.* Loc., Key Vaccas.
 71. *C. PEALEI*, *Green*. Loc., the Keys.
 72. *CONUS ACUTANGULUS*, *Chem*. Mr. Tryon, to whom I submitted this species identifies it, after comparison, with the full series in the

Philadelphia Academy of Sciences, as above, though the specimens are so different from the typical shells that many persons, he remarks, would consider it a new species. Found by Dr. J. W. Velie on the west coast, and also among the Keys; also by myself.

Family, VOLUTIDÆ.

Genus, VOLUTA, *L.*

73. *V. JUNONIA*, *Chem.* This species has been called the rarest of American shells, and high prices have been paid for it. Col. Jewett dredged specimens off Tampa, and Count Pourtales in the Gulf stream. Very good specimens are occasionally found on the Gulf coast that have been washed ashore. It is an inhabitant of deep waters.

Genus, MITRA, *Lam.*

74. *M. GRANULOSA*, *Lam.* Loc., the Keys.

Genus, MARGINELLA, *Lam.*

75. *M. APICINA*, *Menke.* Large variety.

76. *M. APICINA*, *Menke.* Small variety.

77. *M. CARNEA*, *Storer.*

78. *M. GUTTATA*, *Dilln.*

79. *M. ROSCIDA*, *Redf.*

Loc., from the Keys and west coast. All well marked species.

Family, CYPRÆIDÆ.

Genus, CYPRÆA, *L.*

80. *C. EXANTHEMA*, *L.* Syn., *C. cervinetta*, *L.* Quite common at Tortugas and around the southern end of Florida.

Sub-Genus, TRIVIA, *Gray.*

81. *T. QUADRIPUNCTATA*, *Gray.* Common at Key West.

82. *T. PEDICULUS*, *Rumph.* Same locality.

Genus, VOLVA, *Bolten.*

83. *V. UNIPPLICATA*, *Sowerby.* Found at Tortugas.

Genus, OVULUM, *Lam.*

84. *O. GIBBOSUM*, *Lam.* Abundant at Tortugas. The preceding species envelope their shells with the mantle from which the beautiful enamel is derived that gives them so fine a polish.

Family, NATICIDÆ.

Genus, NATICA, *Lam.*

85. *N. DUPLICATA*, *Say.*

86. *N. CANRENA*, *L.*

The first species is abundant. The latter rare.

Genus, *SIGARETUS*, *Lam.*

87. *S. PERSPECTIVUS*, *Say*. Found on both coasts at low tide; generally buried slightly in the sand, in which it leaves a track as it moves along. The animal entirely envelopes the shell, and when caught resembles more a huge piece of fat than anything else.

88. *S. MACULATUS*, *Say*. I have never been able to find this species, and doubt its present existence. Probably an aberrant form.

Family, PYRAMIDELLIDÆ.

Genus, *ODOSTOMIA*, *Fleming*.

89. *O. IMPRESSA*, *Say*. Abundant on both coasts.

90. *ODOSTOMIA ALBA*, n. s. Plate viii, fig. 3.

Shell small, white, shining, pellucid, tapering rapidly to an acute apex; whorls twelve to thirteen; smooth, flat; sutures slightly impressed; outer lips simple, thin; aperture angular above; length $7\frac{1}{2}$ mill., breadth $2\frac{1}{2}$ mill. Dredged by me at Cedar Keys, Fla., in two and six fathoms. My collection. Cabinet of Davenport Academy of Sciences.

Genus, *EULIMA*, *Risso*.

91. *E. JAMAICENSIS*, *C. B. Ad.* I found this species at Cedar Keys, bringing them up in the dredge. Mr. Tryon identified the species.

Family, CERITHIADÆ.

Genus, *CERITHIUM*, *Brug.*

92. *C. VERSICOLOR*, *Adams*.

93. *C. MUSCARUM*, *Say*.

94. *C. SEPTEMSTRIATUM*, *Say*.

95. *C. FERRUGINEUM*, *Say*.

96. *C. EBURNEUM*, *Brug.*

97. *C. LITTERATUM*, *Lam.*

98. *C. NIGRESCENS*, *Menke*.

99. *C. NIGRESCENS*, var. *MINOR*, *Calkins*.

100. *C. SCABRUM*, *L.*

The foregoing species were found mostly among the Keys. No. 99 I obtained at Tortugas Keys on the edge of a coral reef, where I collected several hundred specimens. There were none of the large variety among them; neither did I see any at that point. They present so much uniformity in size and markings, that while resembling generally No. 98, yet are so much smaller that I consider them good as a variety, and propose the name *C. nigrescens*, *Menke*, variety *minor*, as sufficiently distinctive.

Family, TURRITELLIDÆ.

Genus, *VERMETUS*, *Adanson*.

101. *V. RADICULA*, *Stm.* This curious worm like shell is abundant on both coasts.

Genus, CÆCUM, *Flem.*

102. C. NITIDUM, *Stm.*
 103. C. FLORIDANUM, *Stm.*
 West Coast.

Genus, SCALARIA, *Lam.*

104. S. LINEATA, *Say.*
 105. S. MULTISTRIATA, *Say.*
 106. S. ANGULATA, *Say.*
 From both coasts.

Family, LITTORINIDÆ.

Genus, LITTORINA, *Fer.*

107. L. IRRORATA, *Say.*
 108. L. ANGULIFERA, *Lam.*
 109. L. NODULOSA, *Desh.*
 110. L. DILATATA, *D. Orb.*
 111. L. MURICATA, *Lam.*

All abundant except No. 109, of which I found a few specimens at Bahiahonda Key.

Sub-Genus, MODULUS, *Gray.*

112. M. FLORIDANUS, *Con.* Am. Jour. Conch., Vol. 5, p. 107. This species resembles *Modulus lenticularis*, *Ch.*, from which it is doubtfully distinct.

Genus, PHORUS, *Montfort.*

113. P. CORRUGATUS, *Reeve.* Bahiahonda Key.

Genus, LITIOPA, *Rang.*

114. L. STRIATA, *Rang.* Taken by Dr. Brown and myself from the Gulf weed (*Sargassum bacciferum*) near Key West.

Genus, RISSOA, *Fremenville.*

115. R. INCOMPTA, *Gould.* Loc., east coast.

Family, NERITIDÆ.

Genus, NERITA, *L.*

116. N. PELORONTA, *Lam.*
 117. N. VERSICOLOR, *Lam.*
 118. N. TESSELLATA, *Gmelin.*

All abundant on the Keys.

Family, TURBINIDÆ.

Genus, TURBO, *L.*

119. T. CRENULATUS, *Gmelin.* Loc., Tortugas.
 120. T. CASTANEUS, *Lam.* Cedar Keys southwards.

Genus, TROCHUS, *L.*

121. *T. BREVISPINA*, *Gmelin.*
 122. *T. PICA*, *Gmelin.*
 123. *T. AMERICANA*, *Gmelin.*
 124. *T. TAMPAENSIS*, *Conrad.*

All abundant on the west coast and among the Keys. A well marked species.

Family, JANTHINIDÆ.

Genus, JANTHINA, *Bolten.*

125. *J. FRAGILIS*, *Brug.* Syn., *J. communis*, *Lam.*
 126. *J. GLOBOSA*, *Swainson.*

Frequently cast on shore by storms.

Family, FISSURELLIDÆ.

Genus, FISSURELLA, *Brug.*

127. *F. ALTERNATA*, *Say.* A common species.

Family, CALYPTRÆIDÆ.

Genus, CREPIDULA, *Lam.*

128. *C. FORNICATA*, *L.* Syns., *C. glauca*, *Say*; *C. convexa*, *Say.* Very common, attached to oyster shells, etc.

129. *C. UNGUIFORMIS*, *Lam.* Syn., *C. plana*, *Say.* This extremely common shell is better known by Say's name, but on the ground of priority, Lamarck's has the precedence.

130. *C. ACULEATA*, *Gmelin.* Quite common.

Family, PATELLIDÆ.

Genus, PATELLA, *L.*

131. *PATELLA* —, *sp. indt.* Loc., Key West.

Family, DENTALIADÆ.

Genus, DENTALIUM, *L.*

132. *D. DENTALE*, *L.* Syn., *D. attenuatum*, *Say.* I dredged this shell at Cedar Keys, in six fathoms of water, and can identify it with no other species.

133. *D. STRIOLATUM*, *Stm.* Syn., *D. entalis*, *Migh.* From the east coast, and a well-marked species.

Family, CHITONIDÆ.

Genus, CHITON, *L.*

134. *C. PICEUS*, *Gmelin.*
 135. *C. APICULATUS*, *Say.*
 136. *CHITON* —, *sp. indt.*

All abundant species among the Keys. Found clinging to rocks within tide marks.

ORDER, OPISTHOBRANCHIATA.

Family, BULLIDÆ.

Genus, BULLA, *Lam.*

137. B. OCCIDENTALIS,
- Adams.*
- Common among the Keys.

Family, APLYSIADÆ.

Genus, APLYSIA, *Gmelin.*

138. APLYSIA PROTEA,
- Rang.*
- Loc., the Keys and warmer parts of the Gulf.

CLASS, BRACHIOPODA, *Cuvier.*ORDER, ARTHROPOMATA, *Owen.*Family, TEREBRATULIDÆ, *Dall.*Genus, TEREBRATULA, *Brug.*

139. T. CUBENSIS,
- Pourtales.*
- Proc. Phila. Acad. Sciences, 1873. Loc., Florida reefs.

Genus, TEREBRATULINA, *D'Orb.*

140. T. CAILLETI,
- Crosse.*
- Dall. Bull. Mus. Comp. Zool., iii, i, 1871. Tortugas.

Genus, WALDHEIMIA, *King.*

141. W. FLORIDANA,
- Pourtales.*
- Bull. Mus. Comp. Zool., i, 7, 1868. Loc., Florida Reefs.

Genus, PLATIDIA, *Costa.*

142. P. ANOMOIDES,
- Scacchi.*
- Loc., Florida Reefs.

Genus, MEGATHYRIS, *D'Orb.*Sub-Genus, CISTELLA, *Gray.*

143. C. BARRETTIANA, var. LUTEA,
- Dall.*
- Bull. Mus. Comp. Zool., iii, No. 1, 1871. Tortugas.

144. C. RUBROINCTA,
- Dall.*
- Bull. Mus. Comp. Zool., 1871. Tortugas.

ORDER, LYOPOMATA, *Owen.*Family, CRANIIDÆ, *Gray.*Genus, CRANIA, *Retzius.*

145. C. ANOMALA, var. POURTALESII,
- Dall.*
- Bull. Mus. Comp. Zool., 1871. The Keys.

CLASS, CONCHIFERA, *Lam.*
(LAMELLIBRANCHIATA, *Blain.*)

Family, OSTREIDÆ.

Genus, OSTREA, *L.*

146. *O. VIRGINICA*, *Gmelin.*

147. *O. EQUESTRIS*, *Say.*

Both abundant species.

— *O. SEMICYLINDRICA*, *Say.* Doubtful. Aberrant.

Genus, ANOMIA, *L.*

148. *A. GLABRA*, *Verrill.* Synonyms, *A. ephippium*, *Gould*; *A. electrica*, *Gould.* Very common attached to *Pinnas* and other shells.

Genus, PECTEN, *O. F. Muller.*

149. *P. IRRADIANS*, *Lam.*

150. *P. NODOSUS*, *L.*

151. *P. DISLOCATUS*, *Say.*

152. *P. FUSCOPURPUREUS*, *Con.*

All abundant species, except No. 150, which cannot be called so.

Genus, LIMA, *Brug.*

153. *L. SQUAMOSA*, *Lam.*

154. *L. SCABRA*, *Dillw.*

Found at Tortugas, attached to corals.

Genus, SPONDYLUS, *L.*

155. *S. GÆDAROPUS*, *Dillw.* Syn., *S. Americanus*, *Lam.* I obtained this species at Tortugas.

Genus, PLICATULA, *Lam.*

156. *P. RAMOSA*, *Lam.* Occurs abundantly attached to corals and shells.

Family, AVICULIDÆ.

Genus, AVICULA, *Brug.*

157. *A. ATLANTICA*, *Lam.* Quite common among the Keys.

158. *AVICULA* —, *sp. indt.* Tortugas.

Genus, PERNA, *Brug.*

159. *P. PERNA*, *Wood.* Syn., *P. ephippium*, *Sowerby.* From Tortugas. Attached to corals.

Genus, PINNA, *L.*

160. *P. SEMINUDA*, *Lam.*

161. *P. MURICATA*, *L.* Syn., *P. Carolinensis*, *Hanley.* Both abundant species.

Family, MYTILIDÆ, L.

Genus, MYTILUS, L.

162. M. HAMATUS, *Say*. Attached to oyster shells.163. M. EXUSTUS, L. Syn., *M. cubitus*, *Say*.

164. M. EDULIS, L. East coast.

Common on both coasts, except the last.

Genus, MODIOLA, Lam.

165. M. PLICATULA, Lam. East coast.

166. M. SULCATA, Lam. Bahiahonda Key.

167. M. TULIPA, L. Same locality as the last.

Genus, DREISSENA, Van Beneden.

168. D. LEUCOPHÆTA, Con. West coast.

Genus, LITHODOMUS, Cuvier.

169. L. ANTILLARUM, *D'Orb*. Taken from a mass of coral at Tortugas.

Genus, CRENELLA, Brown.

170. C. LATERALIS, *Say*. (MYTILUS.) From the east coast.

Family, ARCADÆ.

Genus, ARCA, L.

171. A. PEXATA, *Say*.172. A. TRANSVERSA, *Say*.173. A. PONDEROSA, *Say*.174. A. AMERICANA, *Gray*.

175. A. NOË, L.

176. A. INCONGRUA, *Say*.

Nos. 174 and 176 are peculiar to the east coast, so far as I know.

Genus, PECTUNCULUS, Lam.

177. P. PENNACEUS, Con. From the Keys.

Genus, NUCULA, Lam.

178. N. PROXIMA, *Say*. East coast.

Genus, LEDA, Schumacher.

179. L. ACUTA, Con. (*Nucula*.) Am. Marine Conch. This species was described as *fossil* from North Carolina. It has, however, been found living there. I also dredged the species alive at Cedar Keys, on the Gulf coast in six fathoms of water. This shows a wide distribution.

Family, CHAMIDÆ.

Genus, CHAMA, L.

180. C. ARCINELLA. Common around Tortugas.

181. *C. MACROPHYLLA*, *Chem.* Also common among the Keys. Syn., *C. Lazarus*.

Family, *CARDIADÆ*.

Genus, *CARDIUM*, *L.*

182. *C. MAGNUM*, *Born.*

183. *C. MURICATUM*, *L.*

184. *C. ISOCARDIA*, *L.*

185. *C. BULLATUM*, *L.*

All abundant species.

Genus, *LÆVICARDIUM*, *Swainson.*

186. *L. SERRATUM*, *L.* Syn., *C. lævigatum*, Gmelin; *C. citrinum*, Wood.

187. *L. MORTONI*, *Con.* *J. Phila. Acad.*, vi, 259.

Both common species on west and south coasts.

Family, *LUCINIDÆ*.

Genus, *LUCINA*, *Brug.*

188. *L. PENNSYLVANICA*, *L.*

189. *L. PENNSYLVANICA*, var. *AURANTIA*, *Desh.*

190. *L. DENTATA*, *Wood.*

191. *L. LINTEA*, *Con.*

192. *L. NASSULA*, *Con.*

193. *L. FLORIDANA*, *Con.*

194. *L. TIGERINA*, *L.*

195. *L. EDENTULA*, *L.*

This family is well represented. No. 190 is remarkable, at least, for having been honored with a dozen or more names by as many different authors, all of which illustrates the beauty of variety in which nature delights, but does not allow for human credulity in seeing something new in a shell of so uniform character or markings as *Lucina dentata*.

Genus, *MYSIA*, *Leach.*

196. *M. PUNCTATA*, *Say.* *J. Phila. Acad.*, ii, 308. Loc., east coast.

Family, *CYCLADIDÆ*.

Genus, *CYRENA*, *Lam.*

197. *C. CAROLINIENSIS*, *Lam.*

198. *C. PROTEXTA*, *Con.*

199. *C. FLORIDANA*, *Con.*

The first abundant. The two latter rare, so far as I have observed.

Genus, *GOULDIA*, *C. B. Ad.*

200. *G. MACTRACEA*, *Linsley.* (*Astarte.*) Found on both coasts. *A. lunulata*, *Con.*, is evidently the same species.

Genus, *ASTARTE*, *Sowerby*.

201. *A. TRIQUETRA*, *Con.* Tampa.
 202. *A. FLABAGELLA*, *Con.* Tampa.
 203. *A. CONRADI*, *Schutt.* Syn., *Cardita incrassata*, *Con.* Tampa.

Family, *CYPRINIDÆ*.Genus, *CARDITA*, *Brug.*

204. *C. FLORIDANA*, *Con.* From Cedar Keys southwards.

Family, *VENERIDÆ*.Genus, *MERCENARIA*, *Schum.*

205. *M. MERCENARIA*, *L.* Common.
 206. *M. MORTONI*, *Con.* Common.
 207. *M. FULGURANS*, *Tryon.* Common. A younger form of 206.

Genus, *CYTHEREA*, *Lam.*

208. *C. DIONE*, *L.* Occasionally found at Tortugas.

Genus, *CHIONE*, *Meg.*

209. *C. CINGENDA*, *Dillw.* (*Venus.*) Common from Cape Sable southwards.

Genus, *CALLISTA*, *Poli.*

210. *C. GIGANTEA*, *Chem.*
 211. *C. MACULATA*, *L.*
 An abundant species from the west coast southwards.

Genus, *DOSINIA*, *Scopoli.*

212. *D. DISCUS*, *L.* Peculiar to the east coast.
 213. *D. ELEGANS*, *Gray.*
 214. *D. FLORIDIANA*, *Con.*
 From the west coast.

Genus, *PETRICOLA*, *Lam.*

215. *D. PHOLADIFORMIS*, *Lam.* Found on the Atlantic coast.

Family, *MACTRIDÆ*.Genus, *MACTRA*, *L.*

216. *M. SIMILIS*, *Say.*
 217. *M. SOLIDISSIMA*, *Chem.*
 218. *M. LATERALIS*, *Say.*
 219. *M. FRAGILIS*, *Chem.*
 220. *M. TELLINOIDES*, *Con.*
 221. *M. SAYI*, *Gray.*

No. 216 is, no doubt, the younger form of *M. solidissima*. All are abundant forms.

Genus, RANGIA, *Desm.*

222. R. CYRENOIDES, *Desm.* (*Gnathodon cuneata*, Gray.)
 223. R. FLEXUOSA, *Con.*
 224. R. ROSTRATA, *Petit.*

No. 222 is better known by Gray's name. The "mound-builders" used this species extensively in constructing their "mounds," of which there are thousands along the Gulf coast, and even so far inland as New Orleans, where the roads are made of this shell, taken from the deposits there. The other species I am uncertain about.

Genus, RAETA, *Gray.*

225. R. LINEATA, *Say.*
 226. R. CANALICULATA, *Say.*

Plentiful on the east coast at St. Augustine and southwards.

Family, TELLINIDÆ.

Genus, TELLINA, *L.*

227. T. CONSTRICTA, *Brug.* East coast.
 228. T. LUSORIA, *Say.* East coast.
 229. T. POLITA, *Say.* East coast.
 230. T. ELEGANS, *Gray.* West coast.
 231. T. TAMPAENSIS, *Con.* West coast.
 232. T. ALTERNATA, *Say.* East coast.
 233. T. DECORA, *Say.* The Keys.
 234. T. TENERA, *Say.* The Keys.
 235. T. BRAZILIANA, *Speng.* The Keys.
 236. T. IRIS, *Say.* The Keys.
 237. T. SUBRADIATA, *Stm.* Mullet Key.
 238. T. RADIATA, *Lam.* Tortugas.

Genus, STRIGILLA, *Turton.*

239. S. PISIFORMIS, *L.*
 240. S. FLEXUOSA, *Say.*

Locality, The Keys.

Genus, SANGUINOLARIA, *Lam.*

241. S. SANGUINOLENTA, *Gmelin.* A West Indian species collected by me at Tortugas. (*Capsa deflorata.*)

Genus, MACOMA, *Leach.*

242. M. BALTHICA, *L.*
 (*Psam. fusca,*) *Say.* East coast.

Genus, SEMELE, *Schum.*

243. *S. EQUALIS*, *Say*. East coast.
 244. *S. LAETA*, *H. & A. Ad.* I have never seen it.

Genus, DONAX, *L.*

245. *D. VARIABILIS*, *Say*. East coast.
 246. *D. PROTRACTUS*, *Con.* Same locality.

Family, SOLENIDÆ.

Genus, SOLEN, *L.*

247. *S. VIRIDIS*, *Say*. East coast.

Genus, ENSIS, *Schum.*

248. *E. AMERICANUS*, *Gould.* Same locality.

Genus, SILIQUARIA, *Schum.*

249. *S. GIBBA*, *Speng.* Syn., *S. Caribæus*, *Lam.*
 250. *S. DIVISA*, *Speng.* (*Solen centralis*, *Say.*) Both are from the east coast at St. Augustine.

Family, MYACIDÆ.

Genus, MYA, *L.*

251. *M. ARENARIA*, *L.* Syn., *M. acuta*, *Say*; *M. mercenaria*, *Say.*
 From the east coast.

Genus, LYONSIA, *Turton.*

252. *L. HYALINA*, *Con.* East coast.

Genus, CORBULA, *Brug.*

253. *C. CONTRACTA*, *Say.*
 254. *C. LIMATULA*, *Con.*

Both coasts.

Family, ANATINIDÆ.

Genus, PERIPLOMA, *Schum.*

255. *P. PAPYRACEA*, *Say.*
 256. *P. LEANA*, *Con.*

Both from the east coast.

Genus, PANDORA, *Brug.*

257. *P. TRILINEATA*, *Say.* Loc., east coast.

Family, PHOLADIDÆ.

Genus, PHOLAS, *L.*

258. *P. COSTATA*, *L.*
 259. *P. TRUNCATA*, *Say.*
 260. *P. CAMPECHENSIS*, *Gmelin.*

261. *P. CUNNEIFORMIS*, *Say*.

No. 258 is the largest and most abundant species. Both coasts.

Family, TEREDIDÆ.

Genus, TEREDO, *Adanson*.

262. *T. NAVALIS*, *L.* Abundant everywhere.

Genus, XYLOTRYA, *Leach*.

263. *X. FIMBRIATA*, *Jeffreys*. Found on vessels and old wood at Key West.

A D D E N D A .

REMARKS.

Having received new material since the main part of the paper was written, and all within the past few weeks, I found myself obliged to make an *Addenda*, or omit altogether a large number of interesting species, which it seemed desirable to add to the Catalogue. For a portion of these accessions I am indebted to Dr. James Lewis, of New York, who thus put into my hands, many forms collected by the late Col-Jewett. I desire again to thank Mr. Tryon, who has kindly compared my specimens with others in the Academy of Natural Sciences of Philadelphia, and identified for me a number of species. I also decided to incorporate in the paper a number of species, which, though not strictly *Marine*, are, however, of such an organization that the vicinity of the sea, with its direct influences, seems necessary to their existence. Some of these, on account of their rarity, are but little known. Of the entire list, I have collected myself two hundred and seventy-seven species. The remainder I add on the authority of others, after careful investigation and correspondence with a number of Conchologists, to all of whom I desire to express my thanks for aid, sympathy and consideration to a degree unexpected by me.

264. ANOMALOCARDIA FLORIDIANA, *Con.* West coast.

265. MODULUS CORRUGATUS, *Stm.* May be a young *M. lenticularis*, *Ch.* Loc., Cedar Keys.

266. MUREX MESSORIUS, *Sowerby.* (*M. trilineatus*, *Reeve.*) Loc., the Keys. Rare.

267. MUREX BREVIFRONS, *Lam.* Cape Sable. Abundant.

268. TROCHUS EUGLYPTUS, *A. Ad.* A distinctly marked species, as heretofore only reported from Texas. Found by Dr. Velie among the Keys.

269. PURPURA LAPILLUS, *Say.* East coast.

270. NATICA PUSILLA, *Say.* East coast.

271. LITHODOMUS LITHOPHAGUS, *L.* Found imbedded in coral at Tortugas.

272. *MODIOLA TULIPA*, *L.* var. *NIGRA*, *Calkins*. From Key Vacaas. Uniformly dark, while *M. tulipa* from same locality is distinctly marked with pinkish rays. May be compared with *M. castanea*, *Say*, but is larger and longer. Both are varieties of *M. tulipa*.

273. *TRITONIDEA TINCTA*, *Con.* Whether different from *T. ringens* *I* cannot determine.

274. *CERITHIUM ATRATUM*, *Brug.* From the Gulf coast.

275. *VENUS (Anomalocardia) FLEXUOSA*, *L.* Common.

276. *COLUMBELLA OBESA*, *C. B. Ad.* Loc., the Gulf coast.

277. *RICINULA NODULOSA*, *C. B. Ad.* A West Indian species. Loc., the Keys.

278. *PLEUROTOMA VEXILLUM*, *Dunker.* According to Mr. Tryon, this species is a variety of *Pl. Zebra*, *Lam.* Loc., Tampa, Fla.

279. *CLATHURELLA BADIA*, *Reeve (?)*. Following the advice of Mr. Tryon, who has compared the specimens with others in the Philadelphia Academy, I give them the above name provisionally. If not this species, it is new. Loc., the Gulf coast.

280. *CERITHIOPSIS TEREBRALIS*, *C. B. Ad.* Loc., Cedar Keys and Tampa.

281. *SIPHONARIA BIFURCATA*, *Kiss.* More elevated than *S. alternata*, *Say.* Loc., the west coast.

282. *BRITTIIUM GIBBERULUM*, *C. B. Ad.* As Mr. Tryon remarks, *Rissoa aberrans*, *C. B. Ad.*, appears to be the same species. Loc., the Gulf coast.

283. *LITTORINA TROCHIFORMIS*, *Dill.* Appears to me quite the same as *L. nodulosa*, *Desh.* Loc., the Keys.

284. *TEREBRA PROTEXTUM*, *Con.* Dredged by me at Cedar Keys. Found also further south.

285. *TIVELA (Trigona) TRIGONELLA*, *Lam.* Loc., Gulf coast.

286. *OBELISCUS*, *sp. indet.* Tampa.

287. *CANCELLARIA STIMPSONII*, *n. s.*, Plate viii, figs. 4-5.

Shell rather small, whitish, rough, nodulous; whorls about four and a half, prominent, finely ribbed; the last large, with a row of nodules on its upper edge, and numerous others scattered irregularly over its surface; the other whorls covered with smaller nodules, the upper part of each flat or shouldered; umbilicus large, flaring outwards; deep; aperture triangular, slightly oval, the upper part square shouldered; lip thin, the outer one somewhat thickened by nodules on exterior edge; two plaits well within the aperture on the columella: length, 17 mill., breadth, 12 mill. Loc., Cape Sable, Fla. My collection.

Remarks.—A single specimen of this new and interesting species was found by Dr. J. W. Velie on the beach at Cape Sable, and from its appearance, had recently been alive. It is in good condition. Believing it to be undescribed, I sent the shell to Mr. Tryon. I cannot do better

than append his "note," returned to me with the specimen: "This is a new species, belonging to the *Trignostoma* group of *Cancellaria*. The genus is very sparsely represented in the West Indies, none of those previously described approaching this. It is somewhat like *C. Verreauxii* of Kiener in general appearance, but differs in having a large umbilicus, and from that and all other species of the genus in the nodules being broken up irregularly over the surface, instead of being in the line of longitudinal ribs. In fact, these nodules seem rather to develop from revolving ribs." I do not know of another specimen ever having been found. I take great pleasure in dedicating the species to the late lamented Dr. William Stimpson, who directed my first efforts in the study of conchological science.

PULMONATA.

Family, AURICULIDÆ.

Genus, AURICULA, *Lam.*

288. *A. PELLUCENS*, *Menke*. This very interesting shell was collected at Punta Rassa by Mr. Prime and Dr. Velie, and at Cedar Keys by myself alive. It has a wide distribution, being quoted from Ceylon, Demarara, and the Antilles, by Pfeiffer, Menke, and others. It is the only representative of the genus in the United States. Mr. Thomas Bland first called attention to the species as existing in Florida in 1874 (*Ann. Lyc. Nat. Hist.*), from specimens collected by Prime. It is certainly not abundant in Florida so far as research has extended. We may account for its presence by the action of equatorial currents, as suggested by Dr. Stimpson with regard to other species of tropical derivation found in Florida.

Genus, MELAMPUS, *Montf.*

289. *M. BIDENTATUS*, *Say*. Abundant north and south to Texas.

290. *M. FLAVUS*, *Gmelin*. A West Indian species collected by Bartlett in Florida (Binney). I searched dilligently, but never found it.

291. *M. COFFEA*, *L.* An abundant species.

Genus, TRALIA, *Gr.*

292. *T. FLORIDANA*, *Shutt.* Collected on the Keys.

293. *T. PUSILLA*, *Gmelin*. Collected by Bartlett (Binney). Found also in the West Indies. This and the preceding species, if not accidentally brought to Florida, are certainly rare.

294. *T. CINGULATA*, *Pfr.* I collected this on several of the Keys.

Genus, PEDIPES, *Adanson.*

295. *P. NATICOIDES*, *Stearns*. This tiny shell, only eleven hundredths of an inch in length, and the only species of the genus thus far detected on the eastern coast, was found by Mr. Stearns near Tampa, and described by him in Vol. XIII, *Proc. Bost. Soc. Nat. History*. It frequents the under side of "coon oysters."

Genus, *BLAUNERIA*, *Shutt.*

296. *B. HETEROCLITA*, *Montf.* (*Voluta.*) (*B. pellucida*, *Pfr.*) The only species of the genus known. Has been found at several different points on the coast. Its generic position seems to be somewhat unsettled. Also found in the West Indies.

Family, *TRUNCATELLIDÆ.*Genus, *TRUNCATELLA*, *Risso.*

297. *T. BILABIATA*, *Pfr.* Abundant on Key West and elsewhere. Also West Indies.

298. *T. PULCHELLA*, *Pfr.* Same localities.

299. *T. CARIBAENSIS*, *Lowb.* Same localities.

300. *T. SUBCYLINDRICA*, *Gray.* I found this species associated with No. 297. The other two species of *Truncatella*, I add on the authority of Pfeiffer, and of Binney and Bland, the latter of whom have included them in their list—L. & F. W. S. N. A.

ADDITIONAL MARINE SPECIES.

301. *CARDIUM MEDIA*, *L.*

302. *SEMELE VARIEGATUM*, *Lam.*

303. *TELLINA LÆVIGATA*, *L.*

304. *TURBO TUBER*, *L.*

305. *NATICA JAMAICENSIS*, *C. B. Ad.*

The foregoing species were lately received by me, and too late for insertion in their regular order. They are from the southern coast of Florida, and have been compared with types in the Philadelphia Museum by Mr. Tryon.

APRIL 6TH, 1878.—BIOLOGICAL SECTION.

Three members present.

Mr. J. G. Haupt had on the table a large number of the early spring wild flowers. He reported that *Acer dasycarpum* blossomed on March 15th, *Hepatica acutiloba* on March 23d, and some fifteen species of field plants were now in blossom.

Mr. J. D. Putnam reported the first appearance of *Vanessa antiopa* on March 23d, and of *Grapta comma* about March 30th

APRIL 12TH, 1878.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Seven members present.

A number of valuable additions to the Library and Museum were reported.

Mr. J. A. Crandall read his report as chairman on the progress of the Section during the first two years of its existence, and of its present condition. He dwelt at some length upon the necessity of preserving the large number of historical documents, books, etc., which are now liable to be lost.

APRIL 20TH, 1878.—BIOLOGICAL SECTION.

Five members present.

Messrs. Haupt and Churchill presented a large number of fresh wild flowers, and some time was spent in their analysis.

Mr. J. D. Putnam reported the discovery, on April 19th, of the male of a species of *Aspidiotus* affecting the soft maple (*Acer dasycarpum*), in company with the more abundant *Lecanium aceris* Fitch. By this discovery the life histories of both species are now pretty well known, with the exception of the embryological development. He exhibited under the microscope the first stages of the eggs now forming in the ovaries of *L. aceris*.*

APRIL 25TH, 1878.—REGULAR MEETING.

Dr. R. J. Farquharson, President, in the chair.

Fourteen members present.

Donations to the Museum and Library, and correspondence, were reported.

Mr. J. D. Putnam reported that the printing of the PROCEEDINGS had been resumed, and that signatures 21-24 had been printed.

Mr. Henry Frahm was elected a regular member.

**L. aceris* Fitch, Trans. N. Y. Agr. Soc., Vol. XIX, p. 775, 1859, = *L. acericola*, Walsh & Riley, Am. Ent., Vol. I, p. 14, 1868.

MAY 21ST, 1878.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Seven members present.

Donations to the Museum and Library were received, and the thanks of the Section voted to the donors.

The Secretary read an interesting letter from Hon. Hawkins Taylor, of Washington, D. C., giving some account of the early county-seat troubles, etc.

MAY 31ST, 1878.—REGULAR MEETING.

Dr. R. J. Farquharson, President, in the chair.

Eleven members present.

The Publication Committee reported that signatures 25-32 inclusive of the PROCEEDINGS had been printed since the last meeting, bringing the record down to March 29th, 1878.

The Corresponding Secretary reported 192 letters and acknowledgments received and 85 letters written during May; that he had distributed 144 copies of the PROCEEDINGS, and had received in exchange and by donation 40 complete volumes and 160 pamphlets and parts of volumes, including current numbers of over 30 periodicals.

The Curator reported a large number of donations to the Museum, among them a large vessel of ancient pottery, and several hundred flint implements, forwarded by Capt. W. P. Hall from Alabama. Many of the flints are of a gray, translucent quartzite, containing numerous opaque, white nodules.

Dr. Farquharson gave an interesting account of the formation of ice on the "Rapids," and stated that he would at an early day read a paper on the subject.

JUNE 1ST, 1878.—BIOLOGICAL SECTION.

Three members present.

Mr. W. H. Pratt read a letter from Prof. S. A. Forbes, of the Illinois State Laboratory of Natural History, regarding the small crustaceans mentioned on page 18 of this volume, specimens of which had been sent to him. He says, "The larger

one proved to be *Limnetis gouldii* Baird, ♂ and ♀—the former more abundantly represented than in its eastern habitat. The smaller one I have temporarily identified as *Cirrotophina angulata* Say. It agrees entirely with Say's description, but that is too incomplete. Say's locality was "swamps of the Southern States," and we cannot fix his species with certainty until collections from the South are studied.

Mr. J. G. Haupt reported two additions to the flora of Scott county, as follows:

Silene antirrhina L. Sandy soil near Walcott. May 28th.

Lithospermum officinale L. Rare in open woods near Valley City. May 13th.

Mr. J. D. Putnam reported that the females of *Lecanirum acericorticis* had commenced to lay their eggs on May 24. He was now engaged in tracing the development of the embryo, and as soon as this is completed would present a paper on the subject.

JUNE 28TH, 1878.—REGULAR MEETING.

Mr. C. A. Ficke in the chair.

Four members present.

The list of donations to the Museum and Library during the month were reported, and the thanks of the Academy voted to the donors.

Antoine J. LeClaire, W. O. Schmidt, and Miss Alla P. Lowrey, of Davenport, were elected regular members. Prof. George H. Cook, Burlington, N. J., and Thomas Bland, New York were elected corresponding members.

JULY 12TH, 1878.—HISTORICAL SECTION.

J. A. Crandall in the chair.

Four members present.

A number of valuable donations were reported; among them a collection of 194 valuable papers from the estate of the late Antoine LeClaire, donated by Antoine J. LeClaire, Esq.

JULY 26TH, 1878.—REGULAR MEETING.

Dr. R. J. Farquharson, President, in the chair.

Nine members present.

A large number of donations to the Museum and Library were reported by the Curator, and the thanks of the Academy were voted to the donors. A collection of over 2,000 flint and stone implements, collected in Mississippi, were received from Capt. W. P. Hall. The Rev. J. Gass, through Mr. Pratt, and in the name of his daughter, Flora Gass, formally presented to the Academy the inscribed tablets of bituminous shale found in the mound known and described as Mound No. 3 of the Cook Farm Group, January 10th, 1877, and the inscribed limestone tablet found in the mound known as Mound No. 11 of the same group, January 30th, 1878. Also, on behalf and in the name of his daughter, Emma Gass, the small carved figure of an animal, with pieces of crystal set in for eyes (Figs. 18 and 19), found at Mound No. 3 above mentioned. These donations are made subject to the following conditions, viz: 1st. That these articles are not to be disposed of by sale, exchange, or donation, but are to remain perpetually in the Museum of the Academy. 2d. They are not to be made or held liable in any way for any debts or obligations of the Academy. 3d. In case of the dissolution of the Academy, these collections are to be transferred to the Archaeological collection of the United States National Museum.

Mr. Pratt presented the following note on a

Curious Relic from the Cook Farm.—[Figs. 18 and 19.]

The "small carved figure of an animal" mentioned in the donation of Mr. Gass, was found in the spring of 1877, while plowing over mound No. 3, from whence it may have been thrown out during the explorations

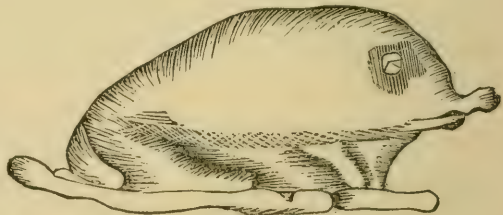


Fig. 18—Side view, natural size.

earlier in the year. It is a natural sandstone concretion, firmly attached, and almost central upon a flat, thin piece of light brown flint, forming a base as perfectly adapted to the figure as if by special design. The ani-

mal has a broad flat snout, resembling the bill of a duck. The lower

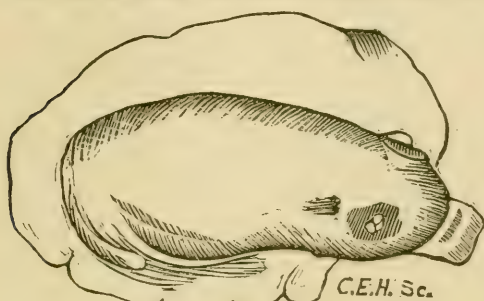


Fig. 19—Vertical view.

parts of the body have been rudely, but distinctly carved to represent tail and limbs. In addition to these improvements upon nature's work, the artist has inserted a pair of eyes, consisting of fragments of crystal—apparently quartz. At least they are hard and sharp enough to scratch glass readily.

These are apparently fastened in with some kind of cement. The flint base is worn as if by much handling. The gleam of the eyes, when placed in a strong light, and the peculiar twist of the head give the creature a most ferocious aspect.

Mr. A. D. Churchill presented the following report :

On the East Davenport Mounds.

On Thursday, July 25th, 1878, a group of ancient mounds in East Davenport were examined by a party consisting of Messrs. W. H. Pratt, Gass, Harrison, C. L. Pratt, Milstead and Churchill. They are situated on the edge of the bluff overlooking the river in Camp McClellan, 300 yards from the southern line, and thirty yards west of the eastern boundary of the Russell estate in Davenport Township. There are three mounds in line with one another, ranging north-east by south-west. They are thirteen to eighteen yards apart. The western and central mounds are each about nine yards in diameter, and two and one-half feet in height. The eastern mound is fifteen yards in diameter and three feet in height. In the two smaller mounds excavations were made seven by four feet, and three and one-half feet in depth. In the larger mound an opening was made nine by eight feet, and five feet in depth. The mounds are of mixed earth, clay and black soil, built upon the original surface soil of the bluffs. Growing upon the central mound are black oaks six to eight inches in diameter. No remains of any kind were found indicating the purpose for which the mounds were constructed.

Mr. W. H. Pratt reported the opening of four Sioux Indian graves at Camp McClellan by a party from the Academy, who secured three good skulls, one of which is especially interesting on account of a bright red stain which covered almost the entire skull.

In view of the recent decease of Prof. Joseph Henry, Secre-

tary of the Smithsonian Institution and an honorary member of the Academy, the following resolutions, drafted by a committee appointed by the President for that purpose, were unanimously adopted, viz :

WHEREAS, It is fitting that an institution professedly devoted to the cultivation of Science, should honor the memory of those who, having been eminent in promoting its advancement by their zeal and talents, have ceased from their labors ; and,

WHEREAS, Prof. Joseph Henry, for more than thirty years Secretary of the Smithsonian Institution, has, by his liberal encouragement of scientific associations, materially aided them in promoting the great objects of increasing and diffusing knowledge among mankind ; by original researches in physics has extended the practical benefits of science to the world at large, and by his uniform gentlemanly courtesy has secured the respect and regard of all true lovers of Science, who now mourn his loss. Therefore,

Resolved, That the Davenport Academy of Natural Sciences unites with similar bodies in offering their sincere tribute of respect to his memory, recalling with gratitude the repeated acts of liberality and kindness received from him in his official capacity, and in his personal encouragement as a friend of Science, that while deploring the loss of his wise counsels, we would seek to improve them by a faithful imitation of his zeal and virtue.

Resolved, That these resolutions be inscribed on the records of the Academy, and a copy of the same be sent to the family of the deceased.

C. C. PARRY,
J. D. PUTNAM,
W. H. PRATT,
Committee.

AUGUST 2D, 1878.—BIOLOGICAL SECTION.

Four members present.

The following paper was read :

Contributions to the Flora of Iowa---No. III.

BY J. C. ARTHUR.

The following accessions have been received since the publication in March, 1877, of my first list of additions.* They have been verified by the examination of specimens sent by those reporting the names. I am indebted for all but ten names to Geo. D. Butler, of Almont, Clinton County, Dr. Geo. E. Ehinger, of Keokuk, R. Burgess, of Ames, E. W. Holway, of Decorah, Dr. J. J. Davis, late of Vinton, and Prof. C. E. Bessey, of Ames. I desire to gratefully acknowledge their kind consideration in furnishing specimens, and the interest they have taken in extending the list of the State flora.

*Ante, p. 126.

- 42^a *Brasenia peltata*, Pursh. Ames.
 52^a *Nasturtium sessiliflorum*, Nutt. Clinton.
 55^a *Nasturtium lacustre*, Gray. Clinton.
 62^a *Arabis hirsuta*, Scop. Clinton.
 66^a *Barbarea vulgaris*, R. Br. Ames.
 97^b *Hypericum sphaerocarpon*, Michx. Vinton and Clinton.
 101^a *Hypericum Canadense*, L., var. *major*, Gr. Vinton, Lyons and Ames.
 112^a *Arenaria stricta*, Michx. Clinton.
 154^a *Vitis æstivalis*, Michx. Clinton.
 177^a *Trifolium reflexum*, L. Vinton and Clinton county.
 196^a *Astragalus Plattensis*, Nutt. Harrison county.
 206^a *Desmodium Illinoense*, Gray. Ames.
 235^a *Spiræa Aruncus*, L. Clinton.
 237^a *Geum Virginianum*, L. Vinton.
 244^a *Potentilla fruticosa*, L. Decorah.
 250^a *Rubus Canadensis*, L. Clinton.
 285^a *Ludwigia palustris*, Ell. Vinton.
 285^b *Ammannia humilis*, Michx. Vinton.
 285^c *Ammannia latifolia*, L. Ames.
 314^a *Cornus circinata*, L'Her. Ames and Vinton.
 364^a *Aster sagittifolius*, Willd. Plymouth county.
 366^a *Aster dumosus*, L. Vinton.
 372^a *Aster puniceus*, L., var. *vimineus*, Gr. Ames.
 374^a *Aster amethystinus*, Nutt. Charles City and Ames.
 428^a *Helianthus occidentalis*, Riddell. Vinton and Clinton.
 435^a *Coreopsis lanceolata*, L. Clinton.
 438^a *Coreopsis aristosa*, Michx., var. *mutica*, Gr. Vinton.
 471^a *Cnicus lanceolatus*, Hoffm. Clinton.
 495^a *Sonchus oleraceus*, L. Cedar Rapids.
 512^a *Plantago Patagonica*, Jacq., var. *gnaphalioides*, Gr. Humboldt.
 525^a *Linaria Canadensis*, Spreng. Cedar Rapids and Vinton.
 590^a *Scutellaria parvula*, Michx., var. *mollis*, Gr. Iowa City.
 606^a *Myosotis verna*, Nutt. Vinton.
 607^a *Echinosperrum deflexum*, Lehm. Clinton.
 615^a *Phlox divaricata*, L. Lyons.
 616^a *Phlox bifida*, Beck. Vinton.
 619^a *Cuscuta tenuiflora*, Engelm. Vinton and Keokuk.
 625^a *Physalis pubescens*, L. Ames.
 696^a *Ceratophyllum demersum*, L. Keokuk.
 697^a *Euphorbia Geyeri*, Engelm. Vinton.
 708^a *Euphorbia obtusata*, Pursh. Ft. Dodge.
 777^a *Potamogeton natans*, L. Ft. Dodge.
 782^a *Potamogeton compressus*, L. Vinton.
 787^a *Sagittaria heterophylla*, Pursh. Clinton.
 818^a *Uvularia sessilifolia*, L. Vinton.
 850^a *Hemicarpha subsquarrosa*, Nees. Ames.
 855^a *Scirpus fluviatilis*, Gray. Ames and Clinton.

- 856^a *Scirpus lineatus*, Michx. Ames.
 862^a *Carex crus-corvi*, Shut. Clinton.
 863^a *Carex conjuncta*, Boott. Ames.
 963^b *Carex alopecoidea*, Tuckerm. Ames.
 879^a *Carex straminea*, Schk., var. *tenera*, Boott. Charles City, Keokuk, Ames.
 885^a *Carex tetanica*, Schk. Ames.
 890^a *Carex oligocarpa*, Schk. Ames and Keokuk.
 891^a *Carex pedunculata*, Muhl. Clinton.
 893^a *Carex trichocarpa*, Muhl., var. *imberbis*, Gr. Ames.
 895^a *Carex Grayii*, Carey. Ames.
 897^a *Carex squarrosa*, L. Keokuk.
 901^a *Alopecurus geniculatus*, L. Vinton, Ames and Lyons.
 931^a *Eatonia Pennsylvanica*, Gray. Ames.
 942^a *Eragrostis pectinacea*, Gray. Vinton.
 943^a *Festuca elatior*, L. Ames.
 950^a *Lolium perenne*, L. Ames.
 953^a *Hordeum pratense*, Huds. Keokuk.
 972^a *Panicum depauperatum*, Muhl. Vinton.

The following descriptions are of plants named in this list, and not described in Gray's Manual. The range of the species, as given, is that hitherto known and published with the respective descriptions. It will be observed that in each instance it is considerably extended by the localities given above.

DESMODIUM ILLINOENSE, *Gray*.—Resembling *D. canescens* in flowers and foliage, and *D. rigidum* in inflorescence and fruit; stem (erect, 3-5 feet) and leaves with short rough pubescence; leaflets (2-4 inches long) ovate-oblong or ovate-lanceolate, obtuse, sub-coriaceous, beneath cinereous, veins and veinlets prominent, strongly reticulated, the lower leaflets nearly equaling the petiole; the persistent stipules and caducous bracts ovate-lanceolate striate, taper-pointed; racemes simple; pods scarcely over an inch, very shortly stipitate, sinuate on both margins (deeper below); joints 3-5, oval, not exceeding three lines.—Illinois, in dry ground. *Proc. Amer. Acad.*, 1870.

SCUTELLARIA PARVULA, *Michx.*, var. **MOLLIS**, *Gray*.—Rather more diffuse, softly pubescent throughout, pubescence somewhat viscid; leaves usually three-fourths of an inch long—Oquawka, Illinois, on the sandy banks of the Mississippi. *Proc. Amer. Acad.*, VIII, 1873. Dr. Gray says: "So different in aspect is this plant from the ordinary *S. parvula*, that I at first took it for *S. Drummondii*, and then for a distinct species; but I cannot detect sufficient characters, and there are transitions to the ordinary *S. parvula*."

ECHINOSPERMUM DEFLEXUM, *Lehm.*—Diffusely branched, a foot or so high; leaves from oblong to lanceolate; racemes lax, loosely paniculate, the slender pedicels recurved or deflexed in fruit; flowers soon sparse, 1-3 lines in diameter; nutlets with a triangular mostly naked back (a line long), the margins armed with a close row of flat prickles, their bases often confluent.—Saskatchewan and Winnipeg Valley, *Drummond, Bourgeau*; Brit. Columbia, *Lyall*. Siberia to Europe. The American specimens have occasionally some few prickles developed from the rough granulate dorsal face of the nutlets. *Gray's Synop. Fl. N. Amer.*, 1878.

CORRECTIONS.

Amarantus Blitum (No. 668), of "Flora of Iowa," is *A. blitoides*,

Watson. The following description is from *Proc. Amer. Acad.*, XII, 1877 :—

AMARANTUS (PYXIDIUM) BLITOIDES, *Watson*.—Prostrate or decumbent, the slender stems becoming a foot or two long, glabrous or nearly so; leaves broadly spatulate to narrowly oblanceolate, attenuate to a slender petiole, an inch long or usually less; flowers in small contracted axillary spikelets; bracts nearly a line broad.—Frequent in the valleys and plains of the interior, from Mexico to N. Nevada and Iowa, and becoming introduced in some of the Northern States eastward. It somewhat resembles the *A. Blitum*, L., of the Old World, and has been mistaken for it.

Aster Novi-Belgii (No. 371) is to be omitted from the list. The specimens on which the determination was made, prove to belong to a much commoner species.

A few very interesting names are withheld for further verification. Collectors will confer a favor if they will forward information in regard to the State flora. It is proposed to publish additions as fast as consistent with accuracy.

Botanical Laboratory, Agricultural College, Ames, Iowa; August, 1874.

The Local Geology of Davenport and Vicinity.

BY REV. W. H. BARRIS.

Read Oct. 16th, 1877.

We are indebted to Prof. Hall for the first detailed description of the rocks in our vicinity. In his report on the Geological Survey of the State of Iowa he has described them under two natural divisions—*first*, limestones of the Upper Helderberg, and *second*, limestones and shales of the Hamilton Group.

The first embraces the series of limestones that stretch away a mile or two above the city, seen in ledges immediately fronting the river, and found also in heavier beds lying back in the bluffs. On Duck Creek is an exposure, attaining a thickness of from thirty to forty feet. Denuded of its uppermost layers, this rock forms the substratum on which Rock Island rests, and into which are sunk the foundations of the various Government buildings now in process of erection. Below Davenport a mile or more it crops out on the river bank, or lies just below the surface soil of the river bottoms. It has furnished abundance of the most durable and massive building material. The latest built stone churches in the city have been constructed of this rock—the Cathedral from the non-fossiliferous quarries above the city, Trinity Church from the fossiliferous quarries below. The character of the bedding is exceedingly variable. There are heavy courses of over a foot in thickness, giving every evidence of toughness and durability. There are layers, splitting into laminae of an inch and less in thickness, the very type of brittleness and decay. A fine grained compact limestone, often alternates with a sub-crystalline form. Strata are distinguished by an extended continuity of surface, or interrupted by irregular masses of clay. And yet what-

ever the character of the rock, there is impressed on it an individuality that makes it impossible to mistake it for any other above or below it. The entire lower portion of the mass seems to be destitute of fossils, the condition of the ancient ocean being to a great extent unfit for the development of animal life.

Prof. Hall considers it the western equivalent of the Onondaga and Corniferous limestones of New York. As in that State, the one often encroaches upon and displaces the other, rendering it difficult to separate or identify either, he prefers the term, "Limestones of the Upper Helderberg." The Ohio geologists apply to the extension of the rock into their State, the name "Corniferous."

The strata succeeding the limestones just described and designated, are known as "The Limestones and Shales of the Hamilton Group." They are as prodigal of life as the rock immediately preceding them was supposed to be deficient. The contrast with the former is as marked in the character of its material and the manner of its deposition, as in the abundance of well preserved animal life.

These "Limestones and Shales," Prof. Worthen of the State Geological Survey of Illinois, has separated into two divisions, each characterized by its own especial series of fossils. Even the localities are pointed out where each division can be studied to the best advantage, and its characteristic fossils gathered. Of these two divisions, as comprising their fossil contents, the Professor thus writes: "There can be no doubt that they represent the organic forms of the Hamilton Group as it appears in New York and Canada."

It is in reference to the limestone immediately underlying these two divisions, (which we have just described as "Limestones of the Upper Helderberg"), that there exists a difference of opinion between Professors Worthen and Hall. Both recognize a certain well defined line of division. They differ as to its significance. Prof. Hall claims it as one of those lines of difference that separate great groups, and hence he claims that all above is the Hamilton, and all below is the Upper Helderberg. Prof. Worthen considers it as simply marking one of the minor divisions of the Hamilton Group, representing a lower member of the same. I use his own language, and give the reason on which he bases his conclusion.* After establishing beyond doubt the equivalency of his two upper divisions with the Hamilton of New York and Canada, he adds: "As no fossils specially different from these have been obtained from the lower bed, we see no good reason for assigning that division to a lower formation." The plain inference being that had he been aware of the existence of such fossils, this knowledge would have necessitated reference of the rock containing them to a lower geological horizon. It is the object of the writer to show the existence of a series of beds of limestone that were necessarily overlooked in the Geological Survey of Illinois, as on the east side of the river they were most imperfectly represented; to point out their relation to the disputed rock in the

*See Vol. V of the Geological Survey of Illinois, p. 223.

neighborhood of Moline and Rock Island, of which it is claimed they form the upward extension; to define the limits within which fossils are found, and to call attention to a group of fossils which distinguish these beds, and differ from any of the well defined fossils of the Hamilton.

On the Iowa side of the river for some years, quarrying has been carried on to such extent that new facts have been gradually accumulating, bearing upon the subject. Examinations have been made from time to time, such as seem to justify the writer in the views presented.

In the locality described by Prof. Worthen—the quarries between Rock Island and Moline—immediately below the well-known shales and limestones of the Hamilton, occurs “a light bluish grey or dove colored limestone, irregularly bedded and concretionary in structure, quite destitute of fossils, except in its upper layers, near its juncture with the shales, where it contains *Phillipsastrea verneuili*, *Alveolites* and *Atrypa reticularis*.” The junction with the shales in some parts is so very gradual that it is difficult to draw the line of separation.

On the Iowa side the passage is distinct and abrupt. With the above named fossils are associated on the surface of the ground huge masses of *Cyathophyllum coalitum*, *Favosites hemispherica*, *Cladopora Fischeri*, with various species of *Zaphrentis*, *Alveolites* and *Stromatopora*, which, though now detached from each other, at a distant day were no doubt consolidated into a coral reef. Immediately underlying these, in each of the three quarries below the city, are a series of rough, irregular beds, varying from two to eight inches in thickness, and measuring in depth two or three feet. They are crowded with fossils having no place in the Hamilton. The surface is roughened with the broken valves of a shell, in external form closely resembling a *Renssellæria*. In one portion of each quarry these take the form of casts, and a continuous reef is presented to the eye, the greater number partially weathered, but so imbedded in the matrix that while they exist by the thousand to the thickness of a foot or more, and almost to the exclusion of any other form, yet it is difficult to extricate a single individual from the mass without breaking it, and its condition, then, is beyond the possibility of identification. These beds are wanting in the locality between Rock Island and Moline. Underneath them we find the same fine grained grey or dove colored limestones which are exposed in these quarries, and, I may add, with their characteristic fossils. The series then, as a whole, is only found on the Iowa side of the river.

Above these beds and to the south of the quarries—in immediate contact with them—we have as its uppermost limit the limestone of the Hamilton. Its lower limits are equally marked, not only by a zone below which fossils rarely appear, but there is a decided change in lithological character. To the close grained compact limestone succeeds a rough rock, concretionary in appearance, closely approaching the character of chert. In Cook’s quarry (and I suppose the same would hold true in reference to Smith’s), the workmen only blast down till they come to what they call “the flint rock.” Mr. Cook told

the writer he could at once recognize the presence of this rock by the peculiar ring it gave back to the stroke of the iron bar, even though its surface was covered deep by water.

This series of beds, then, seems to be well defined in both its upward and downward limits—the Hamilton above, this “flint rock” below. Its thickness is variable, averaging from twelve to twenty feet, of which at times one quarter is made up of these upper broken uncontinuous layers, only found, so far, on the Iowa side of the river.

The following table exhibits not only the succession of strata, but the localities in which such succession has been studied :

No. 5. Uppermost limit; loose masses of coral scattered over the surface.

No. 4. Thin strata of shattered broken layers; crowded with valves of *Renssellaeria* and remains of *Crinoidea*; thickness three to four feet.

No. 3. Bed of compact mass of casts of *Renssellaeria*; thickness one and one-half to two feet.

No. 2. Dove colored compact limestone; ten to twelve feet.

No. 1. Concretionary; thickness unknown.

	Rock Island and Moline.	Cook's Quarry.	Intermediate Quarry.	Smith's Quarry.	Milan.
No. 5.....	* (1)		* (2)		* (3)
No. 4.....		*	*	*	
No. 3.....		*	*	*	
No. 2.....	*	*	*	*	*
No. 1.....	*	*	*	*	

Presence in quarry denoted by a *.

(1) In thin layers. (2) Scattered on surface. (3) Consolidated into reef.

One of the most marked characteristics of these beds is the frequent recurrence of large cavernous openings of greater or less extent and irregularity. They have the appearance of having been worn out by the action of running water. They are filled with foreign material, derived, no doubt, from higher rocks in the series. Prof. Hall, in his *Geology of the State of Iowa*, Vol. I, pp. 84 and 130, has called attention to and described several such instances occurring in the Helderberg. In the quarries we are examining, these reservoirs of foreign material may be resolved into three classes, referable to the material with which the cavity is filled.

First are those filled with sand and sandstone. This sand exists in very fine grains, of a white or greyish white color, occasionally stained with iron. In some portions it is no unusual circumstance to find pebbles and rolled stones. So far no fossils have been discovered in it belonging to the mass. It is most probable this sand has filtered through

from some member of the coal measures. It could hardly have belonged to a later formation.

In other cavities occurs a tenacious blue or greenish clay, having somewhat the appearance of a fire-clay, and to some extent used for that purpose, how successfully I know not. It possesses a uniform consistency, varying little in character or color with the depth to which it has been exposed. It is so difficult of removal that the quarrymen leave large masses of it in place after removing the surrounding rock, so that in the quarries they still stand up in pyramidal forms, or in case the quarries are overflowed with water, they constitute the islands appearing above the surface.

In passing I would call your attention to what appears to have been a regular subterranean water course. In Cook's quarry is a mass of clay, twenty or thirty yards in length, three feet broad, and in depth extending down nearly if not quite to the "flint rock" before referred to. No workman could lay up a series of stone layers presenting a better facing than that exhibited by these walls. The curves are frequent and gradual. The filling of clay is so difficult to deal with that the workmen blast down to "flint rock," then cross over and begin their work on the other side. While so firm is the clay, that after the rock has been removed from its sides, it maintains its erect position, and for days in pleasant weather retains all the impressions made by the abutting rocks. This blue clay, whether confined in cavity or extended in this ancient water course, is of the same character as that described by Prof. Hall as occurring in the quarries between Moline and Rock Island, and which he regards as having originated in the coal measures, finding in it in that locality a *Euomphalus*, distinct from any in the surrounding rock, and very similar to a carboniferous form. This, then, is no doubt the origin of the blue clay.

But we come to a fact new to science, as first developed in these quarries. Side by side with these reservoirs of sand and clay from the coal measures we have immense cavities, filled with the soft *shale* of the Hamilton*. The bedding is generally irregular, no doubt in its lower part conforming to the irregularities of the rock in which it has been deposited, in the upper partaking somewhat of the irregularities of the roof, yet everywhere preserving traces of the layers.

The gentleness of the deposit may be inferred from the fact that this shale is crowded to repletion with immense numbers of the smallest shells of the Hamilton, in the most complete possible state of preservation. Within the space of a few feet, after every rain, hundreds of the small *Chonetes*, with even their spines preserved, are washed out.

*Some of these cavities are distinguished by huge masses of carbonate of lime, most generally presenting the appearance of a crowded, confused acicular crystallization. The form of the mineral, in some instances, suggests its having been originally suspended from the roof of the cavity, and then by some means being detached and precipitated into the clay. Other specimens have every appearance of having been formed where found, as they partake of all the irregularities in the deposits of the clay by which surrounded, while others still have been rounded by the action of water until they are worn quite smooth. Fossils are scarce in this class of cavities.

Cyrtina appears in numbers, some no larger than a kernel of wheat. There is no end to the young of *Strophodonta demissa*, *Strophodonta perplana*, *Orthis runsemi*, *Spirifera sub-attenuata*, etc. The most frail coralline forms generally preserved only on the surface of the hardened shale, fronds of *Fenestella*, *Ptylodictya* and *Tentaculites* here lie loose in the soft matrix. These tender children of the Hamilton have been so cared for and kindly protected through ages, that to-day in these reservoirs may be obtained more numerous specimens of the young, and in a finer state of preservation, than from the same area in any natural exposure of the rock itself. It is a simple question: With no marked natural exposure of the shale about us for miles, how and whence came this shale into its present position? The nurse is here the rough old *Helderberg*, holding the children fondly and lovingly to her bosom; but the mother herself is absent, and has been for ages.

It is mainly in their fossils that these beds present especial points of interest. I have had occasion already to speak of the *Renssellaeria* as they form continuous reefs of more than a foot in thickness, or as their broken valves lay scattered on the surface of the upper layers, extending downwards to the depth of three or four feet. In addition to this abundant fossil, and in the same beds, have been found the remains of *Crinoidea* in great numbers. It is only within a short time that two have been found in such state of perfection as to warrant a full description. These forms are all limited to the uppermost beds so well defined on this side of the river. Underneath these we find a rock corresponding to the disputed beds between Moline and Rock Island, and common to all the quarries we have examined. On lithological grounds alone the two would be pronounced equivalents, while some of the same fossils are found in both, serving still further to identify them. In this rock are found *Gypidula lacriuscula*, Hall, *Spirifera subundifera*, Worthen, *Calceocrinus Barrisi*, Worthen, and *Phrugmocerac Walshii*, Worthen. A *Conocardium* has been found in marking and size so similar to *Conocardium trigonale*, Hall, that there is scarce a doubt of its identity. Of undescribed fossils, part of which are now in process of description, we have three species of *Crinoidea*, the remains of *Ganoidea*, a large *Trilobite*, one *Rhynchonella*, two *Gyroceras*, and one *Aricula*. In addition are quite a number of fossils in too poor condition to admit of description, mainly casts. Among these are the genera *Euomphalus*, *Bellerophon*, *Platysotoma*, *Orthoceras*, *Gomphoceras*, and *Platyceras*.

It is a remarkable fact that of the whole number of fossils thus far enumerated, *not one*, in this locality, is found in either of the two divisions Prof. Worthen describes as fairly representing the Hamilton Group. Prof. Hall recognized the rock as containing "few fossils," neither identifying old or describing new species. Prof. Worthen published that no fossils were found in it differing from the Hamilton. This was a necessary result at the close of the respective State Surveys, of which they were the Geologists in charge. The quarries since opened have furnished facts then unknown. The following list of fossils are found in the rocks

claimed as the Upper Helderberg, *none* of which are found in the Hamilton proper. The localities are also given. A star (*) denotes presence.

	Rock Island and Moline.	Cook's Quarry.	Intermed'te Quarry.	Smith's Quarry.	Milan.
<i>I.—Fossils Already Described.</i>					
Spirifera subundifera.....	*			*	*
Calceocrinus Barrisi.....	*				
Gypidula occidentalis.....	*	*	*	*	
Gypidula laeviuscula.....	*	*			
Renssellaeria Johanni.....		*	*	*	
Conocardium trigonale.....				*	
Phragmoceras Walshi.....	*	*		*	
<i>II.—Fossils in Condition to be Described.</i>					
Megistocrinus.....		*			
Crinoidea, two new species.....		*			
Trilobite.....		*			
Rhynchonella.....		*	*	*	
Gyroceras.....		*		*	*
Avicula, two species.....				*	
<i>III.—Fossils in Poor Condition.</i>					
Crinoidea, three species.....		*		*	
Euomphalus.....		*		*	
Bellerophon.....		*	*	*	
Platystoma.....		*		*	
Orthoceras.....		*		*	
Gomphoceras.....		*		*	
Platyceras.....		*		*	
Paracyclas.....		*			
Stromatopora.....		*			

The present paper, as its title implies, deals exclusively with our local geology, facts as gathered from our immediate neighborhood. We do not claim that the same state of things in all its minutia of details characterizes other localities. But the general principle will be found to hold good, and as time goes on we hope to apply it. While we admit that possibly hereafter some of the above forms may be found penetrating into the Hamilton proper, it is equally possible that with more extended quarrying more new species will be discovered, confined to the lower rock.

If asked why we do not find some of the prevailing forms of the Upper Helderberg, we know no better reply than the following: A friend and accomplished geologist writes, "You ought to find, if your rock is Corniferous, some characteristic mollusks as *Euomphalus De Cewi*, *Conocardium trigonale*, *Pentamerus aratus*, *Paracyclas proavia*, etc." In the same letter he specifies as exclusive and diagnostic species of the Hamilton of Ohio, *Spirifera mucronata*, *Tropidoleptus carinatus*, *Pterinea flabellum*, *Nyassa arguta*, etc. It is remarkable that in the Hamilton of Iowa, here or elsewhere developed, *not one* of these fossils find place. We are necessitated to rely on an entirely different series to determine the Hamilton of Iowa. We look for *Orthis Iowensis*, *Spirifera pennata*, *Spirifera aspera*, *Spirifera subattenuata*, forms unknown to the Hamilton of Ohio. The inference is valid, that if we are necessitated to look to Iowa for the characteristic fossils of the Hamilton, why may we not look to Iowa for the characteristic species of the Corniferous.

As aids in the identification of our rock, we have first, characteristic fossils of the Helderberg; secondly, the occurrence of closely representative species; and thirdly, the *general aspect* of the whole as a whole. Under the first head we have the *Gypidula leviuscula*, Hall, figured from the horizon of the Upper Helderberg of Iowa. The *Renssellaeria Johanni*, Hall, is also from the Upper Helderberg of Iowa. Our *Conocardium* is undistinguishable from the *Conocardium trigonale*, Hall, of the Corniferous limestone of New York. As closely representative species, our *Gyroceras*, seem to have their affinities with those figured from the Corniferous in the Geological Report of Ohio. A *Paracyclas* here occurs, closely resembling the *Paracyclas proavia* of the Corniferous, the *genus*, as such, mainly confined to the Upper Helderberg. The massive plating of our *Ganoidea*, with its array of stellate tubercles, at least recalls the description of the *Macropetalichthys Sullivanti*, Newbury, of the Ohio Geological Reports. The general aspect of the whole series of fossils is widely different from that of the Hamilton.

We do not disguise the fact that intermingled with the above fossils, and especially through the lower parts of the rock, occur many of the same fossils that are found in the Hamilton. Elsewhere they are common both to the Hamilton and Upper Helderberg, and are of no stratigraphical importance. Such, for instance, are the *Atrypa reticularis*, *Atrypa rugosa*, *Athyris vittata*, *Strophodonta demissa*, and others. The position taken by Prof. Hall, and maintained solely on lithological grounds, that the Upper Helderberg is developed in our vicinity, seems thus fully supported by paleontological evidence. With a knowledge of the fossils above enumerated, there is every reason to suppose Prof. Worthen would not hesitate to refer them to the same geological horizon.

If there had been no natural lithological division, if these fossils were only on the surface, if one or two species were alone represented, if they were insignificant in character, their evidence might possibly seem of little weight. But the opposite is true in each particular. There is a well recognized natural distinction. The fossils extend through a thick-

ness of from ten to twenty feet; more than twenty species of fossils are represented. These forms are very marked, some of them in strong contrast with anything above or below. The representatives of seven great classes—*Echinodermata*, *Brachiopoda*, *Gasteropoda*, *Cephalopoda*, *Crustacea* and *Pisces*—ask for a place—their *own place*—in the Helderberg. They enter a standing protest against any attempt to deprive them of their rights. From the very first they abominated the influx of this Hamilton mud into the clear waters of their quiet homes.

This paper claims:—

1. The discovery of beds on the Iowa side of the river that have not before been described.
2. It determines their true relation to the disputed rock between Moline and Rock Island.
3. The two taken together form a series comprised between well-defined limits—the Hamilton above, the so-called “flint rock” below.
4. They contain a series of fossils, entirely differing from any in the Hamilton Group.
5. Their general affinities seem to be with the fossils of the Corniferous, or Upper Helderberg.
6. Of this rock, we conclude they form the upper and fossiliferous member.
7. If common opinion as to the thickness of the group is correct, it must attain to nearly one hundred feet, of which the upper twenty feet contain the fossils enumerated in this paper.*

SEPTEMBER 13TH, 1878.—HISTORICAL SECTION.

J. A. Crandall in the Chair.

Twelve members present.

A number of donations to the Library were reported. The evening was spent in an informal talk on historical matters.

At a meeting of the Trustees, held September 13th, 1878, the following resolutions, presented by W. H. Pratt, were unanimously adopted :

Resolved, That Dr. C. C. Parry be invited to deposit his botanical collections and conduct his investigations in the building of the Academy, and that the “ Botanical Room,” or such other room as may for the time being be more convenient, be placed at the disposal of Dr. Parry for the above purpose.

Resolved, That Dr. Parry be invited to take charge of the Botanical Collections of the Academy.

*See Geological Report of the State of Illinois, Vol. V, p. 222.

SEPTEMBER 14TH, 1878.—BIOLOGICAL SECTION.

Three members present.

Mr. J. D. Putnam stated that among the collections recently brought from Mexico by Dr. C. C. Parry, were two fine specimens of *Thelyphonus giganteus*, Lucas, from Saltillo, called "Vinagrillo" by the natives, from the fact that when disturbed it emits an odor resembling that of vinegar. It is reputed to be venomous, and to sting by the tail! There are also several specimens of both sexes of a species of *Gluvia*, found commonly under stones in the vicinity of San Louis Potosí. The female of this species does not appear to differ essentially from the *Gluvia praeox* of Koch, while the male appears to be *Gluvia cinerascens* Koch, the two sexes showing a remarkable difference in the structure of the mandibles, as has already been noticed in the *Galeodes pallipes* Say, and *G. subulata* Say.

The following papers were presented:

Descriptions of some Species and Varieties of North American Heteroceræ, mostly new.

BY HERMAN STRECKER.

HYPOPREPPIA CADAVEROSA, N. Sp.

(Plate IX, fig. 4)

Size and shape of *H. Miniata*, Kby; head and body pale ochre yellow; antennæ black; tarsi black. *Upper surface*: Primaries same pale ochraceous as the body, and with three broad pale slate colored bands arranged in the same way as in *Miniata*, K., and *Fucosa*, H., but these bands are broader than in these species, leaving less of the pale ground color visible; fringe pale slate color. Secondaries, same color but somewhat paler than the primaries; costal margin pale slate color; exterior margin with a rather broad border of same color. *Under surface* as above, but paler.

A number of this species were taken by H. K. Morrison in Colorado in the summer of 1877. The example from which the above description was drawn I received from Mr. W. Geffcken, of Stuttgart, Germany, who bought it along with other species from Morrison.

ARCTIA GENEURA, N. Sp.

(Plate IX, fig. 5 δ).

♂ expands $1\frac{3}{4}$ inches. Head flesh colored between the eyes, paler and yellowish above, and with a black spot; palpi blackish; thorax pale flesh color as in *Virgo* and allies; the prothorax with two black stripes; the thorax with three, one in the middle and the others on the tegulæ; abdomen scarlet, same shade as in *Phyllira*, Dru., with a dorsal row of black spots, and another row of smaller spots on the sides; beneath pale flesh color, with two rows of small

black spots. *Upper surface*: Primaries; pale yellowish flesh colored, with black spots or marks, to-wit: three basal, the one of which nearest the inner margin is longitudinal, the one nearest the base at costa also longitudinal, its fellow exterior to it oval; these three basal spots are succeeded by two others, the costal lunate, and the one at interior margin rhombus shaped; following these is one very large irregular, somewhat triangular shaped mark, extending from costa two-thirds across the wing; opposite to it at inner margin is a very small oblong mark; between these and the outer margin are three triangular spots, that at costa being the largest, the other two, one of which is at inner angle, are nearly of one size; at apex is a lunate spot, at middle of exterior margin a large, triangular spot, and towards inner angle a very small spot. Fringe same color as ground of wing. Secondaries same scarlet as upper side of abdomen; a sub-marginal row of three large black spots, the innermost of which touches the outer margin near the anal angle; the outermost merges into the rather narrow black costal border not far from the apex; apex with a narrow black mark; in the middle of the exterior margin is a small triangular spot; two other spots connect with the costal border; a small round spot at the outer extremity of discal cell, and another half way between it and the abdominal margin. Fringe same pale yellowish as the ground color of primaries. *Under surface*: All wings pale yellowish; primaries darker along the costa; secondaries tinged with pink towards the abdominal margin; all the spots of the upper surface exactly repeated, but not as deeply black as above.

Described from one ♂, for which I am indebted to the kindness of Mr. G. H. French, of Carbondale, Ills., who stated that he received it from Gilpin County, Colorado, at an elevation of about 8,500 feet. In general appearance this fine insect reminds one of *A. Phyllira*, Dru., its nearest ally, but it is larger, and the black marks of primaries are much more numerous than in that species. *A. Virgo*, L., *Intermedia*, Stretch, *Parthenice*, Kby.; and *Achaia*, Grote, are separated from it by having the venation through the black marks of primaries conspicuously designated by being of the same pale color as ground of wing. From *A. Behrii*, Stretch, it is easily distinguished by the black thorax of the former.

ARCTIA QUADRANOTATA, N. Sp.

(Plate IX, fig. 6 ♀.)

♀ expands $1\frac{5}{8}$ inches. Head, antennæ, thorax and legs entirely black; abdomen above vermilion red, with a dorsal row of large, black, confluent spots; beneath black. Primaries elongate and narrower comparatively than in any other North American species known; upper surface deep uniform black, with two conspicuous, but not large, yellowish white, egg-shaped spots, with the narrow end directed towards the inner margin; the larger of these spots is within the discoidal cell, towards, but not at its outer extremity; the other, which is less than half the size, is half way between the last described spot and the exterior margin; fringe black. Secondaries vermilion; a rather narrow black costal border; a broad black border to exterior margin, which extends inwards in a blunt point at the middle of its inner edge; fringe black. Under surface same as above, but less intense in color, and with a third small whitish spot in primaries, situated at the base.

This species, so totally unlike any previously described, I received from Texas in several examples; there are also examples in the Museum of Comparative Zoology at Cambridge, likewise from Texas.

NEMEOPIILA PLANTAGINIS, L., variations.

Ab. HOSPITA *Schif.*

(Plate IX, fig. 2 ♂.)

Ab. GEOMETRICA, *Grote.*

(Plate IX, fig. 3 ♂.)

Of all species comprised in the genera of the *Arctiidae*, none present, perhaps, variations to the extent exhibited by the present, either in the old or new world. In the ordinary form the primaries are black; with very pale yellowish marks, the secondaries yellow, of a deeper tint, with black marginal, sub-marginal, and basal marks. It was redescribed by G. and R. in 1873 under the name of *Cichorii** from a Californian example. Their type I have examined—it and another Californian form nearly like ab. *Matronalis*, which they also described as new, naming it *Caes-pitilis*,† are undoubtedly only *Plantaginis*. Of *Cichorii*, the authors founded its distinctness mainly on the fact of its having totally black fringes to the wings. In direct refutation of such an assumption is the fact that five European examples now before me have all fringes entirely black; another has them partly black and partly yellow.

Another form has the ground of the wings white. This is the ab. *Hospita*, *Schif.*, figured on the accompanying Plate IX, from one of a number of examples taken by Mr. Th. Mead in Colorado some years since; these agree with the examples of the white aberration from Europe in every respect; I can find no difference. To this form is also allied the *Petrosa*‡ of Walker.

In juxtaposition to these albinous examples are a number of *melanos*, also from Colorado, in which the primaries are black, with some white bars or spots, and the secondaries entirely black, with or without a small white spot not very far from the anal angle. This form was first described by Grote as a *Zygænid*‡ and placed in a new genus (*Eupsychoma*), which he created for its reception.

But there can be no doubt that all these Colorado forms are but variations of the one very variable species *Plantaginis*. I have seen intermediate examples of all those above alluded to from both continents. The most extreme of the black examples are American (from Colorado). I have seen none from Europe with such totally black secondaries, though some come very near. Of the ♀ form, with red hind wings, I have seen no American examples, though I have little doubt but that they will in time be found to occur here. The variation in color in different examples of the same species in the *Arctiidae* is beyond all precedent, and in some instances, as in those above alluded to, as well as others I am about to mention, has led to the describing of many of these varieties as distinct species. The three different forms, with their endless variations, comprised in Stretch's genus *Leptaretia*, i. e. *L. Lena* and *Decia*, Bdl., and

*Trans. Am. Ent. Soc., I, p. 338, t. vi (1868).

†Trans. Am. Ent. Soc., I, p. 337, t. vi (1868).

‡Cat. B. M., III, p. 626 (1855).

§*Eupsychoma Geometrica*, Grote. Proc. Ent. Soc., Phil., IV, p. 318, t. II (1865).

Dimidiata, Stretch, are doubtless but the yellow, red and black varieties of one and the same species. *Callimorpha Dominula*, L., occurs with yellow and black hind wings, as well as crimson. *C. Hera*, L., is found with both red and yellow secondaries. *Arctia Persephone*, Grote, has a variety, with inky black abdomen and secondaries. This has been described as a separate species by Grote under the name of *A. Anna*. *Arctia Figurata*, Dru., occurs with black as well as scarlet inferiors. *A. Achaia*, G.-R., *Virgo*, L., *Parthenice*, Kby., *Nais*, Dru., and *Phyllira*, Dru., all are found in both the yellow and red winged forms.

In fact, with the exception of *A. Yarrowii*, and a few others, that are as yet only known by the types, or one or two other examples, *A. Virguncula*, Kby., is, I believe, the only species of all those known to me in nature in which I have seen no variation from the normal yellow type, unless the insect lately described by myself as *A. Oithona* be a red-winged variety of it. None, however, present a greater number or more astounding variations than the common *A. Caja*, L., found in both the old and new world. Those found in North America were considered a distinct species and described as such by Dr. Harris, under the name of *A. Americana*, on account of having the front of the collar edged with white. This distinction, however, failed in validity when examples were also found in Europe having likewise the white collar. Ordinarily this species has white primaries, with broad brown diverse shaped marks, which latter cover the greater part of the surface, and orange colored secondaries, decorated with many large black and steel colored spots, these spots varying considerably in number and size in different individuals; but examples occur in which the brown marks of primaries are reduced to very inconsiderable spots or streaks, completely altering the whole appearance of the insect. Another and more startling aberration is one in which the primaries are entirely uniform brown, and the secondaries entirely black; both of these monstrosities are figured in Humphrey's British Moths. Other examples occur with the secondaries yellow, and finally Dr. Staudinger discovered in Syria, in 1875, a local form, in which the secondaries of the male were pure white, and those of the female very pale orange; the brown marks on the primaries were very insignificant; this variety was described by Dr. S. as *Caja* var. *Wiskotti*.

Thus I might go on almost endlessly enumerating varieties without number, but enough have been alluded to to give some idea of the extraordinary freaks, be they climatic or otherwise, to which these insects are subject. That the aberration of *Caja*, figured by Humphrey, with wholly brown primaries and black secondaries, is a suffused example, in which the dark color of the markings predominated to the total exclusion of the pale ground, is easily to be inferred, though not to be explained; but why some examples should have yellow hind wings, and others found only in a certain locality, should have them white in one sex and orange in the other, is a matter as yet to me totally inexplicable.

HALESIDOTA AMBIGUA, N. Sp.

(Plate IX, fig 7 ♂.)

Expands nearly two inches. Top of head brown, around eyes rose colored; palpi rose colored; antennæ pale brown; collar brown, edged anteriorly with rosey; thorax above, brown on patagiæ and shining whitish gray dorsally; beneath paler brown; tarsi pinkish; abdomen above and at sides densely pilose, being covered with long, silky, pink fur, with no signs of the sutures between the segments at all visible; beneath not as bright, more of a reddish grey color, and not more heavily scaled than ordinary, each segment being distinguished at a glance. Upper surface; primaries silvery white, with a somewhat greyish tinge, and having a slight tendency towards being semi-diaphanous; the fringe, the edge of costa, the exterior and interior margins, and all the veins edged with brownish, which confines the whitish ground to the cells; secondaries same silvery white as primaries and immaculate. The under surface as above, but the brown color not as dark and more inclined to redish, especially on edge of costa of primaries; the costa of secondaries with a redish brown margin.

Habitat, South-west Colorado. Taken by the party on the San Juan Reconnaissance in the summer of 1877, and by accident was omitted from the report on the insects collected by that expedition.

Mr. G. H. French, of Carbondale, Ill., on one occasion sent me by mail for examination a small box of *Lepidoptera*, among which were the previously described *Arctia Geneura*, and an example of what I now believe to have been this species. But the contents got damaged during transport to such an extent, that in the debris of different examples the fragments of wings could not be identified as belonging to the wreck of the body part, and from the remains of the pink abdomen I thought at the time it might be *H. Edwardsii*, Paek. (*Phæoptera Quercus*, Bdl.), but since receiving the above example, I am nearly sure that the one sent by Mr. French was of the same species; he also received it from Colorado. It is without exception the handsomest and most remarkable species of the genus *Halesidota* yet found in North America.

SCHINIA GULNARE, N. Sp.

(Plate IX, fig. 1.)

Expands $1\frac{3}{8}$ inches. Head, olivaceous; body, brilliant pale metallic olivaceous or greenish gray; beneath grayish, and not so brilliant. Uppersurface, primaries shining silvery greenish gray or olivaceous, somewhat of the tin of *Plusia Modesta*, Hüb., but far more lustrous; three silvery lines cross the wing; the first, or sub-basal, is straight until almost to costa, whence it turns inwards towards the base at an acute angle; the second starts a little beyond the middle of inner margin, from whence it extends in a curve towards, but not to the apex; not far from the costa it too is bent abruptly backwards, forming an acute angle; half way between the last described line and the outer margin, and curved in nearly the same manner, and with the tooth or point formed by the bend near costa, touching the exterior margin a little below the apex, is the last or third line; between this latter and the exterior margin, and resting on the last is an oblong, pointed at both ends, patch of deep gold; another smaller golden mark is nearly at apex. Secondaries much the same color as primaries near and at exterior margin, but paler on all the interior parts; all fringes silvery gray. Under surface somewhat same color as above, and nearly as brilliant, but devoid of the three transverse lines, and also of the golden patch on primaries; the latter are pale at edge of costa, and two short pale lines are at the costa on the exterior third of wing; apex with a

golden reflexion. Secondaries with obscure discal dots, and marginal and sub-marginal bands or lines.

From Mr. G. H. French; one example taken in Illinois; exact locality not stated.

I know of no North American Noctuid that equals this in splendor. It reminds one in a measure of *Plusia Illustris*, F., and *Modesta*, Hüb., in the tints, and somewhat in general resemblance, but its metallic silvery sheen far excels these or any other *Plusia* I have ever seen. It may, according to American ideas, seem to deserve the distinction of being placed in a separate genus, but I believe it is unnecessary to take it from the group that contains *Trifascia*, Hüb., *Gracilentia*, Hüb., *Nedia*, Morr. etc., which, though it exceeds them all in size and beauty, are apparently its nearest allies.

On some Hybrids between *Callimorpha Lecontei*, Bdl., and *C. Interrupto-marginata*, De Beauv., figured on Plate IV, figs. 5, 6, 7.

BY HERMAN STRECKER.

Callimorpha Interrupto-marginata is, especially for an *Arctian*, a most remarkably constant species, presenting scarcely any variation in different examples, whilst to the contrary in *C. Lecontei*, the number of varieties and aberrancies that occur are almost without parallel, and have resulted in the describing of what were supposed to be four distinct species, three of which, however—*Confinis*, Wlk., *Contigua*, Wlk., *Fulvicosta*, Clem.,* are only varieties, though very marked ones, the last named one being entirely immaculate, devoid of all blackish marks whatever; but besides these many more just as remarkable departures from the stem form are found, and without exaggeration I may safely assert that in my own collection are at least twenty well defined forms of this species (*Lecontei*). Of *Interrupto-marginata* I have never seen a variety that was of importance enough to deserve notice. Of the third North American species, *C. Clymene*, Esp., found in the Southern States, I have an immaculate form, all pale yellow, without any dark marks, thus resembling the variety (of *Lecontei*) *Fulvicosta*, except that it is yellow, whilst the latter is white.

Last year I received from a friend in Southern Indiana a box full of *Lecontei* in many varieties, as well as a number of *Interrupto-marginata*, the latter, as usual, quite constant. But among this lot were also a number of examples that at first fairly puzzled me. They were marked exactly like some varieties of *Lecontei*, and one was immaculate like the var. *Fulvicosta* of that species; but the ground color of these was a pale buff, a little darker than in the primaries of *Interrupto-marginata* instead of being white; but independent of this uniform yellow color of all wings and body, they were to all intents *Lecontei*. That they were not a new species I felt certain, and of course the next thought that suggested

**C. Vestalis* Pack., and *Tanada Conscita*, Wlk., are synonyms of this form.

itself was miscegenation. In this surmise I was correct, as I afterwards was enabled to fully prove.

The accurate collector, who was not a naturalist, had put a ♂ *Lecontei*, and a ♀ *Interrupto-marginata* on one pin, he having taken them in copuli. On a little piece of paper attached to the pin he had noted that fact, and written, "male and female, as you may see." So they were too, but not of one species, as he, in his sagacity, had imagined they were. It seems that after pinning there still was life enough left in the female to enable her to deposit some eggs in the box ere she was quite dead. These I took out, and in due time the larvæ emerged. As usual, the greater number died before maturing, but three carried successfully through, two producing the originals of Figs. 5 and 6 on Plate IV. Fig. 7 was drawn from one of the captured examples sent to me by my friend. The larvæ were black above with rich yellow dorsal and lateral lines, the latter somewhat irregular and broken; also with rows of raised blueish black tubercles, from whence proceed tufts of short bristles. Beneath it is pale grayish, with darker marks. Head black. Feet black, prolegs black outside, pinkish on the inside. They were fed on the most convenient thing that offered, *i. e.*, the leaves of a weeping willow that grew on the pavement near at hand, and afterwards on the Morris white peach trees that grew in my garden.

The moths, as the figures on accompanying plate show, are marked as the male parent *Lecontei*, whilst the ground color is that of the maternal relative *Interrupto-marginata*. The examples are, in size, a little below the average of either parent.

From the large number of these hybrids I received, independent of the three bred, it would appear that hybridism in a state of nature with these species is very common. Nor do I imagine it to be as rare with other *Lepidoptera* as is generally supposed, as I have little doubt but that many of the examples of *Argynnidæ*, *Catocalæ*, etc., so puzzling to collectors, are nothing more than bastards, the product of allied species.

The Larva of *Samia Gloveri*, Streck.

BY HERMAN STRECKER.

A number of living pupæ of this heretofore exceedingly rare species have been received within the last year from Utah, where it appears to be as common as *Cecropia* is with us in the East. From the moths developed from these pupæ, ova have in some instances been obtained, and several entomologists, myself among the number, have been successful in rearing the larvæ.

On first emerging they were black. After moulting for the first time they have the appearance of being black and yellow mixed; after the second moult they were lemon yellow, with all the tubercles black; after the third moult the color was pale green, with the two dorsal rows of tubercles coral, or rather of a bright rust red, and the lateral ones pale

blue; when mature, the color was nearly the same pale green, which was much the tint of that of *Cecropia*, but not such a clear blue-green; more of duller hue, especially towards the lower part of the sides. There were eleven pair of dorsal tubercles, the first nine pair lemon yellow, the two last pair on anal segment pale blueish. The tubercles on the third, fourth and fifth segments are largest, and have some small black spots and marks on them, and are armed with short spines. On the twelfth segment is a large yellow dorsal tubercle, also spotted with black. Three rows of pale blueish lateral tubercles, which shine as if covered with glazing. The first three of the upper row are the largest; those of the two lower rows the smallest. Spiracles white, surrounded by a fine black line. Feet yellow; greenish at base, black at ends; prolegs green, terminally yellow. Length three inches.

Of twenty-seven young larvæ, I only succeeded in raising one; the others all died after the first or second moults. This one I fed on the leaves of the common red currant. A correspondent informs me that he had reared them on the plum. I would suppose that like *Cecropia*, and others of the *Attaci*, it will feed on a number of different plants.

The remarkable and beautiful argenteus looking cocoon of this species I have already described on page 128 of the *Lepidoptera*, Rhop. et Het.

Before concluding I would briefly state the difference between the larvæ of this and the three allied species, *Columbia*, S. I. Smith, *Cecropia*, L., and *Ceanothi*, Behr., which consists principally in the dorsal tubercles.

Columbia has three pair of coral red ones, situated on the third, fourth and fifth segments; the remaining six pair, as well as the single one of last segment, are yellow. Lateral tubercles whitish.

Cecropia has two pair of coral red tubercles; these are on the third and fourth segments; the remaining dorsal ones are yellow, as in the preceding. Lateral ones pale blue.

Gloveri has the same tubercles in number and form as the two species above alluded to, but, as I have shown, these are all yellowish. Lateral ones blueish white.

Ceanothi has three pair of dorsal yellow tubercles. These are on the third, fourth and fifth segments; the sixth segment has merely faint white raised spots in place of tubercles, and the remaining segments are without either tubercles or spots dorsally, with the exception of the twelfth, which has the usual single yellow tubercle. This species differs from all the others in the absence of dorsal tubercles on all the segments except the third, fourth and fifth. It also is devoid of lateral tubercles, these being only represented on the third segment by white spots, and on the fourth to eighth by mere black points; the ninth, tenth and eleventh segments are devoid of all spots whatever.

Thus it will be seen that *Gloveri* differs from *Columbia* and *Cecropia* in having *all* the tubercles yellow, and from *Ceanothi* in having dorsal and lateral tubercles on *all* segments, (excepting, of course, the first and second), whilst the latter has these appendages only on the third, fourth and fifth segments, besides the single one on the twelfth.

The larva of *Columbia* has been bred on Larch (*Larix Americanus*) and wild red cherry (*Prunus Pennsylvanicus*). That of *Cecropia*, as is well known, feeds on apple, cherry, plum, barberry, currant, etc. *Gloveri* has been raised on plum and red currant. *Ceanothi*, according to Henry Edwards, feeds on *Ceanothis Thyrsiflorus*, Esch., *Frangula Californica*, Gray, *Rhamnus Croceus*, Nutt., and *Alnus Viridis*, D. C.

The cocoon of *Columbia* is oval, pointed at the end, from which the insect escapes; pitchy black in color, with a few silver threads here and there, principally near the part which is attached to the twig; generally about two and a quarter inches in length. That of *Cecropia* is, of course, too well known to need any description. Of *Gloveri*, it is as if made of native silver, and is most beautiful in its brilliant metallic appearance. Of *Ceanothi*, I here append Henry Edwards' description from the Proc. Cal. Acad. for 1874: "When about to undergo its change, the caterpillar attaches itself usually to the under side of a twig and spins a rather coarse and very compact outer case, with which no leaves or other extraneous substances are incorporated, and within this a reddish brown cocoon, the filaments of which are strong, rather coarse, but glossy. The cocoon and its outer case are oval, produced into a cone at the end, by which the insect escapes."

From what I have shown, there is little doubt but that there are three valid species, as species go now-a-days; but, nevertheless, despite the want of the red tubercles in the larva, I am strongly of the opinion that *Gloveri* is after all but a form of *Cecropia*, and that successive breedings through many generations in the Atlantic districts would eventuate in the changing of the red color of the moth to the blackish of *Cecropia*. As regards the larva, I cannot see why an insect may not be subject to variation in the earlier stages as well as in the imago.

Reading, Pa., August 30th, 1878.

SEPTEMBER 18TH, 1878.—SPECIAL MEETING.

Dr. R. J. Farquharson, President, in the chair.

Thirty-nine members and visitors present.

The meeting was held in honor of the presence in our city of Dr. George Engelmann, the distinguished botanist, and to welcome the return of our fellow member, Dr. C. C. Parry, after an extended trip to Mexico.

Rev. S. S. Hunting, on behalf of the Academy, delivered a happy address of welcome, to which Dr. Engelmann responded in few pleasant remarks.

After adjournment an hour was agreeably spent in social conversation, wherein the Doctor illustrated his remarks by speci-

mens of several varieties of oaks and hickories, which he had gathered at Woodlawn. It was a subject of much regret that Dr. Parry was not able to be present on account of illness.

At a meeting of the Trustees held October 4th, 1878, a series of regulations relative to the assignment of rooms in the Academy building was adopted.

OCTOBER 28TH, 1878.—REGULAR MEETING.

Dr. R. J. Farquharson, President, in the chair.

Thirty-two members and visitors present.

The President reported the actions of the Trustees during the month past, and presented the following letter from Dr. Parry, giving an account of the botanical collection which he has deposited in the botanical room of the Academy.

To the Trustees of Davenport Academy of Natural Sciences:

GENTLEMEN:—Your courteous invitation to deposit my botanical collection in the commodious room of the Academy assigned to that department, has been complied with, so far as the incomplete arrangement of the material, mainly the result of more than thirty years' active field work, would allow.

It may be proper in this connection to state briefly the character of this collection, and the principal sources from which it has been derived.

My earliest gatherings in the botanical field were begun in 1842, while residing in the attractive floral district of North-Eastern New York, and continued more or less actively for five years, while occupied in a course of medical studies. During this interval I spent one season in Central New York, including a trip to Niagara Falls. The two last years of this period was especially memorable by being favored with the personal acquaintance of the distinguished American Botanist, Dr. John Torrey, to whose assistance and encouragement, equally shared by nearly all active American botanists of this generation, I am largely indebted for whatever success I may have attained.

In the fall of 1846 I removed to Davenport, Iowa, and the season following (1847) I was actively engaged in securing the flora of this district, including a summer excursion to Central Iowa, in the vicinity of the present State Capital, Des Moines, with a United States land surveying party, under the charge of Lieut. J. Morehead.

In 1848 I was connected with Dr. D. D. Owen's geological survey of the North-West, making botanical collections along the course of the St. Peters River and up the St. Croix as far as Lake Superior. A list of the

plants collected during this and the preceeding season was included in Dr. Owen's report published in 1852.

In 1849 I was appointed botanist to the Mexican boundary survey, going by way of the Isthmus of Panama to San Diego, California, which latter place was reached in July. In September of the same year I accompanied an astronomical party to the junction of the Gila and Colorado rivers, returning to San Diego in December. The important collections of this season were unfortunately lost in crossing the Isthmus of Panama while in charge of the late Gen. A. W. Whipple, being probably involved in a disastrous fire while stored in Panama awaiting transportation.

In the subsequent year, 1850, this loss was partially made up by somewhat extensive collections in the vicinity of the Southern Boundary line, and including a land trip up the coast as far as Monterey.

In the year 1851 I was ordered to Washington to make up my report, but before concluding it was unexpectedly summoned to join the field party on the survey of the boundary, then transferred to El Paso on the Rio Grande. This point was reached by an overland trip, *via* San Antonio, Texas, late in the fall of that year (1851). In January of the succeeding year (1852), I was connected with a small detailed party of exploration across the country west of El Paso, extending as far as the Pimo settlements on the Gila river, returning by the same route to El Paso in April. Subsequently I was connected with various surveying parties on the line of the Rio Grande south of El Paso, including late in the season the section of the river below Presidio Del Norte, comprising a succession of gigantic chasms, which never before or since have been visited by any botanist.

In the winter of 1852-3 I returned to Washington and made up my report, since published in the bulky volumes of the Mexican Boundary Survey. The interval from 1854 to 1860 was spent mainly in Davenport, not actively engaged in botanical work.

In the spring of 1861 the culmination of the Pikes Peak fever again opened the way for western exploration, and in a private collecting trip to the Rocky Mountains, I succeeded in securing a rare collection of Alpine plants, including, among many novelties, some of the early discoveries of Dr. James on Long's expedition in 1820. In the following season I was associated with E. Hall and J. P. Harbour in further exploration of the Rocky Mountain district, the botanical results of which were published in Proceedings of the Philadelphia Academy for 1863.

In 1864, in company with Dr. J. W. Velie, then of Rock Island, Ill., I continued my Rocky Mountain collections, embracing the districts of Long's Peak and Middle Park.

In 1867 I accompanied a railroad surveying party in the interests of the Pacific Railway Company, across the continent, on the line of 35° parallel north latitude. The most valuable part of my collections during that season were made in Western Kansas and South-Eastern Colorado, passing by the Sangre de Cristo Pass to Northern New Mexico; thence

late in the winter season through Arizona, crossing the Sierra Nevada at Tehachapi Pass, and through the Tulare and San Joaquin valleys to San Francisco. A list of the plants comprised in this collection was subsequently published in Dr. W. A. Bell's work entitled "New Tracks in North America," but without an opportunity for personal revision by the collector.

An interval of several years subsequent to the latter trip was occupied in filling the position of Botanist to the Agricultural Department at Washington. The principal work there devolving upon me was that of arranging the extensive botanical collections, which, as the result of various government explorations, had accumulated at the Smithsonian Institution. The bulk of these had previously passed through the hands of Dr. Torrey, whose gratuitous labors in reducing this mass of raw botanical material to systematic shape have never yet been properly acknowledged.

On being relieved from this position in the fall of 1871, the season following I again revisited the Rocky Mountain alpine district, being then accompanied for the first time by our associate, J. Duncan Putnam.

In 1873 I was attached to the North-Western Wyoming Expedition, under Capt. W. A. Jones, extending through the Wind River District to the Yellowstone National Park, Mr. Putnam being assigned as my meteorological assistant.

In 1874 I made a private collecting tour to South Utah, securing a valuable collection of the flora of the singular desert district in the valley of the Virgin, near St. George.

In 1875, again accompanied by Mr. Putnam, I spent the summer in Central Utah, in the vicinity of Mt. Nebo. In the fall of that year I continued my collecting trip to Southern California, and in the season of 1876, in connection with Prof. J. G. Lemmon, the enthusiastic California botanist made a very full collection of the plants in the vicinity of San Bernardino, including the high mountain district adjoining, and the desert stretches lying east of the Sierra Nevada.

My last and closing labors as botanical collector were made during the present season, mainly in the vicinity of San Luis Potosi, Mexico, extending on my return trip by way of Saltillo and Monterey to the more familiar botanical district of Western Texas, which I had partly explored twenty-six years previous.

From all these various sources collections, more or less complete, have accumulated on my hands, the great bulk being fortunately distributed far and wide to the different herberia of America and Europe. An active correspondence with the principal American botanists during the past thirty years has added largely, in the way of exchanges, to the material for illustrating Western American Botany. Hoping only for an opportunity to reduce this scattered material to systematic order, and to see it safely deposited in some scientific institution in the West, where it properly belongs, I gladly avail myself of the invitation extended to me by the Trustees of the Davenport Academy of Natural Sciences.

In fully realizing the fact that with advancing years my active labors as a collector and explorer are virtually finished, it is a pleasant reflection that some of the results of my labors, here deposited in an Academy of Science with which I have been from the first identified, and located in my adopted home on the west bank of the Mississippi, may perchance prove a source of assistance and encouragement to future botanists long after the "gathering hand" shall be itself "*gathered*."

Respectfully, your associate,

C. C. PARRY.

The reports of the Corresponding Secretary, Librarian and Curator were presented. The donations to the Library and Museum were placed on the table, and the thanks of the Academy voted to the donors.

The Publication Committee reported that pages 253-276 of the PROCEEDINGS had been printed, bringing the record down to date. Plates IV to XI had been lithographed and were partly printed.

The following papers were presented and referred to the Publication Committee :

New Fossils from the Corniferous Formation at Davenport.

BY PROF. W. H. BARRIS, D. D.

These notes are appended to the preceding paper on Geology* to emphasize some of the positions there taken. The fossils selected for illustration are chosen with reference to the different classes therein enumerated.

ECHINODERMATA.

STEREOCRINUS (nov. gen.).

GENERIC FORMULA.

Basal plates, 3.

Radials, 2×5 .

Supraradials, 2×5 .

Brachials, 2×5 .

Arms, 2×5 .

Interradials, 2×5 .

Anal area undistinguishable from the interradial areas.

Summit slightly elevated.

Proboscis sub-central.

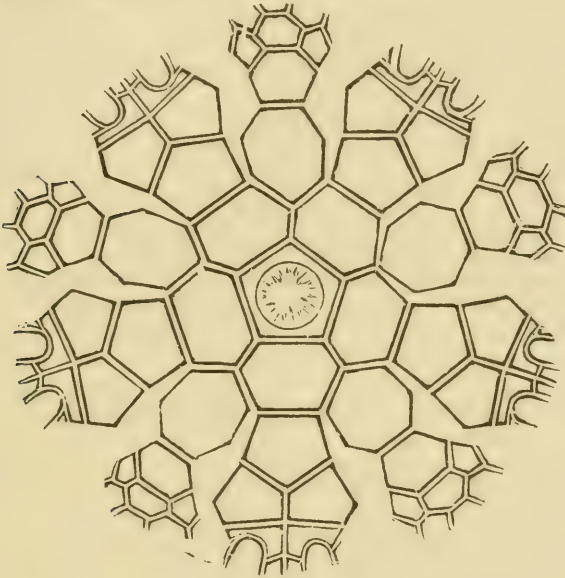
Arrangement of plates such as to give a proportionately greater breadth than height to the calyx.

The resemblance of the genus to that of *Actinocrinus* is very noticea-

* Ante, page 261.

ble. It differs mainly in having no appreciable anal area, and but two radials.

The following diagram illustrates the structure of the body to the summit of the brachial plates :



Stereocrinus triangulatus (n. sp.).

Plate xi, figs. 1 and 2.

Body large ; breadth to height as two to one. Basal pieces solidly anchylosed, and either as a narrow rim clings closely to the column or widens into a pentagon, on each side of which rests the first radial. First radials large, hexagonal, the centers of which are connected together by ridges, forming a pentagon, whose sides are parallel to those of the anchylosed basal plate. Second radials pentagonal, nearly the size of the first radial. First supraradials about half the size of the second radial, pentagonal or hexagonal, resting mainly on the sloping upper side of the second radial, and partly on the interrarial, broader than high. The second supraradial, or rather brachial, is of irregular triangular shape, broader than high, whose base is nearly the breadth of the supraradial. First interrarial large as first radial, heptagonal, higher than broad. This sustains a second interrarial hexagonal, not more than half the size of the first. This is crowned by three small irregular plates, arching from arm to arm, surmounted by another series of three, somewhat smaller. The summit is elevated in the centre. From each series of arms, extending towards the center, is a ridge of larger plates.

giving a five rayed aspect to the summit. Plates roughened and tuberculiform.

Proboscis sub-central.

The ornamentation consists of a series of triangles enclosed one within the other, the outer of which—the enclosing triangle heads in the center of the larger plates, meeting there the apices of as many series of triangles as there are sides of the plates. This peculiarity was traced out first by the artist, Mr. Churchill, to whom the Academy is indebted for the figures accompanying this paper.

Fig. 1 represents the base of a specimen, the pentagon enclosing the base being more sharply defined than in the plate. The column in the specimen is slightly removed from the center of the base, the canal pentalobate.

Fig. 2 shows a portion of the plates on the summit, and the upper plates of the calyx, as seen obliquely from the side.

Fig. 3, though belonging to the next described species, preserves well the normal relations of height and breadth of this species.

The original of the specimen figured was presented to the Academy by the writer.

Stereocrinus triangulatus var. *liratus* (n. sp.).

Plate xi, fig 3

This species does not attain the size of the former. Common to both is the same general arrangement and succession of plates. At the same time in this species there is a marked tendency to roundness in the form of the plates. The upper edge of the first radial is slightly curved instead of straight, as in *S. triangulatus*. The system of ornamentation is entirely changed. There is no longer a series of finely marked including and included triangles, but a system of sharp, well-defined, prominent ridges, disposed in single or double series, transversing the entire calyx, gathering into sharp nodes at the centres of the several plates. The strength of the ridges is uniform throughout.

From the base through the center of the first radial passes a single ridge into the center of the second radial, thence bifurcating it follows the course of the supraradials and brachials, the centres of which are ornamented with nodes. In addition to this single ridge, from the center of the first radial, pass four double ridges, one couplet extending to the center of each adjoining first radial, the other to the center of the nearest first interradial. The first interradials are also distinguished by these, as well as other double ridges, one of which encloses a pit in the center of the plate, its two sides being produced upwards through the second interradial. The other plates abound in single rather than double ridges. The second radial does not attain more than half the size of the first, while the greater part of its surface is covered by strong ridges, drawn out upon the center into a sharp angle. This characterizes the second radials and interradials to such extent that they constitute a girdle of ten nodes, completely surrounding the calyx, giving it a decided

decagonal aspect. This species is readily distinguished from the last by its smaller size, its tendency to a curved outline of plates, the smaller comparative size of its second radials, and its different system of ornamentation.

This and the last are found in bed No. 4, which represents a thickness of three to four feet, and is only developed on the west side of the river.

The original of the specimen figured was presented to the Academy by the writer.

Megistocrinus nodosus (n. sp.).

Plate xi, fig. 4.

Of this Crinoid another specimen has been found (now in the collection of Prof. Pratt), far more perfect than the portion figured, having the dome in excellent condition. The calyx, though preserving well its general figure, is yet so worn that the lines marking out the plates are not recognizable, yet the nodes are preserved on which the specific character is based. The description then is of necessity limited to the figure.

Body broadly urnshaped, the three basal plates, firmly united, extend beyond the column, and widen into an hexagonal form, presenting the appearance of a single plate. First radials hexagonal, wider than high, base and upper margins parallel. Second radials hexagonal, higher than the first radials. Third radials heptagonal, higher than first radials; not as high as the second. Supraradials two, hexagonal, resting on the sloping upper sides of the third radial. On the two supraradials is a second series, wider than high, most probably supporting the arm plates. Between the supraradial series are two smaller plates, one above the other, the lower of which, resting on the notch between the first supraradials, is pentagonal. The first interradians are hexagonal, as large as the third radial. These are succeeded by two others, also hexagonal, and nearly as large as the first interradian. A third series comprise three smaller, two hexagonal, and one pentagonal; a fourth and fifth series are small and irregular. Anal side unknown. Dome convex composed of an immense number of small, well-defined plates, its height about equal to height of calyx. Proboscis sub-central. The peculiarity giving rise to the name is a tendency to nodose development exhibited first on the second radials and first interradians, and drawn out into points in the plates succeeding them.

Found only in bed No. 4. The original was presented to the Academy by the writer.

BRACHIOPODA.

Rhynchonella intermedia (n. sp.).

Plate xi, figs. 5, 6 and 7.

This shell is of the type of the *R. cuboides* of European celebrity. It holds an intermediate position between two of the most marked American species of that type, *R. venustula*, Hall, and *R. Emmonsii*, Hall and

Whitfield. From the latter it differs in size, being much smaller, having a less ventricose aspect, a finer character of plications, a fewer number, both on the sides and on the mesial sinus, while in *R. Eumonsi* the breadth of the sinus is to the breadth of the shell as two to three, in our species the breadth of shell is nearly twice the breadth of sinus. It differs from *R. venustula*, Hall, in some of the same particulars. It is smaller, less ventricose, and more finely plicated. The youngest specimens yet found maintain the same general form as the older, the plications not being confined to the middle portion, but extending along the side. In a smaller specimen than any figured by Prof. Hall, there are eight plications on the mesial fold (while this is the full number ascribed to an adult of *R. venustula*), forty may be counted on the sides. In ordinary sized shells the number of plications is still greater,—on the sides about fifty, on the mesial fold from ten to twelve. The fold is more square, reaching a higher elevation in front, measuring nearly the height of the shell. The plications are not flattened as in *R. venustula*, but rounded. The groove longitudinally dividing each plication is armed with a pinnatifid structure, which is exhibited on the sides as well as on the front of the shell. In our specimen a still deeper groove separates the plications from each other, and forms a conspicuous feature. This shell is found in bed No. 2, a dove-colored compact limestone. It is not abundant. The specimen figured is larger than the ordinary size.

Fig. 5 represents a cardinal view of shell.

Fig. 6.—Front view, with ten plications in the sinus, showing pinnatifid structure.

Fig. 7.—Profile view. This shell is found only in bed No. 2. Specimen figured with others presented to the Academy by the writer.

LAMELLIBRANCHIATA.

Avicula (Plerinea) *cancellata* (n. sp.).

Plate xi, fig. 9.

Shell obliquely subovate, length twice the breadth, gradually expanding from the beak. The right valve convex, marked by concentric striæ and apparent lines of growth. The left valve is far more convex than the right, with concentric striæ of very unequal strength, which are crossed by radiating striæ, the concentric predominating over the radiating in numbers, strength and persistency. The hinge line is straight. The beaks are oblique, that of the left valve very convex, that of the right projecting a little above the hinge margin. The posterior wing, so far as shown—nearly the length of the shell—marked with similar unequal striæ as on the body; the anterior wing not shown on any specimens.

This shell has been found in three conditions. First, as a cast from which every trace of marking has disappeared, next as in the case of a specimen in the cabinet of Griswold College, where both valves are preserved, and yet only showing concentric striæ; and as in the present

nstance, where both concentric and radiating striae are seen on the left valve, concentric striae on the right.

Fig. 9 represents the left valve, the concentric striae more numerous and stronger on the specimen than on the figure. From bed No. 2.

The shell figured is from the collection of Prof. Pratt.

CEPHALOPODA.

Gyroceras Pratti (n. sp.).

Plate x, figs. 1 and 2.

Shell large, composed of one and a half volutions, rapidly enlarging from the apex. Along the side of the shell, and parallel to its volutions, is a prominent angular ridge, dividing the disk into very irregular parts, two-thirds of the surface inclining with a gentle curve in a dorsal, the other third in a ventral direction. The dorsal inclination is gradual, the ventral abrupt.

Septa distant. At the last one of the series, where the dorso-ventral diameter measures three inches, the distance of the septa on the dorsal side is one inch, on the ridge (two-thirds across the disk) one-half of an inch, while on the ventral side it has declined to one-quarter of an inch. These measurements will hold equally good of the last ten septa. Body chamber occupies nearly half of the last volution.

In the larger specimen figured, the greatest diameter across the disk is eight inches. The dorso-ventral diameter of the outer volution is four inches. The transverse diameter at the same point is four inches. The number of septa is about twenty, visible the entire length of shell.

The smaller shell preserves a similar ridge on its disk, differing mainly in retaining traces of ornamentation, the apex for the distance of seven or eight septa being marked by a series of elevated longitudinal ridges. One side of each of these shells is well preserved, the other much marred. In each instance the apex is a little out of place, most probably distorted by pressure. The figures are half the size of the fossils.

Fig. 1 very fairly represents the original.

Fig. 2 shows the longitudinal striae on the apex, through which can be seen the septa, necessarily faintly shown. These fossils are only found in bed No. 2. This shell is named in honor of its discoverer, Prof. Pratt, the efficient Curator of the Cabinet of the Davenport Academy of Natural Sciences.

CRUSTACEA.

Proetus Davenportensis (n. sp.).

Plate xi, fig. 8.

Body subelliptical, length to breadth nearly as three to two. Head and thorax of equal length, pygidium somewhat shorter. Breadth of head nearly twice its length. Border at posterior angles of the cheeks produced into long spines, extending three-fourths the length of the thorax,

divided by one distinct ridge, leaving on each side a shallow groove, with a secondary and less distinct ridge close to the margin. Glabella prominent, longer than broad, gently rounded and narrowing in front, touching the first ridge. Occipital furrow narrow, flanked at either end by two conspicuous nodes. Occipital ring stronger than any rings on the thorax. Lateral lobes marked by furrows, the anterior on a level with the anterior portion of the eye, the middle close and parallel to it, both gently curving downward, while the posterior starts opposite the centre of the eye, bifurcating, one arm produced toward the inner edge of the nodes, the other pointing directly across the glabella. Eyes prominent, clinging closely to the glabella, and extending nearly one-half its length. The facial sutures in their anterior extension curve outwardly from the eye, reaching the border so as to divide it into three nearly equal parts. Thorax having ten segments. Mesial lobe prominent, semi-circular, its anterior portion very little narrower than the lateral lobes; these traversed by a sharp angular ridge, from which on each side the descent is very conspicuous. Pygidium wider than long. Axis prominent, composed of nine or ten well-defined rings, tapering gently almost to a point, scarcely reaching the border. On the lateral lobes are seven or eight annulations, less and less distinctly marked as they approach the termination of the axis. Posterior margin bearing traces of two ridges, such as distinguish the anterior margin. The whole surface finely granulose.

Fig. 9 represents the head with glabella and spines; also the thorax. The artist, in endeavoring to give expression to the two ridges, has slightly exaggerated the breadth of margin. In the Cabinet of the College is a specimen of the cephalic shield alone, while in the collection of Prof. Pratt is another, showing head, pygidium and shield; on both the facial sutures are more plainly shown than on the specimen figured. Found in bed No. 2. The original of specimen figured was presented to the Academy by the writer.

[An error occurs in the third sentence of the description of *Stereocrinus triangulatus*. Instead of reading "whose sides are parallel to those of the anchylosed basal plate" read "the angles of which are equi-distant from the angles of the inscribed pentagon forming the base."]

Dr. Farquharson then read the following paper:

Exploration of a Mound near Moline, Ills.

BY J. GASS AND R. J. FARQUHARSON.

The mound was about three miles above Moline, and was situated on the brow of the elevated plateau. Before the growth of the rather small trees now covering the spot, it must have overlooked the Mississippi river and its valley, here several miles wide. The mound was circular, with a circumference of one hundred and fifty feet, and a central elevation of nearly seven feet. Near the centre, a pit some eight feet in diameter and six feet deep had been sunk some days before our visit, so that we had but little digging to do in order to expose the contents of the mound, if any were to be found. In sinking the pit human bones were encoun-

tered at the depth of one foot beneath the surface. Fragments of these bones were found, at the time of our visit, intermingled with the earth and thrown out. They showed no indications of the action of fire.

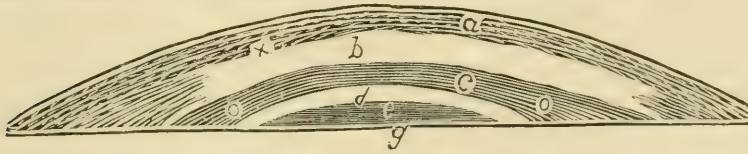


FIG. 21. Scale 1-120 natural size. (a), Surface layer of vegetable soil. (x), Spot where Indian bones were found, twelve inches under the surface. (b), A stratum of lighter and looser earth, two feet thick. (c), A layer of friable, slightly burned clay, one foot thick. (d), Red clay, hard burned, six inches in thickness. (e), layer of dark friable earth, containing fragments of bone and wood, partially burned. (g), Base of oven, undisturbed soil on which rested the bones, etc. (o, o), A layer of hard-tramped, unburned clay, extending around the periphery of the base of the oven.

The side of the pit next the center of the mound (the south-west side) showed in section the structure of the mound, and exhibited the following appearances: The soil, from just below the vegetable layer, showed a gradual change of color, becoming lighter, more ash-like and friable, finally merging in and ending with a layer of very fine red clay, evidently hard burned. Here, also, were found a good deal of charcoal, some in separate pieces, but mostly in a finely divided state, and so intermingled with the soil as to make it quite dark in spots.

Below this layer of red clay, which was arched in form and six inches thick, a dark friable earth was found, containing one small pebble stone, some shards of pottery, and some fragments of burned bone, rounded masses of lime, intensely black in color, and consisting of bodies of the vertebræ, the head of a humerus, and a portion of an *os calcis*. Here, also, were found fragments of bone, a portion of a tibia exceedingly friable, and a portion of a fibula, dense, firm and apparently recent. Intermingled with this dark soil were fragments of partially burned or charred wood, showing evidently the action of a smothered fire.

The removal of the dark earth exposed the whole interior of what might be termed the "cremation oven." This structure was found to be semi-ovoid, having for its base the natural surface of the ground, a height of eight inches at its greatest elevation, with a major and minor axis of twelve and six feet respectively, the former being in an east and west direction. Just outside of the edge of the oven, the clay seemed more densely packed than elsewhere, indicating that it had been tramped. The small elevation of eight inches would indicate that the arch of red clay had been put in place while it was in a soft condition, and had settled down upon the contents.

The bones found were in such small pieces, and so friable, that but little information could be derived from them, except the fact that they had been exposed to a fire, and that a smothered one. This was plainly indicated by the interior structure of the spongy bones, which were so uniformly blackened as to denote in the oven the presence of a considerable quantity of organic matter, either animal or vegetable, whose

destruction by fire, without the access of oxygen, could give rise to such a quantity of empyreumatic or tarry vapor as to effect this discoloration.

The portion of a tibia found in the oven was about four inches long, and was from the middle third of the bone. Though it was exceedingly brittle and friable, it did not seem to have been exposed to the action of fire; if so, it was not blackened like the other bones. This small fragment of bone proved of considerable interest for the following reasons: First, its medullary cavity was traversed by a small fibre of a root, which had penetrated this depth (seven feet), perforating in its passage downwards the layer of hard burned clay, thus showing that this bone was placed there before the growth of the present forest, and perhaps before one that may have preceded this, as there were on the surface some old rotten stumps of large oak trees. Second, its surface showed distinct marks of some cutting instrument; these marks were evidently old, and could not have been made by the spade, as from its very friable nature, the bone would have been crushed by the first blow; it is probable that these marks or cuts are the result of a cleaning process the bones underwent before being exposed to the action of the fire. Third, the tibia, to the unassisted eye, showed a high degree of flattening or platycnemism, and such was the case, for upon measurement the antero-posterior and the transverse diameters were found to be .033 m. and .015 m., thus giving an index of .45. This is the smallest index found in the measurements at this Academy, being below the average found by Gilman of tibiae from the Detroit mounds (.48), and approaching very closely the measurements of his celebrated tibiae from the River Rouge, the smallest indices known, viz: .40 and .42.

Here is a mass of drift-clay, which we have exposed for some hours to the heat of a fire of coke in an open grate, which, as we see, is very similar in color and appearance to the pieces of the cremation mound, which are exhibited with it.

In the vicinity are many common burial mounds, probably erected by the same people, but this cremation mound must have been built for a particular purpose; but whether the ceremony was to honor or disgrace the deceased, whether the bones were those of conquered enemies, or those of the lower classes (servants) of their own nation and tribe, it is difficult, if not impossible, now to determine.

The proceeding was probably as follows: A large open fire was kindled, and the bodies of the deceased were burnt to a certain degree, together with some other bones in the dry state. Afterwards the still glowing fire was covered with earth or clay, and this covering was beaten a little, or to a certain consistence; then the mound was filled up to its intended height, and immediately finished. This is proved by the traces of fire in the burnt clay, which appear as dark streaks, showing clearly the passage of smoke, fire and heat. These views are not in the least contradicted by the illustration of a cremation in our tablet; on the contrary, that representation of the ceremony and this newly explored cremation mound certainly bear a close relation to each other.

NOVEMBER 28TH, 1878.—REGULAR MEETING.

Dr. C. H. Preston, Vice-President, in the chair.

Sixteen members present.

The reports of the Corresponding Secretary and Curator were presented. A large number of valuable donations to the Museum and Library were announced, and the thanks of the Academy voted to the donors.

The following persons were elected corresponding members: Dr. E. L. Mark, Cambridge, Mass.; Dr. R. A. Philippi, Santiago, Chili.; Dr. L. Koch, Nurnberg, Bavaria.; Prof. T. Thorell, Upsala, Sweden; Dr. V. Signoret, Paris, France; V. M. Firor, Charlestown, W. Va.

Dr. Parry called attention to the recent discovery of *Shortia galacifolia*, Gray, by Mr. M. E. Hyams, of Statesville, North Carolina.

The following papers were read:

Report of Exploration of Indian Graves.

BY REV. J. GASS.

About one mile east of Moline, Illinois, near the bank of the Mississippi River, on Mr. John Deere's farm, is a group of low mounds, thirty-three in number, doubtless an old Indian graveyard, occupying a space of about one-quarter of a mile, by ten rods, in four irregular rows, running east and west. Twenty of the mounds of this group are of circular form, but of various sizes, diameters varying from twelve to thirty feet. Nine are oval, fifteen feet wide, and from thirty-six to sixty-nine feet long. Three are remarkable for their extraordinary length, one being 147 feet and two 186 feet long, but all of the same width—fifteen feet. One is of crescent form, with dimensions sixty-six feet by thirteen feet. The height of all varies from one and a half to three feet.

In these burials, the bodies of the deceased were laid, either directly upon the sod or upon the natural soil after the removal of the surface earth to the depth of a few inches, and then covered with earth. The very long mounds are probably rows of single graves, the bodies being added one by one from time to time, somewhat similar to our modern custom.

Careful excavation of some of these mounds resulted in the discovery in most of them of not a single relic. Nos. 6 and 14 were explored several years ago by some members of our Academy, but only bones were found. Mounds Nos. 17, 27, 29, 31 and 32 were opened during the past summer. No. 17 is circular, thirty feet in diameter and two feet high. A few inches below the surface were found a number of stones (lime-

stone), arranged in the form of a triangle. Two and a half feet deeper a skeleton was found, resting upon the hard clay, and lying in an east and west direction. The distance from the skull to the ankle was thirty-one inches. The covering earth was black soil. Near this skeleton a roughly chipped flint stone and a small piece of Galena were discovered. The face was turned to the side, with a finger bone between the teeth.

Mound No. 27, circular, diameter twenty-eight feet, height two and a half feet. In this, three feet below the surface, was found a skeleton, in the same position as that in No. 4, and near it a number of bones.

Mound No. 29, oval shaped, sixty-nine by thirteen feet, and one and a half feet high, the earth black and hard. Two feet deep were a number of skull bones and other bones, but nothing more.

Mound No. 31, oval form, thirty-six by twenty-four feet, and three feet high. A little below the surface was a layer of stones, eight and a half by six and a half feet, oval, and somewhat curved upward in the middle. These stones were closely fitted together, and like those in the other mounds, were limestone from the river bank. Two feet below this stone layer, in the center, was also a skeleton, situated as those in Mounds 4 and 27, *i. e.*, lying in an east and west direction, and resting upon the side. The skull was well preserved. The whole skeleton was also doubled up so as to occupy a space of only three and a half feet, indicating that the dead were buried in a sitting posture, as is still the custom of many tribes. A second skeleton was found at the west side of this mound, beyond the stone layer, at the same depth as the other, and lying in a similar position, but the skull was all in fragments. No relics were to be found except a piece of pottery, which was probably accidentally dropped in the covering earth.

Mound No. 32, circular, twenty four feet diameter, three feet high. A few inches below the surface was also a quantity of stones, arranged in lines as shown in diagram, and extending six feet in one direction and two feet in the other. Beneath this, and resting on the hard clay, were the remains of one or two very much decayed skeletons.

In these mounds no implements, weapons, ornaments, or relics of any kind were found buried with the dead; nor any pieces of wood, shells, or other articles showing any sign of having been used.

Close by, on the bank of the Mississippi, is an extensive layer of shells, which some (erroneously, as I believe) consider to be "kitchen heaps," or refuse left there by the Indians who erected these mounds. About one-quarter of a mile east of these mounds in the present Moline Cemetery, Mr. Toellner, who also assisted in the above explorations, has found a stone heap of different character; perhaps a kind of monument in which the stones were piled up carelessly, without any evident intention to represent any distinct form. Under this pile was discovered a stone "maul," weighing twenty-five pounds.

Near the Cemetery, in creeks and ravines, are frequently found pieces of pottery, and flint and stone implements. On both sides of one of the creeks are shell layers, containing also fragments of pottery, perhaps

“kitchen refuse,” and where, we may suppose, was for some time the dwelling place of a tribe of Indians.

On Mr. Davenport’s land; above Moline, a mound was opened, or rather a burial place which may formerly have been a mound, but which was not at all elevated above the surrounding surface. Attention was drawn to the spot by some shells thrown up by the plow. About six inches below the surface was a layer of shells, fifteen feet in diameter, and several inches thick. One and a half feet below this layer, near the center, a skeleton was found in the same position as in the mounds on Deere’s land. The skull was well preserved, and is now in our Museum. The other human remains were much decayed.

BIOLOGICAL AND OTHER NOTES ON COCCIDÆ.

BY J. DUNCAN PUTNAM.*

I. PULVINARIA INNUMERABILIS.

[Plates XII and XIII.]

SYNONYMY :

Coccus innumerabilis Rathvon. *Pennsylvania Farm Journal*,† Vol. IV, pp. 256-7-8, (with figure). West Chester, Pa., August, 1854.

Lecanium aceritortosis Fitch. *Transactions of the New York State Agricultural Society* for 1859, Vol. XIX, pp. 775-776. Albany, N. Y., 1860.

Coccus aceris Leidy (not Schrank). *Report to the Councils of Philadelphia on some of the insects injurious to shade trees*, pp 7-8. Philadelphia, 1862. (A wrong determination.)

Lecanium acericola Walsh and Riley. *American Entomologist*, Vol. I, p. 14, (with figure). St. Louis, Missouri, September, 1868.

Lecanium acerella Rathvon. *Lancaster Farmer*, Vol. VIII, pp. 101-102, Lancaster, Pa., July, 1876. (Probably a clerical error for *acericola*.)

Maple-bark Scale-insect, Fitch, *loc. cit.*

Maple-tree Bark-louse, Walsh & Riley, *loc. cit.*

Cottony maple scale, Riley, *in letter*.

? *Lecanium macluræ* Walsh and Riley. *American Entomologist*, Vol. I, p. 14, 1868.

? *Coccus salicis* Fitch. *Fourth annual Report * * of the State Cabinet of Natural History*, [of New York], p. 69. Albany, N. Y., 1851. (*Pulvinaria salicis* Signoret, *Essai sur les Cochenilles*, p. (220), 1873.)

? *Lecanium pyri* Fitch, (in part). *First Report on the Noxious, Beneficial and other Insects of the State of New York*, p. 106. Albany, 1854.

? *Coccus adonidum* Packard. *American Naturalist*, Vol. I, p. 223. Salem, June, 1867.

? *Coccus vitis*, Linne, 1735: *Pulvinaria vitis* of authors.

* A delay of a year in the printing of this paper, has enabled me to include in it the observations made during the past year, which have materially changed my views upon several points.

†Dr. Rathvon writes of the *Farm Journal*,—“ It originated here, [Lancaster, Pa.,] in 1850 or '51, then was removed to West Chester (where it was issued by Mr. Darlington,) and from thence to Philadelphia; and after the completion of the 7th [vol.] it was sold to another party and changed to the *Farmer and Gardener*, finally transferred to Paschal Morris & Son; changed to a quarto, and became the basis of the *Progressive Farmer*, and is still published in that form, under the title of *Practical Farmer*.” I am under special obligations to Mr. C. V. Riley for the loan of a manuscript copy of Dr. Rathvon’s paper and figure.

HISTORY.

The earliest account of this species I have been able to find, is that of Dr. S. S. Rathvon above referred to. Dr. Rathvon first observed it on the linden trees in Lancaster, Pa., several years previous to the publication of his paper in 1854. Besides the linden, he found them later on the silver maple, grape vines and in one instance each, on a wild rose bush, and on a beech. He goes on to say: "The 'silver-leaved maple' (*Acer dasycarpum*) seems to be the greatest sufferer, and there is not a doubt of the partiality of the insect for that particular tree, although they are also found on others when standing near them." The following is the description given by Dr. Rathvon:

"The female is a brownish yellow on the back until all the eggs are deposited when she dies, and turns to a darker color, and resembles what is known in common language as a 'scab.' Beneath, the female is of a dirty bluish white, without any appearance of feet, and adhering closely to the bark of the smaller branches of trees by a simple anterior process, which I have not yet been able to discover. The posterior portion of the body of the female is free, to which is attached a "globular mass" of white, very elastic cotton-like fibre, which serves as a shield or protection to the eggs. The eggs are white, or yellowish white, in shape similar to a common hen's egg, and so minute as to be scarcely perceptible to the naked eye. The young, immediately after exclusion, are also very minute, yellowish white, with a brownish line down the middle of the body, legs and antennæ white, nearly of equal length, and the latter terminated by a seta or diverging hairs. The abdomen is terminated by two very slender, white, hair-like appendages about two-thirds the length of the body; there are also a few spiny hairs upon the legs and the anterior margin of the antennæ, at the base of which are the eyes which are black and distinct. They occur in such countless millions that I propose to name the insect *Coccus innumabilis* until a better or prior one may be found:—for I have never yet seen a description of them anywhere."

The above description, together with the accompanying figure and remarks on habits, etc., applies so perfectly to the species which I have studied and is so much better than those given by later authors that I do not hesitate to adopt the name proposed by Dr. Rathvon.*

The next account of this insect is a brief article by the late Dr. Asa Fitch, entitled "*Ravages of Insects on Forest and Fruit Trees—Remedy.*" inserted in the *Transactions of New York State Agricultural Society* for 1859. (Vol. XIX, pp. 775-776), but dated June 27, 1860. The description is very general, and partly erroneous, but is sufficient to show that it should be placed in the modern genus *Pulvinaria*. It is said to be a "very extensive depredator upon the trees in Albany," also "abundant upon the maples, especially the soft maples, at Rochester," and "in former years, I have occasionally met with single specimens of this scale on the trees here in Washington county." As it seems improbable that there should be more than one species of *Pulvinaria* on the soft maple in this country, I think we may safely regard Fitch's *acericorticis* as identical with Rathvon's *innumabilis* and Walsh & Riley's *acericola*.

In 1862, in the pamphlet above referred to, Prof. Joseph Leidy mentions this insect as occurring on the silver maple in Philadelphia. He

*In deciding upon the adoption of this name I have been aided by the good advice of Dr. H. A. Hagen regarding the synonymy.

writes to me that he "called it *Coccus aceris* merely from supposition that it was this species, because it infested the maple."*

In the number of the *Practical Entomologist* for October 30th, 1865, (Vol. I, p. 6) mention is made of a supposed new species of *Lecanium* found "upon a branch of Sugar Maple at Fort Wayne, Indiana," which probably refers to the species under consideration.

In the number of the *Practical Entomologist* for August and September, 1867, (Vol. II, p. 119) mention is made of a bark-louse on the leaves of the common maple, received from B. W. McLain, Indiana. These same specimens are afterwards (in *American Entomologist*) mentioned as types of *Lecanium acericola*.

In the *American Entomologist* for September, 1868, this species is figured and named *Lecanium acericola* by Messrs. Walsh and Riley, from the above mentioned specimens received from Indiana, and others from Mr. A. S. Tiffany, of this city. The figure represents two females with their egg nests *on the leaf* of about half the usual size, and the only hint at a description is, that it has "similar cottony matter at its tail," and is "light-brown and white" in color. Although the description is defective there is traditional knowledge sufficient to fix the identity of this species with that which I have studied, in the fact that the specimens sent by Mr. Tiffany to Mr. Walsh in 1868, were taken from the same trees on which my first studies were made in 1871; by numerous determinations made by Mr. Riley himself, and by an examination of specimens contained in his collection. This figure and name have been copied by Dr. A. S. Packard, Jr., in his "*Guide to the Study of Insects*," (2d ed., p. 528, fig. 530a,) and in his "*Half hours with Insects*," (p. 112, fig. 77a) but without any additional information.

In the *Lancaster Farmer* for July 15th, 1876. (Vol. VIII, p. 101) Dr. Rathvon published another article on this insect, this time calling it *Lecanium acerella*. This paper is mainly a resumé of the previous one, but with the addition of a brief mention of the males, and a statement that the *leaves* as well as the twigs were infested. Regarding this paper, Dr. Rathvon writes to me as follows:

"The paper in the *Lancaster Farmer* for July, 1876, relates to the same insect, so far as my observations extended, for my remarks there are in reply to a correspondent whose trees were infested. I nevertheless have all along been impressed with the belief that there are two species found on the maple trees; but, other occupations have always prevented their investigation. My reasons for thinking so, are mainly these. While they were at their very worst, on the linden, the maple, and the grape, I never noticed any of them on the leaves, they were entirely confined to the undersides of the branches, and especially the twigs which were entirely covered at the period of incubation, and the leaves were dwarfed, turned yellowish, and many of them fell off. Some years, however, after the publication of the paper in the *Farm Journal*, I noticed them, or another species, both on the branches and the leaves of the silver maple, (there being then few linden trees left) but they differed somewhat in form those described in my paper alluded to. They were not so large, the secreted cotton mass was somewhat depressed, faintly bilobed, and transversely undulated or indented; in some very irregular, but in others almost as regular and distinct as the articulations of a *Tri-lobite*."

*I am under obligations to Dr. Leidy for a copy of his *Report*, and for a number of specimens from Philadelphia for comparison, which are not specifically different from those found in this locality.

The suggestions of Dr. Rathvon, regarding the possible existence of two species of *Pulvinaria* on the maple is of much interest, and as some doubt has been thrown upon the correctness of Mr. Riley's figure,* it is satisfactory to have such definite and conclusive corroboration as the above. Dr. Rathvon was not able to find a single specimen of either form in the vicinity of Lancaster, Pa., during the past season, so that I have not been able to make comparisons. He first observed this form on the leaves in 1864, the other on the twigs about 1852.

In the *Prairie Farmer* for July 22, 1876, Dr. Cyrus Thomas published a short account of *L. acericola*, which he states was very abundant in Illinois and Iowa that year.

In 1877 Prof. Townend Glover, in his "*Report of the Entomologist*" contained in the "*Report of the Department of Agriculture for 1876,*" page 44, gives a figure (No. 53) of this species, under the name of *Lecanium acericoortices* Fitch, stating that it "was found on a silver-maple in the Smithsonian Grounds in Washington." This appears to have been the first application of Fitch's name since its publication seventeen years before, all other entomologists having overlooked it because of its not having been contained in one of his regular Reports. Prof. Glover also suggested that *L. acericola* and *L. macluræ* were but varieties of this.

In a useful little pamphlet on "*Shade Trees, Indigenous Shrubs and Vines, and the Insects that infest them,*" published in Peoria, Illinois, in the spring of 1877, Miss Emily A. Smith has given a brief account of this bark-louse, (*L. acericola*) which was first observed in that city on the soft maples in 1874. During 1877 and 1878 Miss Smith made a very careful and pains-taking study of the life and habits of this insect and especially of its parasites and enemies.† A portion of the results of these studies were given to the public in 1878 in the "*Seventh Report of the State Entomologist of Illinois,*" pages 120-131. A synopsis of this report had previously been published in the *Prairie Farmer* for March 2, 1878. In the *American Naturalist* for October and December, 1878, she gives another very interesting illustrated account of this species, having now adopted Fitch's name, *L. acericoortices*. The illustrations are, unfortunately, not very good and sometimes quite misleading, as for example, the sternal region of the female (fig. 2 c) is made to appear quite convex, whereas it is in reality always concave; in fig. 4 the ventral eyes are made to appear as if on the dorsal surface of the head, etc., etc. The imperfection of the illustrations is mainly due to the poorly preserved specimens which the draughtsman had to work from. I speak of this freely, because I furnished a portion at least of the specimens.‡ A few errors which have crept into these papers will be noticed in their proper places hereafter. Other articles upon the same subject have been published

* See Miss Smith's paper in *American Naturalist*, 1878, page 660.

† M. Signoret speaks thus deservedly of Miss Smith's work in a letter to the writer: "Pour moi c'est surprenant de voir une femme s'occuper de notre science et ainsi bien! je desirais beaucoup que nombre d'hommes en feroient autant."

‡ See 7th Report of the State Entomologist of Illinois, p. 121.

by Miss Smith in the Peoria local newspapers, and in the *Prairie Farmer* for July 6, 1878, and July 12, 1879.

In the *Cultivator and Country Gentleman*, Albany, July 25, 1878, Dr. J. A. Lintner, has reprinted in full Dr. Fitch's very scarce and almost inaccessible article on this species. He states that he had been unable to find a trace of them on the maples in Albany, in 1878. Dr. Fitch in his article compares his species with the *Lecanium aceris* of Europe, and Dr. Lintner desires to have the question of their identity settled. The *L. aceris* is quite fully described by M. Signoret in his invaluable "*Essai sur les Cochenilles*," and is a true *Lecanium* of the third group in which the females become "more or less elevated, hemi-spherical, more or less globular," with the eggs laid loose in a powdery deposit beneath the scale of the mother, and hence is even generically distinct from our species, and differs in many other particulars. In addition to this I have sent specimens to M. Signoret who informs me that they are quite distinct.

Other articles in which this species is mentioned have been published in the *Country Gentleman* for July 4th and July 11th, 1878; in the *Prairie Farmer*, August 24th, 1878, August 9th, and October 25th, 1879; in the *Rural New Yorker*, November 15th, 1873; in the *Practical Farmer*, Philadelphia, January 13th, 1877, where it is recorded from Circleville, Ohio, by M. B. Bateman; in the *Canadian Entomologist*, Vol. X, 1878, page 176. Vol. XI, 1879, page 196; and in various local newspapers.

Mr. Riley writes to me that he first bred the male and the *Coccophagus* parasite in 1869. In 1870 he received specimens from Prof. D. S. Sheldon, in 1871 from J. D. Putnam, Davenport, in 1875 from Suel Foster, Muscatine, in 1878 from Janesville, Wis. He has also been able to confirm the main points of what Miss Smith says concerning the development of the male.

History in Davenport. *Pulvinaria innumerabilis* was first noticed in Davenport in 1867, by Mr. McEwen on the large maple trees then standing about the corner of Brady and Third streets, near the center of the city. They were then few in numbers and attracted little or no attention from passers by. In 1868 our fellow member, Mr. A. S. Tiffany, noticed them in the same place, and took some specimens over to Mr. Walsh, and these specimens formed part of the types of *Lecanium acericola* Walsh and Riley. In 1870 they had increased greatly in numbers, and had extended their ravages to a distance of seven or eight blocks. This year they attracted very general attention during the egg laying period, on account of their very large and conspicuous egg nests, and were made the subject of several newspaper articles. Prof. Sheldon sent specimens to Mr. Riley who determined them to be the *L. acericola* above mentioned. In 1871 they were still more abundant, and had extended their ravages to a distance of ten or twelve blocks. Many trees showed evidences of great depletion, and a few died. During this year I made my first studies of this insect,—but with very unsatisfactory results. A brief sketch of my observations of 1871 was published in the PROCEEDINGS of this Academy, Vol. I, page 37, 1876. In 1872 they became comparatively scarce, probably on account of the great increase of

their enemies during the previous years. During the years 1873, 1874, and 1875 they were scarcely noticed at all. In 1876 they again became sufficiently abundant to attract general attention, and in 1877 and 1878 they were as plentiful as in 1870 and 1871, only more extensively distributed, being found as far as twenty blocks from the starting point in 1867. In 1879, through the increase of their enemies and the depletion of their food trees, they have decreased considerably in numbers and vitality. During the last three years I have given a good deal of attention to this insect, and the results of my studies are given in the following pages. I have also published a brief article in the *Davenport Daily Gazette* for June 5th, 1877, and another in the *Transactions of the Iowa Horticultural Society* for 1877, Vol. 12, pp. 317-324, Des Moines, 1878. Having traced the complete circuit of its life for three generations, I will begin my account with the period at which it first becomes an independent creature.

THE EGG.

The *Egg*, fig. 18, is regular oval in form, nearly elliptical, about 300 μ * in length and 180 μ in breadth, the greatest breadth being a very little in front of the center. When very highly magnified it is seen to be covered, more or less closely, with minute circles, fig. 18, a. These last appear to be the dust-like, waxy secretions of the ventral abdominal pores, which have become attached to the egg shell by means of a viscid substance, possibly secreted by the vaginal glands shown in fig. 47. The eggs found in the ovaries are without this ornamentation.

When first laid, the egg is of a pale yellowish white color, but becomes very much darker, as the embryo becomes fully developed. This color comes mainly from the embryo showing through, as the egg-shell is nearly colorless and transparent. In this locality the first eggs are laid during the last part of May, varying from the 18th to the 25th, according to the weather, and the egg-laying continues from five to seven weeks according to the health of the mother.

THE EMBRYO.

At the earliest stage noticed, Fig. 17, the yolk appears to be somewhat contracted, leaving a small, apparently vacant space at each end, and to be inclosed by a thin layer of granular substance with a gathering of granules at each end. One of these, larger than the other, appears to be at the head end. I failed to observe any nucleus or germinal vesicle at any stage, probably because I did not know how to look for them. It is probable that the gatherings of granules at the two ends may represent the first stages of segmentation.

The collection of granules at the head end grows most rapidly, extending gradually further and further downwards through the yolk. It has the appearance of being a hollow sack, denser at the sides and in the

*In this paper I have taken the 1-1000 of a millimeter, equal to 1-25400 of an inch, indicated by μ as the unit for measurement, thus 4 μ is a little less than 1-1000 of an inch. The measurements given should be regarded as approximate rather than absolute, though I believe they will be found correct within the range of individual variations of the insects themselves.

middle, something like I have attempted to represent in Fig. 19. I have been under the impression that it might be formed by the inturning of the outer granular layer, but of this I am not certain. I have observed embryos thus far advanced while still in the ovary of the mother.

This granule mass, or embryonal band, continues to extend backwards until its rear end is again turned forward as shown in Fig. 20. At this stage the anterior or head end is much the largest, composed of larger granules, and lies nearer the surface, while the posterior portion is seen to be gradually more and more deeply imbedded in the yolk, becoming finally very indistinct and hidden from view. At a little later stage the head appears to be divided into three distinct lobes, while the posterior end is somewhat shortened and thickened.

The subsequent development of the embryo I did not observe with sufficient accuracy to say anything of value. Of the interesting phenomena accompanying the segmentation of the body, the budding out of the limbs and the revolution of the embryo, I caught only tantalizing glimpses the full import of which I was not able to comprehend. It appears in a more advanced stage to lie with the dorsal surface outward against the egg-shell with several of the abdominal segments turned under.

The embryo when fully developed, occupies the whole of the interior of the egg, without any portion of the body being doubled under. Its ventral thickness is nearly equal to its transverse diameter. Viewed from above (Fig. 21) the division into segments is quite distinct. The head is deeply set into the prothorax, and these two together are equal to nearly one-third the length of the whole. The last two thoracic and first six abdominal segments are nearly equal in length, decreasing gradually in size towards the rear. The seventh segment is larger, bilobed and entirely surrounds the very small eighth segment which bears the conical appendages from which the anal filaments are secreted; these last do not seem to have appeared as yet. The ninth segment with its appendages is already seen to be withdrawn, so that the latter appear to arise from the interior of the seventh segment. The body cavity is filled with yolk globules, and the intestinal canal is indistinctly seen.

Viewed from below, (fig. 22) the head is seen to be produced over the prothorax nearly to the mesothorax, and is closely united to the former. The various limbs are perfectly developed to the smallest hair: the antennæ are directed backward and extend slightly beyond the bases of the first pair of legs; the six legs are of nearly equal size, have their bases at the sides, and are all extended backwards and inwards nearly meeting on the median line. The eye spots are very prominent and are situated just above and behind the bases of the antennæ, one or both of them are distinctly visible from every point of view. The labium, through which the buccal setæ are eventually thrust, is situated between the bases of the anterior feet, and appears to be distinctly bilobed. The buccal setæ are seen to be coiled up spirally and nearly vertically on each side of the head with their ends directed towards the internal frame work of the mouth parts.

On the front of the head are two or three small conical projections (fig. 23, *a*) arranged on the median line, that on the extreme front being largest. There is no trace of these on the newly hatched larva, and they are probably left behind with the embryonal skin. Their function is undoubtedly to open the egg shells, which are always seen to become split open vertically at the anterior end.*

When the shell becomes split open the young larva makes its exit very laboriously and slowly, undergoing a great amount of wriggling and stretching. On freeing itself from the egg-shell it becomes greatly expanded in length and breadth, and correspondingly depressed in height. During the process of working its way out of the egg, the tracheæ become filled with air, and it is probably at the same time that the buccal setæ are withdrawn from their spiral coils, and form a loop in the abdomen.†

At fig. 24 is shown an egg of abnormal form containing a fully developed embryo which I observed on June 22d, 1878. Just behind the head of the embryo it was contracted into a neck, giving it an appearance very similar to that of an immature egg follicle.

The development of the embryo is completed and the birth of the larva takes place within three or four weeks after the eggs are laid, that is to say between June 10th and July 20th.

[The development of the embryo of *Lecanium hesperidum* on oleander, which I have observed incidentally, appears to be almost precisely the same as in this species, except that the eggs remain in the ovaries until hatched. The egg-shell being thinner, more transparent, and without the peculiar ornamentation of the shell above described, it would be a more convenient species to study. The conical "egg-openers" on the head are larger.]

THE LARVA.

The young *larva*, fig. 25, is a little more than twice as long as broad, being at birth about 450 μ in length and 210 μ in breadth. It is of an elongated oval form, widest in front of the middle, and with the sides of the abdomen slightly converging posteriorly. It is considerably flattened, with the dorsal and ventral surfaces meeting acutely at the margin, which is entire except slight emarginations at the eyes and opposite each of the four spiracles, and a very deep anal fissure formed by the lobes of the seventh abdominal segment. The margin is furnished with a limited number of slender spines,—six or eight between the eyes, three or four on each side of the thorax, and one on each side of each abdominal segment. At each of the spiracular emarginations is a larger spine, set between two small ones, and at the tip of the ninth abdominal segment are six long spines. On the eighth segment are two

*Dr. A. S. Packard, Jr., describes and figures what appears to be a similar object in the embryo of *Diplax*, but states that it is "attached to the anterior pole of the shell," and supposes it "to be a micropyle." *Memoirs of the Peabody Academy of Science*, Vol. I, No. II, pp. 3 and 24, Pl. II, fig. 13. Salem, 1871.

†Dr. E. L. Mark has given a very interesting account of this process in *Aspidiotus nerii* in his *Beitrag zur Anatomie und Histologie des Pflanzenleuse*, page 11.—Bonn, 1876.

conical protuberances from each of which arises a long slender filament. The *integument* is of a pale yellow color, and quite transparent, showing with distinctness such of the internal organs as are not themselves transparent. It is soft and flexible, but quite tenacious, and when very highly magnified it is seen to be finely striated, the striae being approximately parallel with the sutures between the segments. Thirteen segments can be distinguished, namely: one to the head, three to the thorax, and nine to the abdomen. These are all closely united and the divisions are not always easy to see, and do not appear to extend into the internal cavity at all. The head and thorax together slightly exceed the abdomen in length.

The *head* is deeply sunk in the prothorax, and very greatly flattened with the portion corresponding to the *front* of other Homoptera turned completely under so that appears as if it were a part of the ventral surface, while in reality it is tergal. The upper surface, or *epicranium*, is somewhat transversely and irregularly lozenge-shaped, with the anterior margin regularly curved, while the posterior margin is slightly prolonged, and the lateral angles slightly acute, or nearly right-angles. It is one-fifth broader than long, and occupies one-fourth of the entire length of the insect. On the anterior margin are six or eight slender spines each directed away from the center, and near the lateral angles are the two eyes.

Beneath the head is divided into three distinct parts, which for convenience may be designated the *front*, the *clypeus*, and the *labium* (or *mentum*). Of these the *front* and *clypeus* belong strictly to the tergal region, and only the *labium* is truly ventral.

The *front* is of nearly similar form and dimensions to the *epicranium*, but is more prolonged posteriorly towards the *clypeus* from which it is separated by a transverse suture connecting the sutures which separate the head from the thorax. It supports the antennæ and the eyes, and marginal spines appear to belong as much to the *front* as to the *epicranium*.

The *clypeus* is a little longer than wide, of a somewhat triangular form with the anterior margin nearly straight, and the sides strongly convex. It is possible that this part might be more properly designated as *labrum*. Within it is situated the rather complicated framework which supports the buccal setæ. Viewed in its relation to the interior framework, it appears to correspond very nearly with the *area inferior* of Dr. Mark.

The *labium*, or beak, consists of a single joint which appears to be formed by the sides of the *labium* being turned forwards and then inwards, becoming united to form a flattened conical sheath through which the buccal setæ are eventually thrust. Its structure is in fact very similar to that of the beak of a *Cicada*, only the proportions are different. Its external surface is nearly circular, but truncated on the anterior side, and therefore somewhat broader than long.

The *eyes*, two in number, are situated on the margin at the extreme outer angles of the head, and are equally visible from above or below.

They each appear to consist of a simple convex cornea projecting beyond the margin which is here slightly emarginate. They are rendered very prominent by a collection of reddish or reddish black pigment granules more or less closely connected with the cornea, and which appear to form the termination of the optic nerve.*

The *antennæ*, fig. 25*b*, arise from slight tubercles on the front, slightly in the rear of a line connecting the eyes and at a distance from the margin equal to about one-third of the width of the head. They are quite jagged in outline, tapering gradually towards the end, and furnished with an apparently definite number of long slender spiny hairs. The separations of the joints are more or less indistinct, so that it is difficult to ascertain the exact number. Signoret gives six as the maximum number of joints in the larva of *Pulvinaria*. In this case the joints marked 5 and 6 in my figure would be considered as but one joint. As the insect approaches maturity the joints become more distinctly separated, and in the adult female one can always make out seven or eight without difficulty, and it seems to me quite probable that this is really the correct number for the larva as well.

Considering the antenna as composed of *seven* joints as represented in the figure, the terminal joint is the longest, the third next, and the fourth, fifth and sixth progressively shorter. (If there are but six joints the fifth is equal to, or a little longer than the fourth, and if there are eight joints the seventh is shorter than the sixth, and the eighth shorter than the third.) The *first* and *second* joints are each of regular outline and bear two slender spiny hairs; the *third* joint of slightly jagged outline, bears two very long, rather stout hairs inserted about two-thirds of the distance from the base; the *fourth* joint, of quite jagged outline, bears usually one slender hair; the *fifth* joint, jagged bears one short and one rather long hair inserted near its extremity; the *sixth* joint, about the same length as the fifth, but more jagged, appears to be without hairs; the *seventh* or terminal joint has its greatest diameter nearly midway between its base and its center, thence decreases in four irregular jagged steps to the apex, and is furnished with eight or ten prominent hairs, having their insertions in the jagged incisions, several of which are very long, sometimes that arising from the extremity, and sometimes one from the side is the longest and most prominent. The first joint is about twice as thick as long. The long hair on the second joint is longer than any of those on the ultimate. The second to sixth joints are of nearly uniform diameter, gradually, and not very regularly, decreasing from 12 μ to 10 μ . The entire length of the antenna from the base to the tip of the ultimate joint is about 130 μ and to the tip of the terminal hair, 215 μ . On the *front* between the bases of the antennæ, are two small spines directed backwards.

The *chitinous frame work* supporting the buccal setæ does not differ except in the size and strength of the parts from that of the adult female, which will be fully described hereafter. Fig. 25*a* represents this frame-

* Miss Smith in 7th Report of Entomologist of Illinois, p. 123, says that the eyes are compound, but I think that this must be an error.

work in a larva of the second stage magnified 200 diameters. If we regard it as magnified 275 diameters it would correspond to that of the newly hatched larva.

The *buccal setæ*, four in number having been withdrawn from their spiral coils, during the hatching, are now seen to be united into a bundle, often called the beak, which forms a large loop within the body cavity, reaching as far as the third or fourth abdominal segments. The enlarged conical bases of the setæ, are held in their places within the frame-work above mentioned, while the anterior ends are still held in the cavity of the labium, not having been yet protruded.

The *thorax* is very large and occupies nearly one-third of the entire length of the insect. The prothorax is larger than both the other segments taken together, and is deeply excavated in front to receive the head, with which it is very intimately united. It is much narrower in the middle than at the sides. There is a slight emargination near the center of each side, opposite the anterior spiracles. Inserted in this emargination is a rather stout movable spine accompanied by two more slender spines in close proximity. Three or four other slender spines occur at regular intervals on the margin of each side.

The *mesothorax* is very much smaller than the prothorax, but is larger than the *metathorax*. Both of these are very similar to the abdominal segments in structure and appearance, each is a very little larger at the sides than in the middle, and each is furnished with a single slender spine on each side. Between the metathorax and mesothorax is an emargination opposite the posterior spiracles, furnished with one large and two small spines just as that on the prothorax.

The *legs* have their insertions on the underside at a distance from the margin equal to about one-fourth of the width of the insect, and are about equi-distant from one another.

The anterior legs, fig. 25a have their origin either side of and a little posterior to the *labium*. The portion of the integument to which the leg is attached (*co*) is quite flexible, thus giving the movements of the leg a greater freedom. The coxa (*tr*) is quite large, about one-and-a-half times as long as thick, and bears one or two slender hairs. The trochanter (*y*) is a small triangular piece closely and rigidly united with the femur of which it appears as if simply a part. It bears one very long spiny hair. The femur (*f*) is the longest joint of the leg, but is of a little less diameter than the coxa. Near the outer extremity are two slender hairs. It moves upon the coxa in but one direction,—outwards. The tibia (*ti*) is a little shorter, but nearly as large as the femur. On the inner side near the center it bears a long slender hair, and on the back two short hairs near the middle and one longer one on the side near the extremity. It moves upon the femur in but one direction,—inwards. The *tarsus* consists of a single joint a little shorter than the tibia, slightly sinuous, and tapering somewhat rapidly. It is furnished with several (three to five) more or less, long slender hairs on the basal half, and with four knobbed hairs, or *digitules*, and a single stout claw at the end. It is

joined closely to the tibia and has a limited movement either inward or outward. The claw is comparatively large, slightly curved, considerably swollen at its base, and appears to be movable. The upper pair of digitules are the longest and are inserted on each side a short distance from the extremity. The lower digitules are shorter and appear to be inserted on each side of the swollen base of the claw. Both pairs extend slightly beyond the tip of the claw, and are quite flexible and movable. All the hairs of the leg appear to be articulated at their bases and movable. They probably act as organs of touch,—the digitules being without doubt the most sensitive.

The second and third pair of legs are inserted near the fore margins of the mesothorax and metathorax respectively. They are as near as may be exactly similar to the anterior legs in all particulars.

The *spiracles* (fig. 26, *sp.*) are surrounded by kidney-shaped chitinous pieces, (thickenings of the integument), with the emargination inwards, and are four in number. The first pair are situated on the prothorax just behind and outward from the bases of the anterior legs; the second pair between the meso- and metathorax behind and outward from the bases of the middle legs. Extending from each spiracle to the margin is a shallow groove, which terminates in the spined emargination above mentioned.

The *abdomen* is composed of nine segments of which the first six are similar in form, being each of them a little longer at the sides than in the middle, and furnished with a single slender spine at each side. They gradually decrease in size posteriorly, and the excess of the length at the sides over that at the center of each segment continues to increase until in the seventh segment the disproportion is so great that it forms two large lobes which almost completely surround the eighth segment. There are about three slender spines on each lobe of the seventh segment. The *eighth* segment is very small and entirely surrounded by the seventh. It is prolonged upward and backward into two large conical projections (*an*) from the extremity of each of which issues a long deciduous seta or filament about as long as the entire insect. On the conical projections are two or three slender spines. Remaining between the cones is a small triangular piece beneath which is supposed to be the anus. The *ninth* segment is usually kept withdrawn within the eighth and seventh segments. When the young larvæ are placed in water they are very apt to project it and I have frequently watched them gradually project and withdraw it. [They appear to lose this power when they grow older.] When projected it appears nearly triangular and is terminated by six long spines arranged in two flat groups cemented together by a waxy secretion, thus forming what appears to be a pair of leaf-like organs (fig. 25 *ov.*). In fig. 25 the *ninth* segment is represented protruded to nearly its whole length, but occasionally the "leaf-like organs" are made to extend in a line at right angles to the length of the insect; in 25c it has been partially contracted and the "leaf-like organs" brought together so that they appear as but one group; in 25d it has been entirely withdrawn, so that the spines appear to arise from within the seventh seg-

ment; fig. 25*c* represents the same from below. It will be noticed from the last figure that there is still a considerable space intervening between the lobes of the seventh segment which eventually meet on the median line and form the so-called "anal fissure."

The internal organs of the larva, and in fact the external as well, are exceedingly similar to the adult female only more simple. The malpighian vessels, tracheæ, stomach, and cephalic ganglion are well developed and quite prominent, especially the two first named. In the body cavity of the larva there usually remains a more or less considerable number of yolk globules at birth, which serve as nutriment during the first few days of its life.

HABITS. As soon as born the larvæ begin to walk about quite actively and if not prevented proceed very soon to the leaves where they settle down along the veins, mostly on the under side, (fig. 36) but a fair proportion also on the upper surface. As the first hatched seem usually to settle on the under side it is probable that they do not proceed to the upper side until the desirable places on the under side are mainly occupied. On the underside they settle along the sides of the veins, with the heads either up or down, rarely crosswise, making two rows along each of the principal veins. On the upper side they settle directly over the vein making but one row to each vein. As soon as they settle down they thrust forth their slender setæ, withdrawing them from the loop in the abdomen. The incision into the leaf is, I think, most probably made by the ends of the setæ themselves, worked by the muscles contained within the head. The object in going to the leaf is to find a soft place in which to insert their tender beaks. On box-elder trees the larvæ frequently settle on the younger shoots as well as on the leaves.

They instinctively move towards the light and always upward. I have frequently had them swarming on my table for days at a time, having hatched from egg-nests brought in for examination, and they invariably gather on the side nearest the window, and though they mount to the top of the highest objects on the table, I have as yet never seen them crawl over the edge and down the sides,—they die of starvation first. When deprived of their natural food in this way they live for several days without other food than the yolk globules which remain within the body cavity at birth. During this period they increase rapidly in size notwithstanding their want of food. After being starved a few days they become very transparent.

When settled on the leaf the antennæ and limbs are always arranged in the positions substantially as shown in fig. 26,—the antennæ are directed backward and outward, the anterior legs have the femur directed outwards and slightly forwards, while the remainder of the leg is directed forwards and inwards, nearly at right angles with the femur and parallel with the antennæ; the middle and posterior legs are directed backwards and inwards. Soon after settling down, the anal filaments fall off or otherwise disappear, while their conical bases remain and form a pair of valves covering the anus. A thin layer of a waxy secretion begins to form on the dorsal surface soon after the larva settles on the leaves.

In the course of about three weeks after birth, the larva has attained rather more than double its size at birth, and begins to show some signs of an approaching moult. A considerable quantity of yolk or food globules (adipose tissue) has been accumulated, and on each side of the head are seen two setæ coiled up spirally as in the embryo before birth, very much as shown in fig. 43. By careful observation the enlarged bases of two setæ can be seen at each side (*a, b* and *a', b'*). I am uncertain whether both pair are coiled in the same direction or in opposite directions, but my impression is that the last is correct, and they are so represented in all my drawings. As the old setæ (*g*) are still seen to exist with their conical bases (*h* and *i*) in their proper position, it seems quite certain that those in the spiral coils are an entirely new set. For a long time I believed that the old setæ had been withdrawn into the spirals, and M. Signoret writes me that such is his opinion.* Dr. E. L. Mark however wrote me, expressing the opinion that they were a new pair, and this caused me to make a rather careful study of the subject with the result that the more I study the matter the more certain I am that Dr. Mark is right and a new pair is formed. Among other reasons for this belief, in addition to the above statement, is that the setæ increase materially in size with each moult, which would be a fact difficult to account for if they were persistent. This spiral formation of the setæ just before moulting time, I have observed frequently in this species, and in several species of *Aspidiotus* and *Psylla* and in the last two mentioned genera it is always followed by an actual casting of the skin. It appears probable to me that the setæ of most if not all Homoptera are formed in the same way. There is one other puzzling fact in connection with the "moulting" of this species, notwithstanding very numerous careful examinations specially directed to this point, I have never under any circumstances succeeded in seeing any thing in the least resembling a cast off skin. But the difference in the appearance of the larva before and after is marked and easily recognized at a glance. The only way that I can account for this is that the skin is shed in small fragments or scales. That something corresponding to a moult takes place at this time, I think there can be no reasonable doubt.

THE LARVA OF THE SECOND STAGE.

After the "moult" above described has taken place the larva, fig. 26, is still twice as long as broad, but nearly equally broad behind as in front of the center, and is no longer broadest in front. The abdomen has grown rather more proportionately than the head and thorax, and the lobes of the seventh segment have increased in size until they meet at the median line, thus forming the so-called "anal fissure" characteristic of the *Lecanites*. The marginal spines have become very much more numerous and stouter, there being now upwards of one hundred of these spines nearly equi-distant from one another surrounding the whole mar-

* Speaking of Fig. 43, Signoret writes: "Ce n'est pas, je crois, une nouvelle paire de soies, c'est une ancienne qui se degage d'une espee de tube ou gaine qui formait les anciennes visibles—c'est a voir le formation nouvelle serait assez difficile a expliquer."

gin; one on each of the lobes of the seventh segment is larger than the others and bent at the ends. The legs, antennæ and other organs show no apparent changes except an increase in size. The waxy coating now becomes increased in thickness, and a series of fine pores lying in the groove between each of the spiracles and their spiracular spines begin to secrete a small quantity of white waxy substance.

Up to this period there appears to be not the least observable difference between the larvæ which become males and those which become females. But soon the differentiation begins to take place and progresses gradually. From this time forward the lives of the two sexes are as different as if they belonged to different orders of insects instead of to the same species.

DEVELOPMENT OF THE MALE PUPA.

Those larvæ destined to become males can soon be easily recognized, as follows: The length becomes considerably more than twice the breadth; the sides are nearly parallel, or at least not wider behind than before; the dorsal surface is very elevated, strongly carinated, and covered with a very thick coating of whitish wax, traversed by many irregular cracks as shown in fig. 27. The spines on the larval scale in the specimen from which this figure was drawn show conclusively that the males as well as the females are developed from larvæ of the form shown in fig. 26.

At this time, the larva has laid up a considerable quantity of food globules, and ceases to increase further in size. The pupa begins to form within the larval skin, new antennæ and legs begin to bud out and develop gradually, and the first indications of wings appear. The large flattened lobes of the seventh abdominal segment become changed into prominent conical projections, while the "anal valves" (or the bases of the anal setæ of the larva) are contracted into small tubercles. The ninth segment becomes transformed into a small triangular piece, turned right side out, and is gradually elongated until it forms the style-like penis. Very slight traces of the large dorsal and ventral eyes become gradually visible, in the shape of clusters of pigment granules, but they are never so prominent as in the pupa of *Aspidiotus*. The buccal setæ of the larva persist for some time and probably supply the pupa with food during the earlier stages. What finally becomes of them I do not know, for I have not seen any signs of them under the scales after the male had come out.

The appendages grow gradually in size and definiteness of form until their full development is reached. The separation of the head from the thorax and all other changes take place in an equally gradual manner. The pupa also gradually decreases in size, nearly if not quite as much as shown in the engravings, figs. 27 to 30.

The pupa is covered with a thin transparent pellicle which incloses all the limbs and appendages. This appears to me to be a waxy secretion, at least it shows no apparent structure. Fig. 23 represents this pellicle slipped half way off.

When the wings and all parts of the male become fully developed, but still very soft and pale, the long anal setæ or filaments begin to be projected from the small tubercles on either side of the penis. These setæ are composed of a brilliant white waxy secretion, and probably continue to grow as long as the insect lives, at least they often reach to more than its entire length. The scale becomes loosened at the posterior end while the head end remains fast, and the setæ are gradually projected from under the posterior end, and are always a sure sign that the fully developed male is to be found beneath.* This fact may be known also by the slight rosy tint given to the scale by the partial showing through of the rose colored wings. In escaping from the scale the male backs out, keeping the wings close to the body, and not drawing them over the head as is described of some other species of *Coccidæ*.

THE MALE.

The male (figs. 30 and 33) is a very beautiful, delicately formed two winged fly, of yellowish brown, and chestnut brown colors,† with brilliant rose-colored and iridescent wings. It varies considerably in size, ranging from 1050 μ to 1750 μ in length, including the head and penis, from 320 μ to 520 μ in breadth at the thorax, and from 2000 μ to 2700 μ in the expanse of wings. The other parts appear to vary in like proportion. The *head* is separated from the thorax, with which it is connected by a slender neck. It is nearly globular in form, pointed in front and below, slightly hollowed beneath the front. It is entirely rigid, except the neck which is flexible, and of a general ochrous brown color. The *epicranium* is slightly depressed, at its highest part quite narrow, enlarging both posteriorly and anteriorly. In front it is prolonged into an obtusely conical point, on each side of which is a large very convex eye projecting beyond the margin. A short distance posterior to and outward from each eye is a small black ocellus, which corresponds to the *eye* of the larva and female. The sides or *checks* are very large and globular, forming the larger part of the head, inroaching on the *epicranium* above and on the *front* below. On the cheeks and on the projecting frontal point are a few sparse hairs. The *front* slopes rapidly downward and backward, giving the head a triangular aspect when viewed from the side. At the ventral apex of the head are two large convex ventral eyes, and between them are two very minute tubercles, which are probably all that remains to represent the external mouth parts. There appears to be no doubt as to the function of these ventral eyes as organs of vision. It is necessary that the male should see downward in order that he may detect the female, unless this may be done entirely by touch, which is not likely. When dissected out and observed from the inside

* Miss Smith's remarks on this subject in the *American Naturalist*, 1878, p. 809, are based upon a mistranslation. In the 2d line of the 3d paragraph read "this" for "that," and "and this remains" for "which rests," and it is evident that Signoret's statement agrees exactly with Miss Smith's observation.

† Miss Smith says, in the *American Naturalist*, 1878, p. 660, "fuliginous," but this is probably an error for *ferruginous*, which would be nearer the truth, though hardly correct according to my observations.

highly magnified they exhibit a spiral structure, and their position in the developing pupa corresponds precisely to that of the spirally coiled setæ in the earlier stage of the larva, and in the female. I do not feel quite ready to assert that the setæ are converted into eyes (two to each), as it is possible that the spiral structure mentioned may be superimposed upon and yet distinct from the eye. The two ventral and the two large dorsal eyes are similar in size and appearance, both pairs are very convex, smooth, shining, dark reddish brown, nearly black, and so far as I can discover they are simple. The small dorsal ocellæ are about one third as large and much darker in color.

The *antennæ* (fig. 33a) are inserted upon tubercles just below the frontal apex and are ten jointed. The first joint is short and thick, the second large and globular, the third small and triangular, the fourth longest, the fifth to ninth progressively decreasing in length, the tenth a little longer than the preceding. The third to tenth joints have a somewhat irregular surface, and are very nearly equal in diameter, though the last three are a little thicker. All the joints are thickly furnished with slender hairs, longer than the diameter of the joints. The tenth joint, in addition, is furnished with three knobbed hairs rather longer than the joint, and with three plain curved hairs, without knobs, about twice the length of the joint.

The *thorax* is large and somewhat irregularly lozenge-shaped in form with the angles rounded. It is distinctly separated from both the head and the abdomen, though most closely connected with the latter. The dorsal surface of the thorax is divided into a number of distinct pieces. Three of these parts are particularly noticeable, and appear to offer by their form more or less good specific characters. The most anterior of these, probably the *scutum* of the prothorax, is of an irregular oval form with the front margin very convex and the posterior margin slightly concave, smooth, polished, and moderately dark brown in color. It is large and prominent and projects over the neck, giving a hump-backed appearance to the insect when viewed from the side. This piece is followed at an interval by a strongly arched transverse quadrilateral piece, called the *apodema* by Targioni-Tozzetti and which appears to correspond to the prominent transverse band in *Cicada*. It is about three times as broad as long, with the sides slightly flexuous and parallel, of a polished dark brown color, and is very prominent. The *apodema* and *proscutum* are connected at their nearest outer angles by sinuous convex, narrow, dark brown bands, and both are divided longitudinally into two halves. If we may judge from the males of several species of *Aspidiotus*, the form and proportions of the *apodema* will probably be of service in distinguishing the males of the different species of *Pulvinaria*. Immediately following the *apodema* is the *scutellum*, a very large convex, somewhat triangular shaped piece, which projects over the first and second abdominal segments. The sides of the *thorax* are considerably bulged out in the center, and are made up of a number of pieces which I have not studied with care. The anterior

lateral pieces show a distinct flexure on each side. The wings are inserted on the upper portion of the widest part of the thorax, each side of the *apodema*. Beneath, the thorax is comparatively flat. The prosternum is narrow and triangular, allowing the coxæ of the anterior legs to approach comparatively close to one another. The mesosternum is a large flat, sub-hexagonal plate, causing the coxæ of the middle legs to be widely separated. The metasternum is short and broad, causing the coxæ of the posterior legs to be also widely separated.

The integument of the *thorax* is entirely rigid except the region about the neck, which appears to be flexible and contractible, so that often the head appears to approach closer to the thorax than is shown in the figure. The *proscutum* and *apodema* are shining dark chestnut brown—the latter being the darker. All other parts are sparsely furnished with fine hairs, and are of an ochreous brown, varying in darkness according to age. The legs, like the antennæ, are of a pale ochreous color, with a decided rosy tint when alive.

The wings when fully developed are thin and membranous, as long as the entire body from the front of the head to the base of the penis; nearly half as broad as long, with the front margin nearly straight, except a slight bending out near the base, and the posterior margin strongly and regularly curved. They are each furnished with a rather stout vein at a short distance from the anterior margin, and a much more slender vein directed somewhat parallel to the posterior margin; both veins appear to lose themselves before reaching the margin. The wings are scarcely transparent, and are somewhat whitish or highly iridescent, according to the direction of the light. The anterior portion, especially between the vein and the edge, is strongly rose-colored. The surface is covered with numerous very fine hairs which are longer on the margins and more numerous in the costal region. They are directed outwards on the margins, but appear to stand erect on the rest of the surface.

I have never succeeded in finding any indications of the *balancers* or wing hooks which are so characteristic of the males of the *Coccidæ* in general, with but one doubtful exception. This last was in the dissection of a fresh specimen in August, 1879, and as I saw but one I was not able to prove conclusively that it might not be a fragment of some other part of the integument. Notwithstanding that I have carefully searched many scores of specimens under the microscope both alive and variously preserved, both transparent and opaque, without detecting any trace of a balancer, yet I believe they do exist and will eventually be found—though probably in an imperfect form, or held in a position difficult to see.

The legs (fig. 33*b*) are long and slender,* as compared with those of the female; and are somewhat densely† covered with long slender flexible hairs. With the exception of size and the mode of attachment of the coxæ they all appear to be exactly alike. The coxæ of the front legs

* Miss Smith says "stout." *Am. Nat.*, 1878, p. 660; *7th Report Ent.* III., p. 125.

† Miss Smith says "sparsely."—*loc. cit.*

are shortest and directed forward and inward; those of the four posterior legs are alike, a little longer than the anterior coxæ, and are directed backward and outward. The coxæ are all quite large and stout. The trochanter is tolerably long and slender, and is closely and immovably united to the femur. The femur is twice as long as the trochanter and is stouter. The tibia is a fifth longer than the femur and trochanter combined, is more slender, and is furnished on the inside with about six pairs of rigid spines, of which those at the extremity are largest and most prominent. The tarsus is about one-third the length of the tibia and tapers toward the extremity where it is terminated by a short movable claw* with an enlarged base, and by four digitules or knobbed hairs,—the two longer of which are attached to the outside of the tarsus near the tip, and the two shorter to the enlarged portion of the claw. Both extend a very short distance beyond the tip of the claw.

The *abdomen* is longer and more slender than the thorax and, like that of the larva, is composed of nine segments. The integument is soft and yielding and capable of considerable expansion and contraction. The color is normally pale ochreous, but the integument being somewhat transparent it is modified by the color of the internal contents of the abdomen—giving it a grayish hue. The whole abdomen is sparsely furnished with fine short hairs. The first six segments are similar in form and simple in structure, each presenting a nearly circular section. They become successively smaller from before backwards. In mounted specimens it is often difficult to see the divisions of the segments, but in the living insect they are plain enough.

The seventh segment is modified by being prolonged at the sides backward into two rather long conical processes. These decrease by steps and are furnished with a number of spiny hairs at the tips. They are developed from the lobes of the seventh segment of the larva, and correspond to the lobes of the female which inclose and form the "anal fissure."

The *eighth* segment, as in the larva and female, is very small and lies between the bases of the conical projections. It is furnished with two small tubercles, one on each side of the base of the penis, from each of which arise about two long spines. These secrete two waxy filaments, or rather bundles of filaments united together, of the purest white. These filaments often attain a length greater than the entire length of the insect, and their presence is a sure sign that their bearer has attained his majority. They appear to grow continuously during the life of the insect and if broken off still continue to grow. They dissolve readily in turpentine, etc., and in reality form no part of the insect, being simply a secretion.

From the *ninth* segment is formed the penis, and its enlarged base is generally kept slightly within the eighth segment. The penis is in the form of a long slender conical style, curved downward and tapering to a rounded point at the end. It is composed of two dark brown horny

* Miss Smith says "two claws," which is certainly an error.—*loc. cit.*

pieces, of which the tergal or dorsal is strongly bent downward at the sides, forming a deep groove on the underside throughout its entire length, and which for a short distance near the base is formed into a complete sheath by the meeting of its sides. The sternal piece is rather flattened and lies within this groove, or sheath.

Internal Organs.—The *nervous system* I have not studied. A large apparently three lobed ganglion, is often plainly seen in the head in specimens which have been rendered somewhat transparent. It is evident from his actions that the male is well supplied with nerves and very sensitive to them.

The *muscles* are numerous and well developed, especially in the thorax, but I have not studied them.

The *digestive organs* are apparently very abortive. There appears to be no opening for a mouth, and I have been able to discover no anus, neither any indications of stomach, nor intestines. There is however a small pair of malpighian vessels similar to those of the larva. The male appears to subsist entirely upon food cells stored up during the early part of the pupa state.

The *respiratory organs* I have likewise not studied. The larger tracheal vessels and the spiracles I have not observed, but I suppose the latter are situated on the sides below the wings. Small tracheal vessels are seen to extend into the limbs, and one passes along by the side of the main vein of the wing.

Two rather large glands (fig. 45, *i.*) situated in the eighth abdominal segment, furnish the material forming the long waxy anal filaments, (fig. 45, *f.*, *f'*) and are the only *secretory organs* I have observed.

The anterior portions of the *generative organs*, (fig. 45) including probably the testes, lie within the thorax and have not been studied by me, but in the anterior part of the abdomen are two large vessels (*a.*, *a'*) filled and distended with the filamentary spermatozoa. These vessels extend backward about as far as to the sixth segment, becoming gradually narrowed into slender tubes (*b.*, *b'*). They then take a turn outward and forward and then again inward and slightly backward, until they come together and unite to form the *ductus ejaculatorius* (*c.*). This last is composed of thick cellular or muscular walls, transversely striated, is enlarged towards the middle, then becomes smaller again as it approaches the penis (*d.*, *e.*) into which it extends and discharges itself. I have an impression of having seen, under pressure, this or some other organ protruded from the tip of the penis.

The *spermatozoa* (fig. 46 and 46*a*) after passing out of the *ductus ejaculatorius* and *penis* appear usually more or less closely united in bundles. Fig. 46 shows a small detached bundle, to the structure of which Dr. Mark has called my attention. One end of each spermatozoon is sharply pointed and more highly refracting than the other end, thus giving it an arrow-head-like appearance. The specimen figured is found on one of my preparations, and has been preserved for over two years in glycerine. In fresh preparations in glycerine or acetic acid, there is no appearance

of the refracting ends, neither have I been able to detect it in numerous other specimens of the same date as those figured. Some of these however show irregular refracting spaces along the filament, not confined to the end, so that I am inclined to regard the arrow-head appearance as due to the preparation and not to the structure of the spermatozoon itself. I have sometimes thought I could detect a slight transverse striation. The filaments represented in Fig. 46 are about $400\ \mu$ long and less than $1\ \mu$ in diameter. It will be noticed that each spermatozoon is considerably longer than the entire length of the egg when it is laid.

Habits.—The male when he first comes out is quite pale colored and soft, but soon becomes darker and stronger. He however at once walks about quite rapidly, and at first pays no attention to the females in his way. On two occasions I have observed the process of copulation. The male mounts the back of the female with his head in the same direction, (fig. 34) and vibrating his antennæ rapidly; he now strokes her actively with his fore feet in the region of her eyes; then, by means of alternate contractions and expansions of the abdomen, the penis is inserted between the anal valves and into the vulva to the extent of its entire length; it is then alternately withdrawn and inserted several times; the vibration of the antennæ goes on continually and the stroking with the fore feet takes place at frequent intervals; several times during the operation the male makes a complete circuit, with the nearly withdrawn penis as a center. The whole process takes about ten minutes. The male then goes off to another female. Whether he ever copulates with more than two females I do not know, but I am inclined to think he does. At any rate his stock of spermatozoa is sufficient for a score or more of females. The proportion existing between the males and females, varies according to circumstances. On healthy trees, and when both males and females are few in number the proportion of males to females is much less than when the trees are unhealthy and the bark lice excessively numerous. In the latter case the males often equal or exceed the females in numbers. A suggestion as to the cause of this will be mentioned under the head of DISEASES.

I have never seen a male take to wing voluntarily, but they will do so when dropped from an elevation; those which I observed flew heavily and but a short distance. I do not know whether they are normally diurnal or nocturnal, but I think most likely the latter, as they appear very inactive by daylight.* The life of the male after attaining the use of his wings is very brief, probably never exceeding two or three days. The males appear from August 1st to September 15th, but the most of them about August 15th, making the entire life of the male, little if any over eight weeks, while the female lives for thirteen months.

*Miss Smith who appears to have observed this point more carefully than I have done, says however, "They are very active flying about the leaves with great rapidity." *Prairie Farmer*, July 12, 1879.

DEVELOPMENT OF THE FEMALE PUPA.

The larvæ destined to become females undergo only very slight changes of form. Up to the stage represented in fig. 26, they are not distinguishable from those of the males, but while those become narrow and long, these become much broader in proportion to the length, usually about two-thirds as broad as long, and with the posterior (abdominal) portion very much broader than the anterior, this change being caused no doubt by the development of the ovaries. They also differ from the males in remaining quite flat with only a slight dorsal carina. These characters soon render them easily distinguishable from the male scales.

Just before the appearance of the males, the female pupa (if such it may be called) is seen to be supplied with a new pair of setæ coiled up spirally on each side of the head (fig. 43) just as in the larva above described, thus indicating a moult, although, as in the previous moulting time, there is no appearance of a true shedding of the skin. Up to this time the females have remained of a pale yellow color; they now become adorned, just in time to attract the attention of the males, with deep red markings, rendering them much more handsome than at any other period of their life, before or after.

The female to all appearances remains a larva to the end of her life, but I speak of this as the female pupa, because it corresponds with the same stage in the development of the male.

THE FEMALE.

The female (fig. 32) is scale like, depressed, approximately oval in form, widest behind the middle, with the anterior tapering more rapidly than the posterior portion; about one and three-fourths times as long as broad, (1400 μ to 1800 μ long by 800 μ to 1100 μ broad). A distinct but rounded and slightly elevated carina extends from the head to the anus. The margin is entire except slight emarginations at the eyes and opposite each of the four spiracles, and a deep fissure extending to the anus. The margin is furnished with a large number of spines, (about 120) set at nearly regular intervals, and each secreting an elongated waxen cylinder or filament, the whole, when unbroken, forming a whitish fringe, not usually very prominent. In each spiracular emargination is a larger movable spine, supported by two smaller spines, which present a different appearance from the others and do not appear to be secretive in their nature, though I am not perfectly certain that they are not.

The dorsal integument is dense and tough and the divisions of the segments are much obscured. The head is deeply set into the thorax, and the head and thorax together are about equal to one half of the entire length. All of the segments of both thorax and abdomen are longer at the sides than in the middle, and in the seventh segment this difference is very great, so that it appears formed of two large lobes meeting on the median line, surrounding the eighth segment and forming the so-called "anal fissure." The eighth segment is entirely surrounded by

the seventh, and is not visible from the above except by two large triangular subconical valves which cover the anus. (These anal valves are developed from the conical bases of the setæ in the young larva). The anus is situated on the eighth segment and opens dorsally. I have not seen the opening itself, but I have seen the excrement (so-called honey-dew) ejected from it.

The general ground color of the dorsal surface is pale yellow, and is very prettily marked with deep red. A narrow margin all around, including the anal fissure in reddish; nearly parallel with this, and at a distance from the margin nearly equal to the depth of the anal fissure (approaching nearer the margin anteriorly) is another more irregular red band; this is connected with the margin by red cross bands as follows: at the eyes, at each of the spiracular emarginations and five or six on each side of the abdomen; these cross bands are more or less faintly continued toward the carina. Besides these there are indications of more indistinct, intermediate cross bands,—and numerous reddish specks over the entire surface. The dorsal carina is also reddish. The principal cross bands above referred to have been generally supposed to represent the divisions between the segments. I can not at present say whether this is, or is not, the case, for when the sutures are rendered visible by acetic acid, glycerine, potash, or otherwise, the colored bands are at the same time rendered invisible. The entire dorsal surface is covered with a thin layer of wax, not enough however, at this stage to obscure the color.

Two black eyes are present, one on each side of the head, equally visible from above or below, and are of the same structure as in the larva.

The *ventral integument* is pale whitish yellow, quite thin and somewhat transparent, allowing the trachæa nearest the surface to be seen by reflected light, as long slender branching tubes. The divisions between the segments are tolerably distinct, especially in the sternal region, as all that portion of the under surface lying between the *labium* and *vulva* and between the bases of the legs may be designated, while the remainder of the under surface, except the head, forming a border nearly as wide as the length of the anal fissure, may be considered as the *episternal* region. The *episternum* is quite flat, fitting closely to the leaf or bark when the insect is at rest, while the *sternum* forms a shallow cavity in which the feet rest when not in use.

The structure of the head and of its different parts is not different from that of the larva. The *labium* however appears a little more strongly developed and is seen to bear at least six quite stout spines, (figs. 35, a and 43, f.)

The *antennæ* are inserted on the front as in the larva and are composed of from seven to eight joints, of which the first is thickest and the rest gradually tapering towards the extremity. The third joint is the longest; then the fourth, the eighth, the first, the second, the fifth, the sixth and the seventh decreasing in length in the order named. In some cases the seventh and eighth are represented by but one joint which is then longer than the fourth, thus reducing the number of joints to

seven.* The first joint appears to be without hairs, the second with two hairs, the third with one short hair, the fourth with two hairs, the fifth with one or two hairs, the sixth with one or two hairs, the seventh with one or two hairs, and the eighth with six or eight hairs, two or three of them longer than the others. All the hairs are proportionately much shorter and more slender than in the larva. When at rest the antennæ are held in the position shown in fig. 26. The two spines directed backwards on the front between the bases of the antennæ are larger and better developed than in the larva. The antenna is $290\ \mu$ to $310\ \mu$ in length without including the terminal hairs.

The very slender "beak" is composed of four very long and very slender chitinous setæ, and often attains a length considerably greater than that of the insect. As these are of internal origin they will be more fully described further on.

The structure of the *thorax* is essentially the same as in the larva. The shallow grooves extending from the spiracles to the spiracular emarginations are more marked. In these grooves are a number of fine pores which secrete a white waxy, filamentary and powdery substance which seems to serve the double purpose of keeping a passage open to the air, but closed to foreign substances, and to hold the insect in place. Whenever the insect is removed four white marks remain on the leaf or bark to mark the position of these spiracular grooves. At the termination of each groove are the three spines as described in the larva. Their function is unknown. The insertions of the legs are as in the larva,—and we may add, between the sternum and episternum.

All six *legs* are of almost precisely similar structure, (fig. 32*b*), except the coxæ of the anterior pair may be a little shorter than the others. The coxa is quite large, about twice as long as thick, and furnished with about two hairs. The trochanter is very small, triangular, and immovably united to the femur. It bears one very long spiny hair. The femur is about one and a half times as long as the coxa, of somewhat less diameter, and bears near its end, outside, one or two small hairs. The tibia is scarcely as long as the femur, but more slender and with three or four hairs. The tarsus is about two-thirds as long as the tibia, tapers toward the end, and is terminated by a curved claw swollen at its base, and by four digitules. The two upper digitules are long and slender, terminated by globular knobs at the end, and inserted near the end of the tarsus on each side. The two lower digitules are shorter, club-shaped, gradually enlarged from the base to the tips, are equal in size, and appear to be inserted on the swollen base of the claw. The legs when at rest are held nearly in the positions shown in fig. 26, the four posterior legs resting in the sternal cavity.

The *abdomen* occupies less than half of the entire length, but is considerably more bulky than the cephalo-thorax. The first six segments, as in the larva, are similar in form, but become progressively smaller

* Signoret states that this same variation occurs in *P. vitæ*. *Essai sur les Cochenilles*, p. (222.)

toward the rear. Each segment is composed of at least four pieces namely: the *notum* forming the dorsal surface, the *sternum* forming the central portion of the ventral surface, and one *episternum* on each side of the sternum. We might go further and consider the dorsal surface as composed of three pieces—a *notum* with an *epimerum* on each side, the latter representing the portion lying between the submarginal band and the margin, and the former the central carinated region, thus making six pieces; and still again, as we have seen in the male of this species, the sternum and notum are each composed of two lateral halves, which would make a total of eight pieces to each segment. [The segments of the thorax would of course have the same structure, with the addition of the insertions of the coxæ.] On either side of the sternum on each segment are two obscure impressed points probably serving for the insertion of muscles. A small portion of the eighth segment remains visible below. The ninth segment is turned outside-in and withdrawn within the eighth and seventh segments, forming a vulvular cavity. At its extremity is the *vulva*, the opening of the vagina. Surrounding the vulva are two flattened appendages (fig. 1, o) each formed of three long movable spines united together by means of a waxy secretion, forming a sort of tube through which the eggs pass. These are evidently the same as the "leaf-like organs" seen in the young larva.

On the sternum of each of the posterior segments, (the 8th, 7th, 6th, and possibly others,) are two long movable wax secreting spines, and large numbers of very small circular wax secreting pores. These last are exceedingly abundant immediately around the vulva on the eighth segment, a little less numerous on the seventh, and on the others there appear to be two irregular rows around the posterior margin of each segment. These pores are about 5μ in diameter and too numerous to count.

Internal Organs.—The *internal mouth parts* of the Coccidæ have been well described by Dr. E. L. Mark,* and those of this species are composed of essentially the same parts. Fig. 26a is drawn from the mouth parts of a larva of the second stage, but by considering it as magnified but 106 instead of 200 diameters it will be sufficient for the following explanation. That portion of the head contained within (what I have considered as) the *clypeus*, forms a cavity lying between two somewhat triangular planes supported by a chitinous frame work. The lower plane (*area inferior* of Mark) is the larger and corresponds very nearly, if not entirely with the external *clypeus*. It is bounded on the front by the *arcus inferior*, (a) and on the sides by the *costæ inferiores dextræ et sinistræ*, each of which appears composed of two parts (b and n, b' and n') meeting at the radiating points, (f, f'), the posterior portions (n, n') join with the corresponding parts of the *costæ superiores* to form the perforated *clavus* or *steuerung* of Mark through which the buccal setæ pass, (between p and p'.) The upper plane (*area superior*) is bounded in front by the

* Beiträge zur Anatomie und Histologie der Pflanzenläuse, insbesondere der Cocciden, Bonn, 1876, pp. 5-20. Also in *Archiv f. Microscop. Anatomie, Band XIII.*

arcus superior (*d*) which is bent inward and then prolonged downward into the *columellæ* (*e*, *e'*) which connect with *arcus inferior*, and backward at the sides into the *costæ superiores dextræ et sinistræ* (*c*, *c'*). These *costæ superiores* are extended backward until they become united into a broad plate, which joins with the *costæ inferiores* to form the *clavus*, and from about their middle they each send off a branch (*h*, *h'*) which connects with the *costæ inferiores* at the radiating points (*f*, *f'*). The broad plate formed of the *costæ superiores* probably represents a part of the original sternal portion of the head, say for example the *gula*; at least it now forms the division between the head and thorax. Two chitinous pieces (*g*, *g'*) extend from the radiating points (*f*, *f'*) about three-fourths of the distance toward the center where they appear to join with two other slender chitinous pieces (*j*, *j'*) lying on each side of the œsophagus, (I am however not altogether certain that there is a junction). This complicated frame-work serves to support the enlarged conical bases of the four buccal setæ (*r*, *r'*, *t*, *t'*). Each seta consists of a very long and slender tube enlarged at the base which forms an elongated apparently hollow cone (*conus*). In the outer and lower pair of setæ the cones are more elongated, more slender, and they are passed through the *clavus* until they can go no further on account of the enlarged ends. The interior and upper setæ are more rapidly enlarged at their bases and come together a short but quite perceptible distance above the lower or outer setæ. They are also more closely united throughout their entire length,—while the outer pair are easily separated, these usually remain together as if but one piece. This fact has caused many persons to believe that there were but three setæ. The four setæ evidently form a tube through which the sap is absorbed from the tree—once started it is probable that the capillary action would be sufficient to draw up the sap, but Dr. Mark has described a distinct sucking apparatus which he observed in *Chionaspis*.* Extending forward from the junction of the inner setæ is the œsophagus (*l*), at its base are two small chitinous pieces (*m*, *m'*), and lying within its swollen part (*pharynx*) is a small chitinous piece (*e*) the *uva* of Dr. Mark. The buccal setæ after passing through the *clavus* enter the cavity of the *labium* in which they are held in place, possibly by a crescent-shaped chitinous piece (fig. 35, *b*), and then pass on and out through the lips at *a*. The internal part of the *labium* is peculiarly modified so as to form a thin transparent elastic sack (*crumina*) within which the setæ are withdrawn whenever the insect wishes to change its feeding place, as is always done when the sap ceases from any cause to flow in sufficient quantities to the leaf or limb on which it is settled. In this case the setæ are seen to form a large loop lying in the *crumina*, within the body cavity and extending back as far as the third or fourth abdominal segments. This withdrawing of the setæ is probably accomplished by means of muscles lying within the labial cavity and possibly attached to the crescent-shaped piece before mentioned.

[Besides the species under consideration I have studied more or less carefully corresponding mouth parts in *Lecanium*, *Aspidiotus*, *Psylla*, and *Cicada*, and in all these the struc-

* *Beitrag*e, etc., pp. 17-18.

ture is essentially the same, namely: four slender elongated chitinous setæ, with enlarged conical bases, thrust through a *clavus*, and thence through a sheath formed of the labium. In all, the bases are supported by a frame-work something as above described. In fact the only essential variation is in the proportions and minor details of the different parts. I found it very easy in dissecting the head of a *Cicada* to withdraw the setæ inwards by catching hold of the muscles to which they were attached, with a forceps. All four setæ were in this way easily separated leaving behind the chitinous piece with a round hole through which they had been thrust, and which held them in place, being in fact the piece which Dr. Mark has called the *clavus*. While dissecting the *Cicada* I noticed that just above and behind the base of the labium on each side is an external chitinous piece, terminated by a sharp pointed bristle, which appears to be capable of a slight motion, and when separated bears a considerable resemblance to a mandible. In *Psylla* I observed the mouth parts of the pupa just before moulting, and of the imago (sex not recorded). In the latter are similar abortive mandibles, rather more distinct than in *Cicada*, but in the Coccidæ I have seen nothing recalling these except the small tubercles behind the ventral eyes of the male. In the pupa was noticed a new set of setæ formed in spirals just as in the *Coccidæ*. It therefore seems reasonable to infer that the setæ of all Homoptera are formed in the same way. Taking all these things into consideration I have come, much against my original inclination, to regard these setæ as *not* representative of the mandibles and maxillæ as is generally taught. From a note in Dr. Mark's work above referred to (page 6) it seems that Mecznikoff has arrived at a similar conclusion from a study of the embryos in the eggs of *Aspidiotus* and *Aphis*. Dr. Henry Shimer has suggested to me that if this is the case, the buccal setæ may more truly represent the *lingua* of other insects.]

The *digestive system* is almost precisely the same as that of *Lecanium hesperidum* which has been well described by Dr. E. L. Mark.* Beginning with the mouth parts above described, a long slender œsophagus (figs. 26,a, l; 35,f; 43,e; 48,i) extends directly forward from the junction of the buccal setæ, then turns upward, passing outside of and around the *arcus superior*, and backward, extending into the mesothorax where it becomes merged in the chyle stomache (*ventriculus*). This becomes enlarged, continues to extend backward a short distance and then turns abruptly forward making three or four convolutions (*ansa minor* of Mark) inclosed within a sack (apparently the anterior part of the rectum!?). It then forms a very long, rather narrow intestine (*ansa major*) lying free in the abdominal cavity, extending backward nearly as far as the anus, and then forward to near the point of beginning where it joins the rectum, thus forming a large loop, and after extending a short distance further terminates in a blind ended sack. The walls of this ventriculus consist of large nucleated cells, very distinctly visible; these undoubtedly serve to transform the sap absorbed from the tree into protoplasmic cells capable of being converted into the tissues.

A short distance from the beginning of the large loop (*ansa major*) of the ventriculus it receives the outlet of the so-called *malpighian vessels*. These are two elongated sacks lying free in the abdomen, one on either side of the rectum, which unite at their anterior ends to form a small short tube which opens into the ventriculus. They consist of large cells filled with a deep yellow granular substance, and in each cell are two (rarely one) large cavities. It seems quite probable that these vessels are secretory in their nature, supplying a substance aiding the digestion of the food, or its conversion into protoplasm or blood. They may also serve as a means of escape for the waste products of the change of tissues.

* Beitrage, etc., pp. 20-29.

Extending from the end of the *vertriculus* directly backward to the *anus* is the *rectum*. It is an enlarged sack-like organ, and is contracted rather suddenly at the small *anus*.

Of the *circulatory system* I have made no positive observations that are of any value. The blood (or protoplasm) after leaving the stomach, appears to circulate all through the cavity of the body not otherwise occupied. If there is a dorsal vessel I have seen no traces of it, neither have I seen any indications of a rhythmic motion.

The *respiratory organs* consist of the *spiracles* and *trachea*. The *spiracles* are four in number, situated on the under side of the thorax as above described. Each *spiracle* consists of an elongated opening in a kidney-shaped chitinous piece. Extending inward from each *spiracle* is a large tracheal tube, which soon divides into three main branches, and these again each divide into two secondary branches. Of the six secondary trachea thus formed about each of the anterior spiracles, one extends near the ventral surface toward the opposite side until it meets and unites with a similar trachea from the opposite spiracle; a second extends dorsally and connects with its fellow in the same manner; a third extends longitudinally near the ventral surface until it meets with a similar trachea from the posterior spiracle on the same side; a fourth extends inward and backward near the dorsal surface until it meets with a similar trachea from the posterior spiracle on the same side; the fifth and sixth extend forward, sending out several branches which lie free in the head. Of the six secondary tracheæ formed about each of the *posterior spiracles*, two connect with the tracheæ from the anterior spiracle on the same side; a third extends near the ventral surface toward the opposite side until it connects with its fellow from the opposite spiracle; a fourth extends near the dorsal surface, inward and then backward into the fourth abdominal segment where it unites with its fellow from the opposite spiracle; the fifth and sixth extend backward sending forth several branches which lie free in the abdomen. The junction point of the connecting tracheæ is usually marked with a slight irregularity, which seems to indicate that at some period in the life of the insect they were not so connected but have grown together. By this connection of the tracheæ, respiration of the insect would not be interfered with even though one or more of the spiracles should become stopped up. This description of the tracheæ applies more properly to the younger states of the larva. In the adult female it is fundamentally the same, but the branches of the tracheæ become exceedingly numerous, permeating every part of the body, and even the tracheæ connecting the spiracles appear to send forth branches, which is certainly not the case in the young.

Adipose tissue. Whenever the insect is about to undergo a moult or other fast, and to a less extent at other times, it lays up in the otherwise unoccupied parts of the body cavity a greater or less quantity of spherical food globules,—exactly similar in appearance to the yolk globules remaining in the young at birth.

The *secretive organs* are very numerous and highly developed. Besides the so-called *mulpighian vessels* already mentioned, there are the *salivary glands*, the *vaginal glands*, and the numerous *wax-secreting glands*. To these might be added the retort-shaped organs in which the buccal setæ are developed, but I know nothing of their particular structure except by seeing the setæ coiled up in them.

The *salivary glands* (fig. 48, *f, f'*) consist of two groups of six or more spherical glands, lying one on each side of the mouth parts, with which they appear to be connected, but in just what manner I did not observe. Each spherical gland appears to consist of two nucleated cells. These organs have been quite fully described by Dr. Mark.*

The *vaginal glands* (fig. 47, *f, f'*) consist of two groups of three large many celled glands, lying one on each side of the vagina. Each group discharges its products into a large spindle-shaped vessel (*g, g'*) which becomes very narrow at its outlet. The outlets of both vessels (*h*) are close together a very short distance above the outlet of the *vagina* at the *vulva* (*d*). It is probable that these glands secrete a viscid substance with which the eggs become coated in their passage, and which after their expulsion causes the fine waxy powdery rings to adhere to the surface, as has been observed to be the case.

The *wax secreting glands* so far as I have observed them, consist of a single spherical gland for each pore (fig. 44, *a*). This appears to consist of a single cell surrounded by small branching tubes which unite together at one point to form a long slender straight tube (*b, c*) extending to the orifice (*d*). The outer half (*c*) of the tube appears to be larger than the inner half (*b*). The *wax secreting pores* are of three kinds: The *first* are circular with a small central tubercle, surrounded by a number of fine pores (fig. 49), these give rise to the fine powder-like substance which when highly magnified is seen to be in the form of rings (fig. 18 *a*). These pores are very numerous, especially on the ventral surface of the abdomen, and in the spiracular grooves as above described. It is possible that these may sometimes give rise to filamentary substance, but I do not think this is usually the case. In the *second* form (fig. 50) the central tubercle is enlarged and greatly prolonged forming a long stout spine (*f*), undoubtedly pierced by numerous very minute pores, through which the waxy substance issues in a soft state and unites to form a long hollow filamentary tube (*g*). It is from these waxen tubes that the so-called "cottony," "woolly," or "silken" substance of the egg nest is formed. These spines are numerous all around the margin, and a few on the underside of certain of the abdominal segments as above described. The *third* kind of pores, those on the dorsal surface, I have not distinctly seen. They are probably very numerous and very minute, corresponding to the sweat glands of the higher animals. At any rate the dorsal surface is entirely covered with a uniform layer of wax very thin in the young, but increasing with age when it generally becomes cracked, but never becoming sufficiently thick to

* *Beitrage*, etc., pages 29-51.

conceal the form of the insect, as is the case in many Coccidæ. This wax is more or less soluble in alcohol, chloroform, ether, turpentine and almost any oily substance, but appears to remain unaffected by water, glycerine, nitric and acetic acids, etc., and renders the insect quite water proof.

It is by no means improbable that a more careful study would reveal a greater variety in the forms of these wax-secreting glands. The form described and figured (fig. 44) appertains to the *ventral* tubercular pores, and I think those of the *spines* and *dorsal* pores can not be very different,—but still they may be.

The *nervous system* (fig. 48) consists of numerous nerves centering in two large ganglia. The anterior, *cephalic*, or *supra-oesophageal ganglion*, (*a*) is triangular in form with the sides convex, and, so far as I have been able so detect, without any indication of a bilateral division. It lies immediately in front of the mouth parts with the smaller end directed backward and dividing into two commissures, allowing the oesophagus to pass upward between them, while they continue on, passing between the *arcus superior* and *arcus inferior* and thence through an opening in the *area superior* and over the posterior parts of the *costæ superiores*. During this passage they become again united and gradually enlarged into the *infra-oesophageal* or *thoracic ganglion* (*b*). This is a large somewhat pointed oval body, which shows obscure indications of a bilateral division and also of four or more transverse divisions. It is continued backward in a rather large ventral cord (*c*) which I have traced a distance equal to about the length of the thoracic ganglion without finding any branches or abdominal ganglia. It probably supplies the large nerves about the vagina, etc. From the posterior half of the thoracic ganglion two nerves (*k* and *e*) are seen to start out on each side, and the most posterior (*e*) of these almost immediately sends off a branch (*d*) thus making three nerves on each side. I have not traced the ultimate destination of these, they may very probably supply the nerves of the legs, or they may in addition send branches to other organs. From the anterior angles of the cephalic ganglion proceed the large optic nerves (*m*) to the eyes. As they approach the eyes they become enlarged and filled with dark reddish granular matter. From the under side of the cephalic ganglion extend two smaller nerves (*l*) to the antennæ, and in all probability there are others to the mouth parts and other organs which I have not seen. Numerous small nerves are found in various parts of the body, but I have not traced their connections. Both nerves and ganglia appear to consist of a grayish granular substance inclosed by a thin transparent membrane.

There are numerous *muscles*, but I have made no attempt to study them. In structure the muscles are composed of fibres transversely striated. There are very numerous muscles in the vicinity of the anus and of the vulva. There are also some indications of muscles attached to the conical bases of the buccal setæ, and in *Cicada* I have actually observed this to be the case.

The *generative organs* (figs. 1 and 47) consist of the *ovaries*, *oviducts*, *vagina*, *spermatheca*, *vulva*, and some accessory glands.

The *ovaries* consist of two large organs, one on each side of the digestive tract and filling the whole of the body cavity not otherwise occupied. I have not been very successful in observing the general structure of the ovaries, as in all my dissections the inclosing membranes have invariably been ruptured. Whatever the anterior structure of each may be, its posterior portion forms a receptacle in which the eggs are received from the ovarioles, and then becomes contracted into a rather long, slender oviduct. The two oviducts (fig. 1, *h, h'*; fig. 47, *e, e'*) discharge into a large *vagina* a little below its center (1, *k*; 47 near *c*). Beginning at the *vulva* (1, *m*; 47, *d*) the vagina becomes slightly narrowed at the point where it received the outlets of the *vaginal glands*. (1, *j*; 47, *h*) and then becomes considerably enlarged both behind and in front of the outlets of the oviducts, forming large cavities (1, *f*; 47, *k, l*), which sometimes appear empty and at others to contain some not very well defined substance. Further on it becomes contracted into a very narrow neck (1, *ed*; 47, *b*) and then enlarged into a large oval sack—the *spermatheca* (1, *a*; 47, *a*) which appears to have no other outlet or inlet besides the narrow neck of the *vagina*. After copulation the spermatheca is always seen to be filled with the long filamentary spermatozoa. The penis of the male during the process of copulation reaches very nearly if not quite to the outlets of the oviducts, as may be seen by comparing the distance *ok* in fig. 1 with the length of *de* in fig. 45. One or other of the cavities above and below the outlets of the oviducts may serve as a *bursa copulatrix*, or it is possible that they may serve to retain the egg while it becomes fertilized in its outward passage, if this has not already taken place in the ovaries. The walls of the vagina and spermatheca appear to be continuous, the latter thinner than the former, and to possess a very distinct cellular structure. On each side of the *vagina* are the *vaginal glands* above described. The *vulva* appears to be simply an inturning of the integument of the ninth abdominal segment. It is surrounded by six stout spines, forming two flattened groups cemented together by a waxy secretion. These I have imagined to possess some of the functions of an oviposter, aiding the outward passage of the eggs. Extending along each side of the vagina is a large nerve sending forth several branches. There are also very numerous muscles and tracheæ.

Owing to the vast number of eggs produced by this species the particular structure of the ovary becomes very complex and I have been unable to satisfactorily explain the relations of the different parts.* The ova are developed in buds or follicles, ovi-capsules of Huxley, (figs. 5-17) and these are seen to be arranged in clusters (fig. 5) each cluster containing capsules in various stages of development. These ovi-capsules appear to be attached to something, a tube or membrane, through which they possibly derive nourishment, while the free ends containing the large

* In this study I have derived much benefit from several letters written me by Dr. Mark explaining the prevalent views regarding the structure of the ovaries and formation of the eggs, but have not always succeeded in making them agree with my observations.

vitelligenous cells, lie *in* the ovary.* Permeating through all parts of the ovary are numerous *tracheæ*, one branch appears to extend to every cluster of oviducts, of which there are several hundreds in each ovary.

This general account of the female generative organs is derived from observations made at various stages of their development. At the period now under consideration, the time of the appearance of the males, the walls of the vagina and spermatheca are very soft and tender, and I have not observed the oviducts at all. In October, (fig. 1) six weeks later, the walls are firmer, the oviducts are present but very small; the oviducts are exceedingly slender, and I have not up to this time seen the vaginal glands, though it does not necessarily follow that they are absent. In May, (fig. 47) three or four weeks before the first eggs are laid, the *vagina* is much enlarged both in length and breadth; the oviducts are larger, but still not large enough for the passage of the eggs, the vaginal glands, muscles, nerves, etc., are fully developed as described, and the more advanced oviducts are nearly full grown. At the time of laying the eggs the oviducts are much enlarged so as to allow the easy passage of one egg at a time.

Habits.—The females at the time of the appearance of the males are still in a quiescent state on the leaves (fig. 37), or rarely in some cases on the twigs, in which condition they remain until fall.

THE FEMALE IN WINTER.

Soon after the disappearance of the males, the bright red markings of the females become gradually changed to a deep dark brown which soon comes to occupy nearly the whole surface, making the general color appear to be dark brown. They grow a very little in size, but become more elevated, the carina higher and more prominent, and the dorsal layer of wax thicker and more cracked.

When the sap ceases to flow into the leaves, which in this locality takes place in October, they withdraw their buccal setæ so that they form a loop in the *crumina* within the body cavity, and migrate to the twigs where they again insert their beaks. They settle on the twigs with their heads indifferently up or down, or very rarely side ways, and are often closely crowded together completely covering the twig, (fig. 38) but generally they prefer the underside. As soon as the sap ceases to flow in the twigs they enter into a state of complete torpidity, and show no signs of life or development until the sap again begins to flow in *April* of the following spring.

THE FEMALE IN SPRING.

As soon as warm weather sets in the ova begin to develop with great rapidity, causing the body to become distended to fully three times its former dimensions. This distention takes place more or less in all parts

* I feel quite certain of this in my own mind, but Dr. Mark seems also quite certain that the egg follicles are directed *outward* from the oviducts with the free ends lying in the body cavity. This would make it necessary for the fully developed egg to pass through the narrow neck-like base of the capsule in order to reach the oviduct, which is directly contrary to my observations.

of the integument, but mostly in the dorsal and episternal regions. The legs and antennæ remain of the same size as in the fall, being rendered almost entirely useless by the great increase in the bulk of the insect. The female is however able to crawl about without difficulty for a less or greater period during the spring, as I have frequently observed them do so. The eyes are still present, but considerably obscured by the dark markings around them.* The females reach their greatest size about the middle of May, soon after which time they begin to lay their eggs.

At this period (figs. 39, 40) the female is elliptical, quite convex dorsally, with a low rounded carina; pale greenish or whitish yellow, marked with black or dark brown after the same general pattern as in the previous August, the yellow color again predominating causing the whole to appear light brown instead of dark brown as in the winter; beneath whitish; length 4 mm to 6 mm, breadth 3 mm to 4½ mm, height 1 mm to 1½ mm. The resemblance in form, color, and markings to a turtle is very striking and has been often remarked by popular writers.

During this period of rapid growth the female necessarily absorbs a large quantity of sap, and in addition to what she uses, she seems to have some to spare. The leaves of every affected tree and the objects on the ground beneath become covered during this time with a sweetish liquid or honey dew. This forms a great attraction to various honey-loving insects,—ants, flies, bees etc. This honey-dew is really the excrement of the female and has its origin as follows: A clear liquid issues from the anus dorsally, between the anal valves, until it forms a spherical globule about one millimeter in diameter (fig. 39, b) when it is suddenly thrown off, as if squirted with some force, to a distance of 5 mm to 10 mm. This is probably accomplished by the muscles surrounding the anus or by the contraction of the rectum itself.†

CONTENTS OF THE OVARIES.

Before proceeding to describe the formation of the eggs it will be necessary to make some preliminary remarks on the contents of the ovaries.

On cutting open a female any time between October and the following May five different classes of bodies are set free. The normal location of these bodies was not very apparent in my dissections owing to the rough manner of their execution. But as some of them appear to be closely connected with the generation of the ova, it is proper that they should be here described. They are:—

First. A clear transparent liquid. Probably protoplasm, or food in process of conversion into protoplasm,—equivalent to the blood of higher animals. This appears to unite readily with water, etc.

Second. Clear spherical globules from 10 μ to 30 μ in diameter, having

*This has caused Miss Smith to state that they are absent. Her description of the female refers to the most advanced period of gestation and not to the normal female.

†Miss Smith's supposition that the honey-dew is derived from the egg-nest, or from the same material which forms the egg nest, is certainly incorrect. I have also observed no indications that it issues from punctures in the bark.

a specific gravity less than water and not readily stained with eosene or magenta, and which have an appearance similar to the yolk globules in the egg. Probably fat or food globules.

Third. Exceedingly minute, apparently spherical, bodies having a specific gravity greater than water, and staining readily with eosene (fig. 2). When stained a portion remains unstained as though there was a vacuole. In water and some other mediums they exhibit an active vibratory motion (brownian movement) which ceases after several hours. They sometimes show a distinct but slow and uncertain progressive movement. The nature and function of these bodies I do not understand. They certainly bear a very strong resemblance to *bacteria*, and may really be parasitic, or, it is possible they may belong normally to the insect, perhaps corresponding to the blood disks, and I have thought of them in connection with the spermatozoa and fertilization of the eggs, and also as being an early stage of the *fourth* class of bodies next described. Whatever they may be, they are always found in great abundance in the females of this species at all times, and I have noticed them in motion while still in the body cavity of the larva. I have frequently observed similar vibrating bodies in various diseased animal matter, as tumors, etc.

Fourth. Small oval bodies $3\ \mu$ to $5\ \mu$ in diameter, and about $10\ \mu$ long, having a specific gravity greater than water, (fig. 4). When highly magnified they are seen to be composed of a greater or less quantity of fine granular matter imbedded in a rather thick coating of some transparent substance. This last though easily stained brown by iodine remains unaffected by eosene or magenta, except in a few instances where the external envelope appears to be imperfect, in which case the granules become stained leaving the envelope unstained. These bodies in general appear to be very uniform in size and shape, usually regularly oval, often slightly constricted in the middle. But a careful study made since the plate was etched, shows a greater variation than I before supposed. Some are seen to taper to a point at one end (fig. 4,c), others while preserving the oval form have a small projection at one end, in others the projection is a little larger, in others it is still larger and of an oval form, in others a similar oval body to the original and finally two, three or more full sized bodies may be seen strung together end to end. In some, as fig. 4,b, the granules appear separated into two groups. A comparatively small number of these bodies are already found in the females immediately after copulation with the males, so they may have been present before that event had taken place. They become exceedingly abundant during the final development of the eggs in the spring, at which time they are found in great numbers in all parts of the ovaries. At a certain period in the development of the egg, just before it takes final leave of the egg follicle, several of these bodies appear to enter at the head end, where they become disintegrated, and soon after this, never before, the embryo begins to form. On this account I for a long time believed them to be spermatophores, the contained granules being the spermatozoa, and that they were derived from the sperm filaments of the male by a process of

breaking up into parts placed end to end, which were subsequently in some unknown manner developed into these oval bodies. It is however very difficult to trace any such connection, and Dr. Mark informs me that *Leydig* has observed these bodies in adult females of *Lecanium* and regards them as parasitic, bearing some relation to the *Pseudo-navicellæ*. At the present moment I am not inclined to object to this view.

Fifth. Spherical bodies from $10\ \mu$ to $30\ \mu$ in diameter (fig. 3) having a specific gravity greater than water, and composed of a number of clear globules or cells inclosed in a mass of clear apparently homogeneous substance which stains readily with eosene and magenta, while the clear cells remain unstained. With iodine the whole becomes stained brown. In water the enveloping substance becomes more or less softened allowing the clear cells to gradually approach the surface and finally escape, after which they cannot be distinguished from the fat or food globules already mentioned, and like them have a specific gravity less than water. There is scarcely a doubt that these are immature ovicapsules, whose enveloping membrane is yet unformed or so tender as to be easily ruptured. The larger individuals show evidences of their previous attachment at one end. From an examination of the ovaries of *Lecanium hesperidum* it appears that these bodies are formed in the anterior portion of the ovary, first appearing as simple very minute cells imbedded in a tissue of fibrous appearance. The cells are quite indistinct at the anterior end, but become gradually larger and better defined posteriorly until they become comparatively free from the investing tissue.*

Of these five classes of bodies it is probable that only the last belong exclusively to the ovaries, and, unless I am greatly mistaken as to their character, each one of these spherical bodies is capable under favorable circumstances of forming an egg, being in fact a true egg follicle or ovicapsule, comparable possibly to the *ovule* of the higher animals.

DEVELOPMENT OF THE EGG.

During the winter the ovicapsules appear to remain in the form and condition just described, but with the advancing warmth of spring, and consequent abundant flow of sap in the trees the development of the eggs proceeds with great rapidity. The more advanced ovicapsules are now seen to be slightly elongated at one end into a short pedicle by which they are attached, and to be arranged in groups radiating about a common center (fig. 5, *a*). The capsules develop unequally, or rather progressively, so that at a later stage capsules in all stages of development may be seen in the same cluster at the same time (fig. 5, *b*) presenting a very bud-like appearance. As the females begin to lay eggs about May 24th and continue often until about July 12th, during the whole of which period they may be found in all stages of development, an excellent opportunity is afforded for the study of their formation.

* In this specimen of *L. hesperidum*, examined Nov. 4th, 1878, the same membrane which inclosed these spherical bodies was still connected with a cluster of eggs containing embryos in various stages of development, some of them just ready to be hatched. Whether each ovary has only one, or more, of these anterior ends or ovarioles I did not observe.

In its earliest stage the ovi-capsule appears as a simple cell less than $2\frac{1}{2}$ μ in diameter imbedded in the tissue in the anterior portion of the ovary. It gradually increases in size, and is pushed farther and farther back by the continued development of new cells, until finally it becomes comparatively free *within* the ovary (or oviduct) except that it remains attached by a pedicle at one end (figs. 6 and 7). It is now 30μ to 40μ in diameter and appears to consist of a number of clear cells or globules imbedded in a clear homogeneous substance, and the whole inclosed in a thin clear membrane. This membrane seems to form a part of, or at least to be derived from, the tissue in which the capsule was originally imbedded, though it is not impossible that it may be a continuation of the membrane of the ovary itself.

A little later (fig. 8) the ovi-capsule has increased considerably in size, and can now be plainly seen to contain three or four rather large clear apparently nucleated cells. (vitelligenous cells) always situated in the free end, and one cell filled with a granular matter always found nearer the attached end of the capsule. This granulated cell grows rapidly and eventually forms the ovum or egg, and its granular contents becomes the vitellus or yolk. It is sometimes seen to be attached by a slender filament to a small group of granules, situated between the vitelligenous cells. When a little further progressed (fig. 9) the *ovum* is easily seen to be surrounded by a rather thick layer of large oval epithelial cells. This epithelial layer undoubtedly extends around the vitelligenous cells also, but being there much thinner it is less apparent. The ovum now becomes elongated and of a distinct oval form, (fig. 10) causing a corresponding change in the shape of the capsule. As it continues to grow in size the different parts become better defined. The capsule becomes slightly constricted just behind the vitelligenous cells forming a "head" which is at first distinctly broader than the "body," as that part containing the ovum may be designated. (Fig. 10; *vc*, vitelligenous cells; *g*, gathering of granules connected with the ovum by a filament; *oc*, membrane of the ovi-capsule; *y*, vitellous or yolk; *ch*, vitelline membrane; *ep*, layer of epithelial cells.)

The ovum continues to grow very rapidly, while the vitelligenous cells increase in size more slowly, so that the "body" of the capsule soon becomes distinctly broader than the "head." The vitellus is now (fig. 12) seen to be composed of vitelline or yolk globules of very variable size, some of them being very large. The cells of the epithelial layer are very distinct, and are seen to contain some fine granular matter. [In some diseased specimens which I examined the ovum was abortive, while the epithelial cells were abnormally developed, and the granules which they contained were seen to have a distinct vibratory movement.]

The vitelligenous cells now gradually cease to increase in size, while the ovum continues to grow rapidly and the yolk globules become gradually more uniform in size and appearance. The epithelial cells begin to show indications of disintegration, and finally cease to exist as such. (Although there are three or four of the large vitelligenous cells it often

happens that but two of them appear in focus under the microscope at the same time, and then they sometimes present a grotesque owl-like appearance.)

It seems probable that the vitelline membrane really extends around and includes the vitelligenous cells, for, as the ovum approaches its final development the yolk globules extend gradually into the "head" forcing the vitelligenous cells into the upper part (figs. 14-15). This continues until the vitelligenous cells finally disappear altogether,—either being assimilated to the yolk globules or broken up and interspersed between them. The yolk globules are now of very uniform size and fill the entire ovum, including the "head" (fig. 16). The epithelial cells have entirely disappeared, and a firm but elastic chorion has been formed around the ovum. The "head" is now but half the width and less than a third the length of the ovicapsule, the dimensions being about as follows: entire length of capsule 380μ , greatest breadth 190μ ; length of head, 90μ , breadth 190μ ; length of body 290μ . The yolk globules are about 15μ in diameter.

At the next stage in the development of the ovum an important change takes place. The membrane of the ovicapsule gives way about the neck and the ovum, in consequence of the elasticity of the chorion and vitellus, assumes a regular oval form, the "head" becoming completely collapsed, and its contents incorporated with that of the "body." After the collapsing of the head the vitellus is seen to be still inclosed in a vitelline membrane leaving a small space at each end between the vitellus and chorion. If at this period there is a nucleus or germinal vesicle I have not seen it, unless the gathering of granules at the two ends be such. Previous to this stage the vitellus stains readily with eosene, etc., now it does not, showing that the chorion has become completed and all openings closed. The ovum being now a fully developed egg the membrane of the capsule gives way still more and allows the egg to slip out into the general cavity of the ovary.

FERTILIZATION OF THE EGG.

During the whole period of the development of the ova, large numbers of the oval bodies (fig. 4) before mentioned (*Pseudo-navicellæ*?) are seen all around and about them. At about the time of the collapse of the "head" of the ovicapsule a number of these bodies find their way *into* the ovum in some manner not fully accounted for, possibly by suction caused by the collapse, in which case there must be an opening (or more than one) in the chorion. I have frequently seen from five to twenty or more of these bodies in the space at the anterior end between the vitellus and chorion. They very soon appear to become disintegrated and the inclosed granules set free. About the same time I have noticed a gathering of granules at each end of the egg, that at the anterior end being the larger; this granular substance spreads over the entire surface and forms what I have supposed to be the *blastoderm*. This formation of the blastoderm so promptly following the entrance of the oval bodies caused me for a long time to believe that the latter were *spermatophores*, but as I

have already stated it is extremely difficult if not impossible to account for their development from the true sperm filaments of the male, and a possibly more important objection to this theory of mine is, that the oval bodies are found of perfect form in the females soon after the first appearance of the males, and before there could possibly have been any development from the spermatozoa. The true mode of the fertilization of the egg in this species is still open for discovery. The following facts may be of use in the investigation: *First*, the eggs while still in the ovaries are often seen to contain embryos in an advanced state of development, and if the polar gatherings are an indication of *segmentation* the fertilization must have taken place before the egg has left the ovi-capsule; *Second*, a careful study of a large number of females has failed to reveal any other bodies in the ovaries than those mentioned; *Third*, I have never seen a filamentary spermatozoon anywhere in a female, except in the spermatheca; *Fourth*, There are never in the spermatheca a sufficient number of spermatozoa to fertilize more than a very small fraction of the entire number of eggs laid and producing young; *Fifth*, the number of spermatozoa remaining in the spermatheca after the eggs are nearly all laid is less than in the fall, showing that some have been used, but a fair proportion remain unused; *Sixth*, each sperm filament of the male is longer than the entire egg and of such a size as not easily to escape detection; *Seventh*, the shape of the vagina is such that an egg could be fertilized while on its passage out; *Seventh*, in *Lecanium hesperidum*, of which no male has ever been found, the development of the egg is almost exactly the same as in this *Pulvinaria*, except the number of ova is much less, and they are developed in broods, so that all the stages can not be seen at once, and the embryos are fully developed and the eggs hatched while still in the ovaries, thus showing that the eggs in that species are fertilized, if at all, while still in the ovaries.

Should it be that a part only of the eggs are fertilized by spermatozoa, it may be that these produce one sex while those unfertilized produce the other, the latter most probably females. It would be an interesting experiment to carefully separate a colony of females until after the males had disappeared, this I have not been able to accomplish as yet.

THE LAYING OF THE EGG.

The egg having escaped from its capsule into the general cavity of the ovary, is now crowded by its fellow eggs into the oviduct, and thence into the vagina and through the vulva and oviduct into the egg nest. While in the ovary the shell appears perfectly smooth, but in its passage through the vagina it probably becomes coated with a viscid substance secreted by the vaginal glands, which causes the fine dust-like rings secreted by the abdominal pores to adhere to the surface, giving an ornamented appearance to the egg shell. The egg now takes its place with the other eggs in the egg nest. It thus appears that the egg laying is almost entirely accomplished by the involuntary crowding of the developing eggs, and hence when the eggs are few in number, as in *L. hesperidum*, they are not laid at all, but remain in the ovary until hatched.

THE EGG NEST.

The egg nest is formed of cylindrical white fibres or filaments of wax, secreted by the peripheral spines of the mother louse, its posterior end being constantly pushed farther and farther back by the crowding of the more recently laid eggs, and the continued secretion of the waxen fibres. The eggs first laid are thus found at the end farthest removed from the insect. The waxen fibres are quite adhesive to one another, forming a perfectly close covering to the eggs, which however separates quite easily along the median line—showing that no waxen filaments are secreted from the anal fissure. This fibrous structure causes the nest to appear faintly striated longitudinally, and the successive layers of eggs often make it appear somewhat coarsely waved transversely, with the waves approximately parallel to the posterior periphery of the abdomen. Permeating all through the nest are filaments secreted by the sub-abdominal spines, and a quantity of powdery matter, the secretion of the sub-abdominal pores. When highly magnified this dust is seen to be in the form of rings. Under ordinary circumstances the egg nest extends to a distance beyond the tip of the abdomen, equal to from once to more than twice the entire length of the mother. The waxen filaments are adhesive and very elastic so that the fibres of the egg nest can be pulled out six inches or more. They melt upon the application of heat are soluble in alcohol, chloroform, ether, turpentine, oil, etc., and insoluble in water, glycerine, nitric acid, etc.

LAST DAYS OF THE FEMALE.

Soon after the middle of May the female begins to lay her eggs, enveloping them in a nest of white waxen fibres, forming a beautiful white cushion—whence the name of *Pulvinaria*. This gradually raises the abdomen of the female from the bark until often an angle of 45° or more is reached (figs. 39, c; 41; 42), causing the back to become more or less transversely wrinkled. The laying of the eggs continues often into the early part of July, the entire laying period lasting from five to seven weeks, varying somewhat with the seasons, the health of the trees and of the insects themselves. Her beak remains inserted in the bark all the time absorbing the sap. The entire number of eggs laid in each nest is rarely if ever less than 500, and must often exceed 2,000, though as I have not attempted to count the number in the larger nests this is only an estimate.* In fact the mother continues to lay eggs until she dies from her own sheer exhaustion, or that of the tree upon which she dwells, with her ovaries still filled with ova in all stages of development. The entire life of the female from her birth to her death is thus about thirteen months. The length of time elapsing after impregnation by the male until the first eggs are laid is fully nine months—but of these at least five are passed in a dormant state. After the females have died they dry up and the beak breaks off, but they still continue attached to the limb by means of the egg nests which remain frequently for a year or more.

*Dr. S. S. Rathvon states, in his paper in *Penn. Farm Journal*, 1854, that he counted in one of these nests 564 living insects and over 300 eggs not hatched.

DISEASES.

Besides disease caused by insufficient food, this insect appears to be subject to some one or more diseases whose nature is unknown to me. At all events a considerable number of both sexes and of all ages are noticed to die without any assignable cause, while their companions on the same leaf remain healthy. Some of the deaths are no doubt caused by wounds from enemies, others by difficulty in moulting, etc. The most critical periods, or those in which the most deaths are noticed appear to be as follows: the young lice just after settling on the leaf, the male pupæ just before completing their transformation, and the females in the spring, probably not having sufficient vitality to revive from the winter dormancy. Diseases of the ovaries have also been observed. In some the ovcapsules will be developed as usual, but with the ovum abortive or absent; in others the spermatheca becomes contracted and shrivelled. In these cases a small amount of waxy matter is secreted, but no eggs are laid. An abnormally formed egg has already been mentioned. The females which have settled on the underside of the leaves against the veins are nearly always distorted, often nearly straight on one side and convex on the other, making them very lop-sided.

The depletion of the trees naturally reacts on the insects, and it is a fact of frequent notice that the females on healthy trees are larger, of more healthy appearance, and lay more eggs than those on sickly trees. It appears that sickly trees produce a greater number of males, and that on them both males and females mature earlier, by several days or even a week, than on healthy trees. In explanation of this fact. Dr. George Engelmann, the Botanist, has suggested to me that the sap of diseased trees contains more sugar than that of healthy trees.

PARASITES.

I have observed the following parasites in *Pulvinaria innumerabilis*:

1. The minute spherical bodies with a vibratory movement already described on page 326, which may possibly be *Bacteria*.
2. The oval bodies (*Pseudo-navicellæ*?) described on page 326.
3. Elongated oval or fusiform bodies divided into two or four large quadrilateral cells. So far only noticed a few times in females at the time of the appearance of the males.
4. *Coccophagus lecanii* Smith,* a small hymenopterous insect belonging to the family *Chalcidæ*. It is of a dark ashy black color with a large transverse lunate spot of bright yellow on the thorax behind the wings, and the feet paler. The wings are quite hairy, the fore wings have a single sub-costal vein extending parallel with the costa more than half way to the tip where it sends a very short branch inward and outward abruptly terminating in an enlargement. The *pupa* is of a pale gray

*I am very much inclined to think that *Platygaster lecanii* described by Fitch in his 5th New York Report, as infesting *Lecanium quercitrionis* may prove to be really a *Coccophagus* nearly allied if not identical with this species. The description applies too well to easily believe that the two species belong to different families. In this event Dr. Fitch's reference to the *Proctotrupidæ* is of course wrong.

color with antennæ, legs and wings free but rudimentary. It is usually found with its head directed towards the posterior end of its host, and with its cast-off larval skin near the opposite end. There is generally but one pupa present in one host at the same time, but in the gestated female there are sometimes several. The *larva* is an elongated soft fleshy worm, of watery color, with articulations indistinct; legs and mandibles present, but exceedingly minute. It is more elongated in its earlier stages. The egg is oval, nearly elliptical, less than twice as long as broad. Not more than one or two eggs are deposited in the same host. The figures of the pupa and the imago given by Miss Smith are quite accurate.

This parasite has been very numerous in this locality during the past three years, and it has destroyed a very considerable proportion of the *Pulviniaræ* which have escaped the lady beetles. There seem to be two broods each year, appearing in May and August, with some intermediate stragglers. The affected lice are easily recognized by being more or less inflated, becoming much more elevated than their fellows, finally turning to a pitchy black color and becoming hard and rigid. Although most often found in the females, I have in a few cases found them in undoubted male scales. During the summer while the *Pulvinaria* is small the *Coccophagus* makes its exit by pressing apart the dorsal and ventral surfaces, but later when the *Pulvinaria* is larger, it cuts a small round hole in the dorsal integument through which it emerges. The manner of cutting this hole, I have observed in an allied species inhabiting a large bark louse on the hickory, (*Lecanium caryæ* Fitch?) and is as follows: After gnawing from the inside until an opening is made, the insect with its mandibles takes in as much of the shell of its hosts back as possible, and makes a cut through; it then moves along and makes another cut just so as to be continuous with the first cut. This continues until the piece thus separated becomes broken off mainly by its own weight, when it is thrown out, and a new series of cuts is commenced. It continues in this manner to go round and round the opening until the circular hole becomes large enough for it to get its body through, in the meantime testing it occasionally to see if it is sufficient.

5. I have on one occasion found two *hymenopterous* pupæ of yellowish color in a female during the egg-laying season, and which evidently belong to a different species from the last.

ENEMIES.

In addition to suffering from the attacks of the above parasites. *Pulvinaria innumerabilis* suffers great havoc from the attacks of various predacious insects belonging to the Coleoptera, Neuroptera and Hemiptera. Among these I have observed the following:

1. *Chilocorus bivulnerus*, Muls., a shining black hemispherical beetle, about 5^{mm} in diameter, with a bright red sublunate spot on each elytron. This beetle, with its grayish-black spiny larva, occurs in great abundance

during the early summer, giving its attention mainly to the young larvæ of the bark lice, of which it destroys great numbers. When about to pupate, the larva attaches itself to the bark, and the skin then dries and splits along the back partially disclosing the pupa within. Large groups of these pupæ are often seen about the junction of the larger branches with the trunk. These are often regarded by the ignorant as but a different form of the bark louse, and are ruthlessly destroyed by them.

2. *Hyperaspis signata*, Oliv., a lady beetle of very similar form and appearance to the last, but of about half the size and with the red spots on the elytra entirely circular in form. The larva however, is very different, of a whitish color, covered with a white downy substance, and dwelling habitually in the egg nests of the *Pulvinaria*. Often two or more of these larvæ are found in a single nest, and do great havoc among the eggs and newly hatched bark lice. Egg nests containing these larvæ can generally be recognized by being partially separated along the median line, and later by their flabby appearance. These larvæ are occasionally seen to migrate from one nest to another. When ready to pupate they leave the egg nest and descend the tree in search of some crevice wherein to undergo their transformations. While on this search they often wander a considerable distance, and thus sometimes prove a possible means of spreading the *Pulvinaria*. Like the *Chilocorus* they are often mistaken for the bark-lice themselves, and unwittingly destroyed. Mr. Riley informs me that he has also raised *Hyperaspis bigeminata*, Rand, from specimens furnished by me.

3. I have several times observed a small black species of *Scymnus* on the twigs, and a small larva probably of the same dwelling in the egg-nests, like the last species.

4. *Anatis 15-punctata*, Olivier, both imigo and larva, I have found in small numbers feeding upon this *Pulvinaria*.

5. The larva of a species of *Chrysopa* I have frequently observed feeding upon the young lice. They probably injure as many by wounds from their long mandibles as they actually devour.

6-7. The larvæ of two species of *Reduvidæ* have been observed preying upon them.

In addition to the above enemies Miss Smith mentions an *Acarus*. I have never observed an *Acarus* upon a *Pulvinaria*, but I have found them often excessively abundant under the scales of an *Aspidiotus* occurring on the same twigs.*

MANNER OF DISTRIBUTION.

The manner in which this insect is transported from tree to tree, and from place to place is a matter of some economical interest. The young lice are able and do move about quite actively. They can easily crawl

* Prof. J. H. Comstock has recently described (*Prairie Farmer*, Oct. 25th, 1879), a lepidopterous insect under the name of *Dakruma coccidivora*, the larva of which dwells in the nests of *Pulvinaria innumerabilis*, and constructs tubular passages out of the waxen fibers. I have never observed any traces of this insect in this locality. It appears to be allied to the bee moth (*Galleria*) in its habits, and it occurs to me that its attraction in the egg-nests of *Pulvinaria* may be the waxen fibers and dust rather than the eggs themselves.

from one tree to another in the close vicinity, but are not likely to go any great distance in this manner. During the laying and hatching of the eggs the females excrete a quantity of sweetish liquid or honey-dew which is a great attraction to flies, bees, ants, etc., and it very frequently happens that the young lice find their way on to the legs and bodies of these visitors and are thus often carried to a considerable distance. I have several times observed them on the legs of flies taken at a distance from any infested trees. In case a tree or branch should die any time during the summer or fall, or even in the early spring, the females would withdraw their beaks and migrate until they found a fresh supply of suitable food. [In case this migration took place after the leaves had appeared in the spring, it is probable that some of them would settle on the leaves, and thus account for the egg-nests observed on the leaves by Dr. Rathvon, and figured by Mr. Riley.]

It is probably first introduced into new localities on trees which are transplanted from place to place. This also probably accounts in part for its being found more generally on the soft maple, for this has always, in this part of the country, been a favorite shade tree for planting in the streets of towns on account of its rapid growth, its beauty and its hardiness. A little care exercised in the examination of trees before planting would in many cases prevent their introduction altogether. With a very little practice an infested tree can be recognized with ease.

I have observed some peculiar features in their local distribution. During the thirteen years they have been known in Davenport they have become distributed throughout a radius of less than twenty blocks of 400 feet each, (a little more than one mile). Yet there are many soft maples within this area that are entirely unaffected by them. One particular case will serve as an example. On the corner of Sixth and Fillmore streets is one of the worst infested trees in the whole city; during 1877-8 it was loaded down with all the *Pulvinariae* it would bear, and as if this were not enough it was thoroughly infested with a species of *Aspidiotus* in addition, also by an *Ageria* and other insects. On each side of this tree is a row of two or three maples of the same age and kind, the two standing next the infested tree actually interlocking branches with it, and yet none of these trees have had more than a few score of *Pulvinaria* females at a time—for all practical purposes, being entirely free from their depleting effects. Other similar cases have been frequently noticed, but the reason of it is unknown to me.

Another feature of their distribution is that they are of very rare occurrence in the country, while they become excessively abundant in cities and towns. I may further say I have never seen them upon the soft maple, or any other tree while growing in a state of nature, with the possible exception of one single individual once found on a wild grape vine. The locality of the origin of this species is as yet unknown. Its known range is from New York and Maryland on the east, to Minnesota, Iowa, and Missouri on the west.

EFFECT ON THE TREES.

As may be easily imagined the effect of so extensive a diversion of the sap from its legitimate functions, soon shows its ill effects upon the tree. In the case of the soft maple, the green of the leaves begins to fade away until they turn yellow and prematurely fall off, then the smaller outer extremities of the twigs die, and if the devastation is very excessive or prolonged the larger branches follow until finally the entire tree dies. But this last event is not very common, for which we must probably thank the enemies and parasites. Badly affected trees become more stunted in their growth, their leaves smaller and weaker, the ordinary pale grayish bark becomes very dark, almost blackish, thus rendering it very easy to recognize an infested tree from a distance. They also put forth their leaves later and shed them earlier than healthy trees.

My observations have been mostly made on the soft maple, but the effect upon other trees is probably not essentially different. I have not the exact data, but I think I am safe in saying that less than five per cent. of the trees infested with this insect during the past thirteen years have died therefrom. This would probably be less than one per cent. of the trees liable to their attacks in this city. But this is a mere estimate and simply conveys the impression made upon me.

REMEDIES.

The best remedy known to me is to cultivate and protect the parasites and enemies already described. The survival of the trees infested with *Pulvinaria* in Davenport is undoubtedly due almost entirely to them. At all events great care should be taken to preserve these enemies, and caution should be used in destroying the injurious insects that we do not destroy the beneficial ones also.

Of artificial remedies the simplest is that of "heading in" the tree, (*i. e.* cutting off the branches so as to leave only the trunk and larger limbs), and then removing the lice from the remaining portion by hand or otherwise. This appears to be the favorite method in use in Davenport, but it does not add anything to the beauty of the trees, though the soft maples stand this severe ordeal very well. This operation seems to succeed best when done in the early summer. On small trees the lice can be removed without much difficulty by hand-picking, or crushing.

In using liquid applications several facts must be taken into consideration: 1st, the effect on the *Pulvinaria*; 2d, the effect on the parasites and enemies; 3d, the effect on the tree; 4th, the cost. Under the first head I made a few tests, of the effects of various chemicals, such as I happened to have at hand, upon the young larva, egg-nests and adult females, and as a result I may state that alcohol and spirits, chloroform, ether, turpentine or other oils, causes the death of the insect in all stages even when fully protected by their waxen coats, while water, acids (such as nitric and acetic) and alkaline solutions (such as solution of potash) had no effect whatever even on the young larvæ. Very probably a prolonged submersion in these substances would cause

death, but such an application is of course not practicable. This subject is worthy of further more careful experiment. Solutions containing soap would do better, as the oily grease would act as a penetrating medium. Under the 2d head it is quite probable that any poison which would destroy the wax-protected bark lice would also destroy their unprotected enemies. Under the 3d head I have no definite observations to report, the effect on the trees can only be ascertained by experiments which I have not performed. Under the 4th head it is plain that to syringe a tree with alcohol at \$2.50 per gallon, even if considerably diluted would not pay, and so it is with most of the other articles I have mentioned, but probably some oily substances can be found which will be cheaper in their application. The use of oil as a remedy against the bark-lice has long been well known and was particularly recommended by Dr. Fitch.

Miss Emily A. Smith recommends the following plan:* "Charge a fire extinguisher in the usual manner with bi-carbonate of soda and sulphuric acid; add to the water one spoonful of carbolic acid to every eight gallons of water; apply this to the tree and the force from the extinguisher will convey the fluid to all parts of the tree alike." This plan has been tried in Peoria and found a success, the applications being made twice on each tree during the time the young lice are hatching. The cost does not exceed twenty cents an application. Mr. Riley has suggested that kerosene oil be substituted for the carbolic acid, as it would then be effectual even after the waxen coats had formed.† Making the substitution proposed by Mr. Riley, this is probably the best artificial remedy yet suggested. But before undertaking to destroy the lice artificially, first ascertain what the natural enemies are doing, and if these are abundant and at work it may often be better to let them have their own way, rather than destroy them also, unless there is a fair prospect of completely exterminating the bark lice, both on your own trees and those of your near neighbors.‡

* *American Naturalist*, Vol. XII, 1878, page 808.

† *Canadian Entomologist*, Vol. X, 1878, page 177.

‡ Of the many other remedies which have been recommended I will mention three that have come under my notice. Our member, Dr. T. J. Iles, in June, 1871, after "heading in" his trees washed the remaining limbs with a mixture consisting of "three gallons each of soft soap and water, one quart of carbolic acid." This appears to have checked the lice for a time, but from some cause the trees finally died. Another of our members, Mr. John Hume, informs me that he has successfully treated his trees by boring holes through the bark and filling them with sulphur. I am at a loss to know how the sap could absorb enough sulphur to kill the lice without injuring the tree itself. I think the lice must have disappeared from some other cause, such as the increase of parasites. On a tree thus treated with sulphur which came under my daily notice in 1871, there was no apparent effect whatever either on the tree or the lice. Another remedy which is being continually recommended is the introduction of the English sparrow. This bird was introduced into our city some years ago and is now exceedingly abundant, yet I have never on any occasion seen one touch a bark louse, or any other insect,—they appear to subsist almost entirely upon the grain continually being dropped in the streets.

FOOD PLANTS.

I have observed the *Pulvinaria innumerabilis* in great abundance on the soft or silver maple (*Acer dasycarpum*, Ehrhart) the box-elder (*Negundo aceroides*, Mœnch.), the linden (*Tilia europæa*), and the sugar maple (*Acer saccharinum*, Wang.), on each of which it thrives well. I have also found it, or had it brought to me, on locust (*Robinia pseudo-acacia*, L.), Concord grape vine, (*Vitis labrusca*, L.), sumac (*Rhus glabra*, L.), etc., but in each of these cases there were infested maples in the near vicinity. In one instance I have found a single under-sized *Pulvinaria* and nest on a wild grape vine (*Vitis riparia*, Michx.) more than half a mile distant from the nearest infested maple.

Although found most commonly on the soft maple, it appears to thrive equally well on the box-elder and the linden. In fact those on the box-elder appear to develop the best and most rapidly. They do not thrive so well on the sugar maple.

Dr. S. S. Rathvon has observed it on soft maple, linden, rose and beech—the latter two on but one occasion each.

Miss Emily A. Smith reports it as occurring on soft maple, sugar maple and box-elder. More recently she writes me that she has studied a *Pulvinaria* on willow, and on osage orange which she regards as identical with *innumerabilis*.

Mr. C. V. Riley writes me that he has "every reason to suppose that this same species occurs not only on the hard maple, but on grape vine, osage orange, oak, linden, elm and sycamore, and without doubt another which occurs on rose, currant, and on the spindle tree (*Euronymus*) is identical." Mr. Riley also writes me, that in 1870 he "experimented in transferring it [*P. innumerabilis*] on to various trees and shrubs. The specimens were received in June from Prof. D. S. Sheldon, Davenport, Iowa, and successfully stationed themselves on *Vitis*:"*

I do not feel fully prepared to agree with Mr. Riley and Miss Smith in regarding all the *Pulvinariæ* found on these plants as identical, but there is enough evidence to show that this insect is capable of thriving on quite a variety of food plants, and in the cases where it has been directly introduced from the maple there is no question of its identity.

OTHER SPECIES OF PULVINARIA.

Dr. V. Signoret in his valuable "Essai sur les Cochenilles"† has brought together descriptions of all the known species of *Pulvinaria*. These are eighteen in number as follows: 1, *P. artemisia* Licht, on *Artemisia*, Europe; 2, *betulæ* Linné, on *Betulla alba*, Europe; 3, *camellicola* Signoret, on *Camellia japonica*, in hot-houses; 4, *carpini* Linné, on *Carpinus stachus*, Europe; †5, *cestri* Bouché, on *Cestrum* and other Malvaceæ, Europe; †6, *eronymi* Goureau, France; †7, *fagi* Hardy, on Beech,

* Mr. Riley has recently sent me specimens of *Pulvinaria* on sycamore, elm and hackberry. In their dried condition it is impossible to say whether they are or are not of the same species. In size and aspect they are very similar to *innumerabilis*.

† *Annales de la Societe Entomologique de France*, 1872, pages 29-48.

England and Germany; 8, *frazini* Licht, on *Fraxinus excelsior*, Europe; 9, *gasteralpha* Icery, on sugar cane, Mauritius; † 10, *lanatus*, Gmelin, on oak, Europe; 11, *mesambrianthemi* Vallot, on *Mesambrianthemum*, Central Europe; 12, *oxyacanthæ* Linné, on *Cratægus oxyacantha*, Europe; † 13, *pyri* Fitch, on Pear, United States; 14, *populi* Signoret, on *Populus nigra*, Europe; 15, *ribesiæ*, Signoret, on wild and red currant, France; 16, *salicis* Fitch, (*salicis* Bouché?), on *Salix viminalis*, United States (Europe?); 17, *tremulæ* Signoret, on *Populus tremula*, Europe; 18, *vitis*, Linné, on *Vitis vinifera*, Europe. Those species marked with a dagger (†) were unknown to Signoret, and are very imperfectly described. Many of the others are known in only one or two stages, mostly the gestated female or the young larva. In addition to the difference in food plants and habitat *innumerabilis* differs from all of them either in the general form, size, color and markings, or in various minute anatomical particulars such as the number and proportions of the joints of the antennæ and of the hairs which they bear, the proportions of the tarsus, tibia and femur, of the digituli, the length of the buccal setæ, etc. Our *innumerabilis* however agrees most closely with the description and figures of *vitis*. The only important difference I can find is that the male of *vitis* has two ocellæ on each side, while *innumerabilis* has but one. As *innumerabilis* thrives well on the grape, the thought has occurred to me that it might be identical with *vitis*. However, I sent specimens of *innumerabilis* to M. Signoret and he regards them as distinct from any species known to him, which must settle the question until the contrary is proved by a careful comparative examination of fresh specimens.

I will now say a few words regarding the species described as occurring in the United States.

Lecanium pyri Fitch. In his first report, pages 105-7, Dr. Fitch describes a large bark louse on the pear, "a hemispherical chestnut brown scale, the size of half a pea;" the eggs and young lice were found under the dried scale of the female, which, together with the figure, shows that it was a true *Lecanium*, and his reference to *L. pyri* Schrank, is probably correct. But in the next paragraph he says: "Beneath the scales the young lice are interspersed through a mass of white cotton-like matter. This subsequently increases in volume and protrudes from under one end of the scale, elevating it from the bark, as shown in the annexed cut." This is evidently a true *Pulvinaria* and certainly a distinct species and genus from the first, but whether it is *vitis*, *innumerabilis*, or an hitherto undescribed species, it is impossible to tell. It is again mentioned in Fitch's Third Report, No. 53, and in the American Entomologist, Vol. I, page 14, the latter reference being to a true *Lecanium*.

Pulvinaria salicis, Bouché. Under this name Signoret has described a species received from Dr. Asa Fitch, found on the willow.* It is nearly allied to *P. populi*, but differs from that, as well as from *innumerabilis*, in having the fourth joint of the antenna longest, and in some other

* *Annales Soc. Ent. France*, 1872, p. 44.

small details. Dr. Fitch's original description of this insect, which appears to have been unknown to Signoret, is as follows: "The Willow Coccus, *C. salicis*, is ferruginous with obsolete black spots, has an oval nearly hemispheric form, and measures 0.20 in length, (No. 873). The Linden Coccus, *C. tillæ*, the largest of our species that have been observed, is ferruginous, hemispheric, and measures 0.24, (No. 874). Both these species have the usual slit at the posterior end, and are wrinkled transversely."* Miss Smith writes me that she has found *innumerabilis* on willow in Chicago, so it remains a question whether *salicis* is really a distinct species. It is also quite possible that *C. tillæ*, if not a *Lecanium*, may be identical with *P. innumerabilis*.

Pulvinaria vitis, Linné. This species is mentioned by Fitch in his Third Report, No. 96, as affecting the stalk of the grape. I find it also mentioned in Walsh and Riley's American Entomologist, Vol. I, page 14. † and Vol. II, page 276; and in the Country Gentleman of July 17th, 1879, there is a notice of this species by Dr. J. A. Lintner, in which he states that it is identical with a Coccus on the grape noticed in the Country Gentleman for July 4th, 1878. This however, is an error, for while the former is a *Pulvinaria*, the latter is very evidently a true *Lecanium*, probably of the same species as one I have found quite common on a wild grape vine (*Vitis riparia*, Michx.) in this locality, and which appears to be undescribed, though approaching *Lecanium mori* Signoret, of the mulberry in general appearance. As *innumerabilis* is not infrequently found on the grape vine, it may be that some of these references relate to that species.

Lecanium macluræ Walsh and Riley. *American Entomologist*, Vol. I, 1868, page 14. This species was described in the same article with *L. acericola* already mentioned, and is said to be found "in considerable numbers on the twigs and leaves of the osage orange at Wilmington, and also in the vicinity of Alton, Illinois." The scale (♀) is said to be "of a blood brown color, as usual in the genus to which the insect belongs," and the young larvæ are said to be "remarkable for having a longitudinal dark line along the back." This "dark line" evidently refers to the loop of the buccal setæ in the abdomen, as all writers on the COCCIDÆ who were unacquainted with the structure of this organ appear to have fallen into the same error. The rest of the notice is quite general, but together with the figure, shows it to be a true *Pulvinaria*. As we have already seen, Mr. Riley now regards the species on osage orange as identical with *innumerabilis*, and Miss Smith who has made a comparative study of the two species during the past summer, writes me that she also regards them as identical. Prof. Townend Glover in the *Report of the Department of Agriculture for 1876*, page 44, had already suggested that *acericola* and *macluræ* were probably but varieties of *acericorticis* Fitch.

* Fourth Report N. Y. State Cabinet of Natural History, p. 69. Albany, 1851.

† The species here spoken of as *L. vitis* is a *Lecanium*, and therefore not the true *Pulvinaria vitis*.

In Harris's *Insects Injurious to Vegetation* (new edition, page 252), is a general allusion to bark-lice which bed their eggs in a considerable quantity of down, accompanied with a very good figure of a true *Pulvinaria*, but without mentioning any particular species. This figure is copied by Dr. A. S. Packard, jr., into the *American Naturalist*, Vol. I, page 223, where it is said to be "the *Coccus adonidum* on the peach." This name is certainly an error, for it bears but little resemblance to that species. I have seen no other reference to a *Pulvinaria* on the peach.

The above are all the references to American species of *Pulvinaria* which I have been able to find to this date. The nearly related genus *Lecanium*, from which *Pulvinaria* has been separated, contains a much larger number of species, none of which have yet been well studied in this country.

FINAL REMARKS.

My study of this insect commenced in 1871 with simply the idea of finding out all that could be known concerning it, and in this paper I have attempted to put in writing what I have learned up to this time. After four years of careful study of this one insect, I am still far from realizing the ideal with which I started out. The amount that can be learned from one insect appears to be infinite, and to this day I never look at an *innumerabilis* without learning something new. I publish this paper now in its imperfect state, because, *first*, it has long been promised, and, *second*, I wish to give my attention to some other investigations already commenced. I have doubtless fallen into some errors, which it will give me great pleasure to have corrected by those who are able and willing. I have labored under great disadvantage in having access to but very little of the literature relating to the embryology and development of insects. I have, however, derived some help in this matter from Huxley's *Anatomy of Invertebrated Animals*, Burnett's *Siebold's Anatomy of the Invertebrata*, Burmeister's *Manual of Entomology*, Packard's *Guide to the Study of Insects*, and several other general and special works. I have also received considerable assistance from Dr. E. L. Mark who, besides sending me a copy of his "Beiträge zur Anatomie und Histologie der Pflanzenläuse," has in the course of several letters given me a large amount of information upon the present knowledge of the development and embryology of the insects most nearly related to the one I have studied.

Dr. V. Signoret has placed me under great obligations by the communication of a copy of his valuable "Essai sur les Cochenilles," and for several letters on the nomenclature and anatomy of this and other coccids. I am also indebted to Mr. C. V. Riley for the communication of numerous notes on this species, for the loan of such specimens of allied species as were contained in his collection, and especially for the loan of a copy of Dr. Rathvon's paper in which *innumerabilis* was first described; to Dr. S. S. Rathvon of Lancaster, Pa., for several valuable letters regarding his original observations on this species; to Dr. Joseph

Leidy for a copy of his report already referred to, and for a number of specimens of *innumerabilis* from Philadelphia; to Dr. J. A. Lintner for a copy of Fitch's article on *acericorticis*; to Mr. J. P. Walton of Muscatine, for a piece of grape vine infested with *innumerabilis*; to Mr. H. F. Atwood of Chicago, for valuable information regarding the preparation of these insects for the microscope; and to our members, Mr. A. S. Tiffany, Mr. W. H. Pratt, Dr. E. H. Hazen, Dr. C. C. Parry, Mr. John Hume, Mr. Simpson, Mr. John Temple, and many others for specimens and information, and assistance of various kinds. To Miss Emily A. Smith of Peoria, Illinois, who has made a contemporaneous study of this species, I am specially indebted for the frequent communication of her observations and discoveries, which for the most part have served to confirm my own, in some cases to anticipate them, and only in few essential particulars appear to differ from mine. To the subjects of habits, parasites and remedies she has given more attention than I have done.

In making this study I have used a McAllister's Physician's Microscope stand, with $1\frac{1}{2}$, $\frac{3}{4}$ and 1-5 objectives by Wm. Wales, and magnifying from 5 to 450 diameters. The stand is small, but I found it very convenient for this kind of work. The objectives were of the cheapest, low angled form, but worked very satisfactorily, except that in some cases a greater amplification would have been desirable.

In pursuing this study I have prepared a series of more than 200 microscopic slides, illustrating every stage of the development of this insect, and containing from one to more than 100 specimens on each. These have been prepared by the following methods; 1st, mounted directly in pure glycerine; 2d, placed first in alcohol, then in glycerine and mounted in glycerine; 3d, placed first in oil of cloves, or in turpentine, and mounted in Canada balsam; 4th, placed first in solution of potash, then in water, then in alcohol, then in turpentine, and mounted in Canada balsam; 5th, mounted directly in solution of salycilic acid; 6th, in solution of acetic acid; 7th, in solution of white of hen's egg, and 8th, in pure water. Each of these methods has its special advantages and neither is to be relied upon implicitly. My studies have been made by a comparison of all these and of great numbers of living individuals, the whole number examined carefully amounts to several thousand examples, with an infinite number examined superficially. For all observations recorded in this paper I am alone responsible, except where it is expressly stated otherwise.

A large number of drawings were made with and without the aid of a camera lucida, of which only a selection is given on the plates. The plates are my first attempts at etching on steel and naturally are quite imperfect, as it is difficult without experience to produce just the desired effect, but the outlines are, I think, very nearly correct. The figures have all been carefully drawn to scale, and the amount of amplification annexed in every case. I regret that I was not more uniform in the use of reference letters on the plates, but the importance of this matter did not fully impress me until after the etching had been completed.

EXPLANATION OF PLATES XII AND XIII.

PULVINARIA INNUMERABILIS.*

FIG. 1. Posterior portion of the generative organs of a female in October, about six weeks after fecundation; *a*, spermatheca; *b*, its wall; *c*, filamentary spermatozoa; *d-e*, narrow neck leading from the spermatheca to the vagina; *e-m*, vagina; *f*, cavity in vagina above outlets of oviducts, containing some not very well defined substance; *t*, thick cellular wall of vagina; *h, h'*, oviducts; *i-i'*, supposed glandular enlargements of oviducts [probably an erroneous observation]; *k*, outlet of the oviducts; *j*, supposed muscular contraction, [probable outlet of vaginal glands]; *m*, vulva; *o*, six vulvular spines supposed to act as an ovipositer; *t*, end of anal fissure, inturning of eighth segment; *q, q'* suture between seventh and eighth segments; *n, n'*, suture between sixth and seventh segments; *p*, and *r*, wax-secreting spines on the seventh and eighth segments; *s*, ventral wax-secreting pores; *s'*, one of these more enlarged, showing a number of fine pores set around a central tubercle. Magnified 50 diameters. See page 323.

FIG. 2. Minute spherical bodies having a vibratory motion, found in the female. *a*, 300, *b*, 500 diameters. See page 326.

FIG. 3. Spherical bodies found in female, probably immature and detached *ovicapsules*; *a-i*, different appearances of these bodies, 150 diameters; *k*, 330 diameters. See page 327.

FIG. 4. Oval bodies, (*Pseudo-navicellæ*?) found in female, once supposed to be spermatophores; *a*, 150 diameters; *b-e*, different forms, magnified about 500 diameters. See page 326.

FIG. 5. Groups or clusters of *ovicapsules* in various stages of formation as seen in the ovaries; *a*, a small immature group; *b*, a larger, more advanced group; *c*, a tracheal tube sending branches to each cluster; *d*, membrane or tube to which the *ovicapsules* are attached—rather exaggerated in this figure. 50 diameters. Pages 323, 327.

FIGS. 6 to 17. *Ovicapsules* in various progressive stages of development; *oc*, membrane of *ovicapsule*; *ep*, layer of epithelial cells; *ch*, vitelline membrane in fig. 10, chorion in fig. 17; *y*, yolk or vitellus; *ve*, vitelligenous cells; *g*, gathering of granules between the vitelligenous cells connected with the vitellus by a filament; *sp. sp'* (fig. 17) oval bodies, [at the time of etching this plate supposed to be spermatophores]; *bl*, (fig. 17) blastoderm or granular layer spread over the surface of the yolk with a gathering of granules at each end. [The shading of the vitelligenous cells in figs. 10 and 15 is an experimental blunder of etching, so also in fig. 3, *k*]. All magnified 100 diameters. See pages 323-329.

FIG. 18. Egg after having been laid, coated with minute rings; 50 diameters. [The outline should be symmetrical]. *a*, two of the rings magnified 350 diameters. See page 298.

Figs. 19 to 23. Embryo in the egg in three stages of development; fig. 21 dorsal, 22, ventral, and 23, side views of the embryo just before

* *Pulvinaria acericorticis* Fitch, on Plate XII, is a synonym.

hatching; *a*, conical projection on the head,—“egg-opener”; *e*, eye spot; *at*, antenna: *m* and *max*, [supposed at the time of etching the plate to represent the mandibles and maxillæ, probably imaginary]; *bs*, buccal setæ coiled up spirally; I, II, III, first, second, and third legs. 100 diameters. See pages 298-300.

FIG. 24. Abnormally formed egg. 50 diameters. Page 300.

FIG. 25. Larva soon after birth, from above. I-IX, first to ninth abdominal segments: *an*, conical bases of the anal setæ; *ov*, leaf-like organs on the ninth segment, each composed of three spines cemented together. [An attempt to show some of the internal organs and external surface at the same time, has rendered this figure somewhat confused in appearance.] 75 diameters. See page 300.

FIG. 25 *a*. Leg of larva; *co*, portion of integument to which leg is attached [which I took for the coxa at the time of etching]; *tr*, coxa; *y*, trochanter; *f*, femur; *ti*, tibia; *ts*, tarsus. 200 diameters. Page 303.

FIG. 25 *b*. Antenna of larva; 1-7, the different joints. 200 diameters. Page 302.

FIGS. 25*c*, 25*d*, 25*e*, showing the ninth abdominal segment in different positions; 25*e*, ventral, the rest dorsal. 75 diameters. Page 304.

FIG. 26. Larva after the first moult, from below; *og*, supraœsophageal ganglion; *spr.*, spiracles; *v*, ventriculus (ansa minor); *ov*, vulvular spines (on ninth segment); *an*, anal valves, seen through enlargement of the end of the anal fissure. 50 diameters. Page 306.

FIG. 26*a*. Mouth parts and chitinous frame work supporting them. See page 317 for full description, also page 302.

PLATE XIII.

FIG. 27. Pupa of male under its scale seen from above; *a*, waxen scale covering the pupa; *b*, integument of the larva; *c*, integument of the pupa formed within that of the larva. 25 diameters. Page 307.

FIG. 28. The pupa a little more advanced, taken out of its scale, seen from below. 25 diameters. Page 307.

FIG. 29. A pupa, *a*, from which a thin transparent pellicle, *b*, has been slipped partly off; from above. 25 diameters. Page 307.

FIG. 30. A still more advanced pupa, from below. 25 diameters. Page 307.

FIG. 31. A fully developed male, from below. 25 diameters. Page 308.

FIG. 32. Female at time of appearance of males, from above. 25 diameters. Page 314.

FIG. 32*a*. Antenna of female. 64 diameters. Page 315.

FIG. 32*b*. Leg of female; *co*, coxa; *tr*, trochanter; *f*, femur; *ti*, tibia; *ts*, tarsus. 64 diameters. Page 316.

FIG. 33. Fully developed male, from above. 25 diameters. Page 308.

FIG. 33*a*. Antenna of male. 64 diameters. Page 309.

FIG. 33*b*. Leg of male; *co*, coxa; *tr*, trochanter; *f*, femur; *ti*, tibia; *ts*, tarsus. 64 diameters. Page 310.

FIG. 34. Male and female in copulation. 10 diameters. Page 313.

FIG. 35. An oblique view of mouth parts of adult female, slightly drawn apart in dissection; *a*, labium; *x*, cross section of base of labium; *b*, crescent-shaped, chitinous piece in the labium; *c*, costa superior; *d*, costa inferior; *e*, conical bases of the buccal setæ; *f*, œsophagus; *g*, buccal setæ. 64 diameters. Page 318.

FIG. 36. Young lice settled on the underside of a soft-maple leaf. Natural size. Page 305.

FIG. 37. Males and females on the underside of a maple leaf in August, at the time of the appearance of the males. Natural size. Page 324.

FIG. 38. Females on twig in winter. Natural size. Page 324.

FIG. 39. Females on twig about commencement of egg-laying; *a*, dark colored parasitized female; *b*, female in process of excreting a drop of honey-dew; *c*, female with egg-nest just beginning to form. Natural size. Page 325.

FIG. 40. A female just before beginning to lay eggs; *a*, from above; *b*, from below; showing the markings, and the position, and comparatively small size of the legs and antennæ. Natural size. Page 325.

FIGS. 41, 42. Females with egg-nests, more or less fully formed. Natural size. Page 331.

FIG. 43. Mouth parts of female pupa just before final moult; *a, b*, and *a', b'*, conical bases of new setæ in spiral coils; *c*, arcus superior; *d*, arcus inferior; *e*, œsophagus; *f*, labium, or sheath; *g*, loop of old setæ in abdomen; *h*, base of outer pair of old setæ; *i*, base of inner pair of old setæ; *k*, clavus. 112 diameters. Pages 306, 314.

FIG. 44. Wax secreting glands attached to ventral pores of female; *a*, gland; *b, c*, tube leading to pore, the portion *c* being larger than *b*; *d*, pore. 160 diameters. Page 321.

FIG. 45. Generative organs of the male; *a, a'*, vessels containing spermatozoa; *b, b'*, slender tubes connecting with ductus ejaculatorius; *c*, ductus ejaculatorius; *d*, dorsal portion or sheath of the penis; *e*, ventras portion or valve of the penis; *f, f'*, anal filaments; *g*, lateral prolongation of the seventh segment; *h, h'*, sides of the abdomen, *i, i'* glands secreting the anal filaments. 56 diameters. Page 312.

FIG. 46. Detached bundle of spermatozoa from male. 63 diameters. FIG. 46*a*. End of a spermatozoon magnified 457 diameters. Page 312.

FIG. 47. Female generative organs in May, several weeks before the first eggs are laid; *a*, spermatheca; *b*, neck of vagina; *c*, vagina; *d*, vulva; *k*, and *l*, cavities in vagina; *e, e'*, oviducts; *f, f'*, vaginal glands; *g, g'*; spindle-shaped ducts; *h*, outlets of vaginal glands. 56 diameters. Page 323.

FIG. 48. Nervous system of female; *a*, supra-œsophageal or cephalic ganglion; *b*, infra-œsophageal or thoracic ganglion; *e*, main dorsal nerve; *d, d', k, k', c, c'*, lateral nerves [probably to the legs]; *l, l'*, antennal nerves; *m, m'*, optic nerves; *h*, costa superior; *g*, costa inferior; *f, f'*, salivary glands; *i*, œsophagus. 56 diameters. Page 322.

FIG. 49. Portion of ventral surface of eighth abdominal segment of female, showing pores. 160 diameters. Page 321.

FIG. 50. Wax-secreting peripheral spines of female; *a*, external layer of integument; *b*, middle or main portion of integument; *c*, inside portion of integument; *d*, dorsal layer of wax projecting over the margin; *e*, duct leading from gland to spine; *f*, wax-secreting spine; *g*, cylindrical filament of wax secreted by the spine. 180 diameters. Page 321.

II. ASPIDIOTUS ANCYLUS.

Diaspis ancylus. Putnam. *Transactions of the Iowa State Horticultural Society for 1877*. Vol. 12, page 321. Des Moines, 1878.

While engaged in the study of *Pulvinaria innumerabilis* on a soft maple in 1877, I very unexpectedly discovered that the tree was fairly loaded down with a species of *Aspidiotus* in addition. My leisure time being otherwise occupied, I have not been able to give this species the attention it deserves. It is found on the branches and trunk of the soft maple (*Acer dasycarpum*), and of the linden (*Tilia europæa*) and, so far as my observations have yet extended, only on trees infested with *Pulvinaria innumerabilis*, but this last circumstance is undoubtedly accidental. A comparison of these two species so alike in some particulars, and so different in others, gives rise to many fascinating speculations upon the principles underlying their development. Sometime when I have studied more I hope to write more fully of this subject.

Aspidiotus ancylus approaches closely in all respects to *A. nerii*. It is however easily separated from that species by its heavier, slightly larger, and darker colored shield. The adult female differs from that of *nerii* in having the *vulvular* pores arranged in five groups, two on each side and one in front of the *vulva*, the side groups containing from 8 to 16 pores each, and the front group 5 to 10 pores—the exact number varying considerably in different individuals. The female lays about thirty or forty eggs, with a greater or less interval between each. This takes place in the late spring or early summer. The young larva is less than twice as long as broad, with the antennæ and legs inserted near the margin, and is much less active than the *Pulvinaria* larva. Its beak is excessively long forming a loop more than twice the length of the abdomen. Its eyes are scarcely visible, it rarely moves any great distance from its mother, and very frequently settles down right under her scale without having seen daylight at all. As soon as it settles it withdraws its antennæ and legs into a position corresponding to that of the *Pulvinaria* larva (fig. 26), and then gradually becomes contracted until it forms nearly a perfect circle. At this time a very thin layer of wax is seen to be secreted by the dorsal surface. This layer continues to increase steadily in thickness throughout the life of the insect. During the summer the larva moults and the cast off skin becomes imbedded in the dorsal scale, forming the dark red “umbilicus.” Before moulting the insect appears to enter a dormant, encysted state, becomes

of a dark red color, and a pair of setæ are seen spirally coiled up on each side—as has been already described in *Pulvinaria*. In all cases this appears to be a certain indication that the insect is about to moult. Late in the fall both sexes enter the pupa state, that of the female being exactly similar to the encysted state of the larva before its first moult, except in size, while that of the male now for the first time shows a difference of form. Both sexes appear to remain in this quiescent state until spring, when, with the first warm days they quickly complete their transformations. The female remains of a similar form to the more matured larva, but has lost all traces of antennæ and legs,* and the vulvular pores have for the first time made their appearance. The cast off skin again becomes incorporated with the scale as before. The male appears about the middle of April, and is very similar in appearance to that of *nerii*, but can be quickly and certainly distinguished by the form of the *apodema* or transverse thoracic band; in *nerii* this is of a slightly waved outline, rather suddenly enlarged at the sides, while that of *ancylus* is of equal width throughout, with parallel sides, the whole slightly curved forward. On April 18th, 1878, I observed a male copulate with the female. After coming out of his scale he walks about with his wings folded, in the usual position, flat on his back. The long style-like penis is curved under the body so that its point is directed forward. This he keeps in constant motion. When he meets with a female he mounts upon her back standing high up on his legs; the penis soon finds its way under the scale and keeps constantly vibrating. When interrupted he goes on to another female. I watched this process continue for about ten minutes.

I have submitted specimens of this species to M. Signoret who regards it as a distinct species. I hope before long to give a more detailed account of it with suitable illustrations.

Miss Emily A. Smith while searching for this species in Peoria, found another very different species of *Aspidiotus* on the hard maple (*Acer saccharinum*). I have since found it in Davenport. There appear to be two broods (both ♂ and ♀) each year, one on the leaves in summer, and one on the trunk and branches in winter. Miss Smith has made a careful study of this insect and expects soon to publish a paper upon it.

ERRATA.

Page 293. *Coccus tiliæ* Fitch, might be added to the list of doubtful synonyms. See p. 340.

Page 298, line 4 from bottom. For "4 μ ." read "25 μ ."

Page 305, line 21 from bottom. For "always" read "usually."

Page 305, line 16 from bottom. Insert at end of this line:—"On the trees however they sometimes move downwards as is shown by their settling on new shoots below any infested branches."

Page 307, line 2 from bottom. For "23" read "29."

Page 308, line 15 from top. For "30" read "31."

Page 319, line 27 from bottom. For "26, a" read "26a."

Page 322, lines 13 and 21 from top. For "oesophagal" read "oesophageal."

Page 329, line 19 from top. Insert "Fig. 17."

*The antennæ and legs are probably lost at the first moult, but I cannot state this for a certainty.

DECEMBER 28TH, 1878.—REGULAR MEETING.

Dr. R. J. Farquharson, President, in the Chair.

Twenty persons present.

The reports of the Corresponding Secretary and Curator were presented, and the thanks of the Academy were voted to the donors to the Library and Museum.

Dr. C. F. Waldron, Brush Creek, Iowa, and Prof. H. A. Ward, Rochester, N. Y., were elected corresponding members.

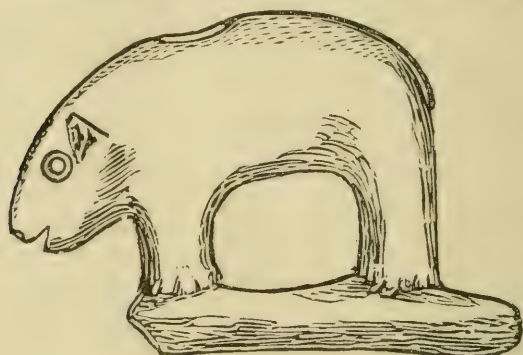


Fig. 22, two-thirds natural size.

Two carved stone pipes, recently obtained by Mr. Gass, were exhibited. One of them (Fig. 22) evidently represents a bear, and the other (Fig. 23) an elephant, though both are considerably out of proportion, the bear being too tall, and the ele-

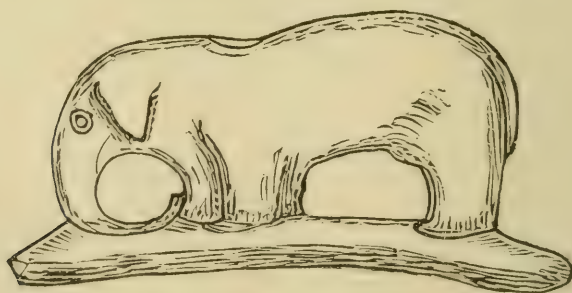


Fig. 23, two-thirds natural size.

phant too long and slender. The bear pipe was found by some German farmers, in a mound in Muscatine County, Iowa. The

elephant pipe was supposed to have been found in the same locality—but as the finder had moved to Kansas, no definite information had yet been obtained.*

The following papers were read :

The Formation of Ground Ice in the Rapids of the Mississippi.

BY DR. R. J. FARQUHARSON.

In this country, where everything but nature is new, where man, at least of our own race, is but a recent arrival, it is the duty of such pioneer institutions as our Academy to diligently study our surroundings, and to faithfully record the more prominent and important phenomena.

To one of these, a phenomenon on the grandest scale, I would ask your attention to-night; it has been constantly recurring, season after season, for many ages, certainly since that time, when at the close of the last Glacial Period, the present course of our great river, the Mississippi, was laid out. Many persons, some of my present audience no doubt, have remarked the sudden appearance of a great quantity of floating ice in front of the city of Davenport, where the near approach of winter is regularly signalized by this event.

On one of the bright, clear days of our early winter, say in the latter part of November, the observer leaves the river at sunset perfectly clear of floating ice, during the night the mercury falls to any degree below 20° of Fahrenheit, in the morning he is surprised to find almost the whole surface of the river, as far as the eye can reach, both up and down, covered with floating cakes of ice.

Being alone familiar with our Southern rivers, which rarely close, and those only by means of a "gorge" of floating masses of surface ice, which have formed at the shores of the river, and then become detached, I fell into the natural error of attributing the accumulation of ice here to the same cause.

But a very little further observation was sufficient to dispel this error. On such a morning as is here described, the shore ice would be found to be not over one or two inches in thickness, and to extend not more than from ten to twenty feet from the shore, to which, moreover, it would yet remain attached.

If the observer now placed himself upon the Government bridge, and

* By a letter from Mr. Peter Mare, now living in Kansas, we are informed that he found this elephant pipe six or seven years since, while planting corn on his farm in Louisa County, Iowa, where he then resided. He kept it until last year, when he moved to Kansas, and then gave it to his brother-in-law, from whom we obtained it. Rev. Mr. Gass heard indirectly last winter of the existence of such a relic, sought out the owner and endeavored to purchase it, but could not. He, however, borrowed it for the purpose of taking photographs and casts. While in our possession it was accidentally broken, and thus by compromising the matter with the owner, and paying him about \$5.00, we obtained ownership of it. The finder, Mr. Mare, an illiterate German farmer, had no appreciation of any scientific value or especial interest attaching to this pipe; he regarded it as a curiosity merely, and his brother-in-law valued it only as a keep-sake, and used it habitually for smoking.—(*Extract from the Proceedings of the Meeting of April 25th, 1879.*)

looked from above upon the floating masses of ice, the whole mystery would be solved. He would see that these masses were not formed at the shore, and then detached, for they are nothing like shore ice, but were formed on the bottom of the rapids; that they were ground-ice in fact, and that he stood in the presence of one of nature's great ice making machines.

I shall now quote from notes of observations made during a series of years, these notes being made on the spot, and they will go to show the nature of the ground-ice which forms upon the rapids.

Note 1st.—On the night of November 26th–27th, 1876, the mercury fell to 0° F. for the first time this winter, and in the morning the floating ice was running freely from the rapids, so as to fill the main channel of the river, as far as the eye could reach. This ice, as seen from the bridge above, consisted of quite large cakes, some with a smooth upper surface, others again were rough, as if from having met some obstruction, thereby breaking the upper crust, and forcing the fragments upwards along the lines of fracture. As always observed before, beneath the upper crust were projections, several feet deep, which seemed like great sponges, as seen at the edge of the cake and through the transparent upper crust, the adherent sand and gravel giving to some of these projections the almost exact appearance of stones. Their true nature is however made quite manifest when the floating cake strikes the pier, the apparent stone glides a short way up the slanting stone-work, and is evidently of soft ice, like slushy and muddy snow. That these large cakes are not of shore ice is evident from the fact, that the shore ice along the rapids only formed last night, is only 29 or 30 feet wide, and is still adherent as far as can be seen; besides, shore ice never has the muddy masses like stones, nor the great irregular, projecting bodies, like sponges.

Note 2d.—March 4th, 1877. Mercury fell last night to 0° F. Same appearances as above noted; shore ice one inch thick and ten feet wide. Upon returning to my office noticed the formation of ground-ice on a miniature scale, in a small bottle of river water, left standing over night on the window ledge; here the water at the bottom of the bottle being frozen by the cold external air coming up through the crevice between the sashes, would thus become lighter, would pick up the sand and other sediment at the bottom, and rise with it to the top, here meeting the warm air of the room it would melt and drop the sediment to the bottom, to be again picked up and transported to the surface, and thus the round went on.

Note 3d.—February 11th, 1878. Mercury fell last night to 18° F. Plenty of ground-ice running, simulacra of stones abundant. Shore ice one inch thick and ten feet wide.

Note 4th.—December 7th, 1878. This morning at 2 A. M. the first ground-ice passed under the bridge, mercury then standing at 10° F., being the first floating ice of the season. Shore ice one inch thick, and about ten feet wide, just above the bridge. At 10 A. M. large cakes of floating ice are passing by, with usual freight of sand, gravel, &c., simulating stones.

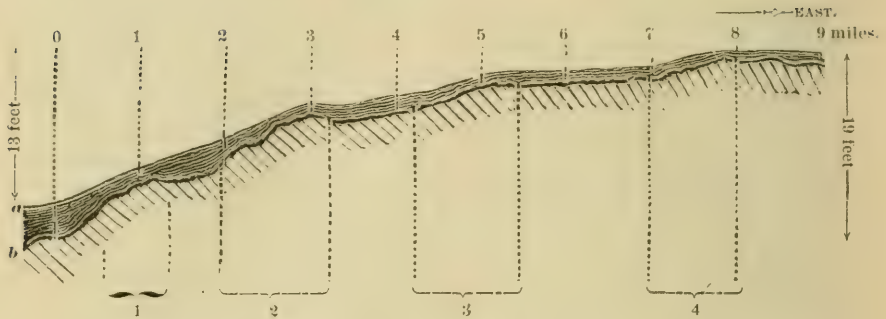
These quotations will suffice to show the general nature of the phenomena observed. In addition to the above, two rather irregular effects of the ground ice were observed.

At times during the winter, the water as delivered by the hydrants is very muddy. This occurs when there has been no rise or freshet, the river being generally low, and at its clearest stage, and is the result of the lower projecting parts of the spongy masses, when laden with sand and mud coming in contact with the rough line of the conduit in the river bottom, and there depositing their muddy freight. Again, when the floating ice is very abundant in the river, the ferry boat meeting it, has her hull so incrustated with this spongy ice, which becomes compacted or balled by impact, that her draught of water is increased by several feet, and to reach the usual landing-place on the Illinois side, she has to run off and scrape herself where the bottom is hard, as the whale is said to rid itself of barnacles and other obstructive parasites.

The phenomenon of the formation of ground ice or bottom ice, or anchor ice, always in running water, has been observed in many parts of the world, and was for many years quite a puzzle, or at least a perplexing problem in physics. By general consent it is now explained in accordance with the well known properties of water, and the varying changes of density it undergoes in passing from the fluid to the solid state.

Fresh water attains its maximum density at 4° centigrade, or 39.2° F., above or below this, as it is warmer or colder, it becomes lighter; water at 4° centigrade being 1000, ice has a specific gravity of 920. Again, if you expose water in a metallic vessel, a common iron pot, to a freezing temperature, say to our winter air when the thermometer is below 20° F., ice to a certain thickness will form on the surface, and along the sides and bottom of the containing vessel, but, a very long exposure, or a very reduced temperature is necessary to freeze the mass of water solid; if however, by any means, the water be so stirred as to be thoroughly mixed, the whole mass will become solid ice in a comparatively short time. This is also observed in the familiar process of making ice-cream or water ices, when the crust of ice forming at the outside must be constantly scraped off, and the whole mixed by motion, in order to freeze the mass.

The formation of ground-ice in our great natural freezer or ice-machine, will be better understood after a consideration of the nature of the Rock Island Rapids, the description of which is made much clearer by an inspection of the accompanying cartoon, giving a sketch or plan of the rapids, for which I am indebted to the courtesy of Col. Flagler, commandant of the U. S. Arsenal, and to the kindness of our associate, Mr. W. Otto Gronen, who has made a perfectly accurate copy from the official surveys as made by the U. S. Government.



LEGEND.—0, Davenport Bridge; 1, Lower Chain; 2, Moline Chain; 3, Duck Creek Chain; 4, Winnebago Chain; *a*, surface of water; *b*, river bottom; horizontal scale, 1-142,560; vertical scale, 1-228.

From this it appears that the volume of the Mississippi is precipitated down an inclined plane, whose fall in 14 miles from LeClaire to Davenport is 25.74 feet, or at the rate of 1.84 feet per mile.* Not only is there an inclined plane, but the channel is an exceedingly tortuous one, turning in almost all directions, and the bottom again, so far from being smooth enough to facilitate the descent of the falling water, is roughened to the highest degree, by means of boulders and other detached masses of rock, of crevices in the layer of rock forming the bottom, and of numerous excavations and pot holes. Thus is formed the machine for the mixing and churning process, and a very effectual one it is.

At the head of the rapids the water is cooled by radiation and the contact of the cold air below the freezing point, but long before the three hours necessary for the passage of the rapids, indeed, in all probability soon after the descent is begun, the whole mass of the water has by the mixing process been reduced to the same temperature throughout, and being thus on the point of freezing, needs but the slack water afforded by the eddy of a boulder, or a pot hole to freeze instantly into a spongy mass, including in its embrace all the small stones, sand, mud or other sediment in the pot hole or eddy; the mass thus formed becoming, even with its included freight, lighter than a corresponding bulk of the surrounding water, it must rise to the surface, where the action of the waves and of the wind smooth off the upper surface, which is soon rendered solid by radiation and contact with the colder air.

That the soft ice forms under the lee, as it were of the stones, as well as in the holes and hollows, the presence of the gravel and sand would indicate; for each stone or other obstruction to the current has on its lower side a small delta of sand, gravel and mud, and it is just here that the ground-ice forms, bearing off this sediment in its embrace.

The Bibliography of this subject, at least of the books accessible to me, is very meagre indeed, consisting of an article in the Smithsonian Report of 1866, being a translation from the "Annales de Chimie et de

* Hall's Geological Survey of Iowa, Vol. 1, p. 7.

Physiques," (Paris, 1866), of an essay by Engelhardt, whose observations were made on the lower Rhine. From this we learn that the first mention made of ground-ice by any writer is by Dr. Plott, in 1705, in his "Natural History of Oxfordshire."

Arago, in the "Annuaire du Bureau des Longitudes" for 1833, first gave the proper explanation of the formation of ground-ice; this explanation Engelhardt adopts with an addition. "With Arago, then," he says, "I attribute the formation of ice at the bottom of water principally to the obstacles which occur in the current; but, in my view, these obstacles are not solely resting points for the crystals, but they serve, on the one hand, to augment the movement of rotation, the vortiginous movement by which the water at a temperature 0° C. (32° F.) is made to descend to the bottom of the river; and, on the other hand, they create stationary points in the midst of the movement, when the crystallizing force can exert itself."

Another article on the subject is a notice in the Journal of Applied Science, of a paper by Professor Hind, of New Brunswick, giving some account of the effects of anchor ice on the coast of Newfoundland. He speaks of the anchor ice forming about the seal-nets, at the depth of from 50 to 60 feet below the surface, and that if the sealers neglect to lift the nets after spiculae of ice begin to form on the casks at this depth, they are liable to be lifted by the forming ice, and being carried away by the tides are lost. This author on the authority of Despretz, explains the phenomenon by the statement that sea-water, when near the freezing point, behaves differently from fresh water; taking no account of the mixing of the surface water with that below, by the action of the tides, the roughness of the bottom, &c. It is very doubtful if sea water in cooling obeys a different law from fresh water, for it has been lately shown that all the metals and some rocks expand or become of less specific gravity at the moment of solidification or freezing, a property long known as belonging to, and thought also to be peculiar to some of the more easily fusible metals; indeed, it would seem highly probable that all bodies obeyed the uniform law that all bodies are lighter in the solid than in the fluid state, that all solids would float on the surface of their liquids, just as ice floats in water. But, there is no necessity in calling in the aid of any supposed peculiarity of salt water, when almost identically the same phenomena are to be seen in fresh water.

Anchor or ground-ice forms upon the chain cables of vessels anchoring in the Detroit river to the depth of fifty feet and more. Some years ago, the apparatus for straining the water at the mouth of the conduit, which supplies the city of Detroit with water, which was in very deep water, and projected somewhat above the bottom, became so covered with ground-ice, as to completely stop the flow of the water, and necessitate its removal. The divers engaged in this work could see the whole mass of water filled with spiculae or crystals of ice, which needed but the momentary check of the current by some obstacle to form a spongy mass of ice. Here the cooling of this great mass of water

is effected when it passes over the shoals above Detroit, where there is a maximum depth of only fifteen feet, with great width.

Finally, in the Penny Magazine of August 6th, 1842, there is an article on ground-ice or ground gru, the latter being the term used in Lincolnshire, where in the river Don it was observed by the author, Dr. Farquharson. He says, "Gru is the name by which the people of Lincolnshire designate snow saturated with or swimming in water; and as the ice formed at the bottom of rivers very nearly resembles that in appearance, a better name than ground gru could hardly be given." Again, he says, "when it begins to form at the bottom, it aggregates in forms, somewhat resembling the hearts of cauliflower."

The synonyms for this form of ice, as far as I make out, are the following, viz: Grundeis (German); Frazeau (Canadian French); Lolly (seal-fishermen) (lolly, soft, as in lob-lolly—gruel or mush, and lollepop—soft candy); ground-ice; anchor-ice; and ground-gru, (Lincolnshire.)

Whether the ground-ice continues to form on the rapids after the final freezing of the surface for the winter takes place, is not yet definitely known; but as an observer (Dr. Jackson, Journal of the Royal Geographical Society, Vol. 5), states that such is the case in regard to the river Neva, in Russia, when covered with three feet of ice and as much snow, it is probable that here it also continues to form. This would account for the growth of the ice opposite the city, after it forms, the accretion below being sufficient not only to counteract the effect of the enormous loss by evaporation from the upper surface; but to so exceed it as to produce a total thickness of three feet.

Exploration of Six Indian Burial Grounds in the Vicinity of the Mouth of Rock River.

BY REV. J. GASS.

On the 29th of November, in company with Mr. Toellner of Moline, I visited five Indian burying places on Rock River, and one on the Mississippi. We found on the right bank between the mouth of the river and the first railroad bridge, three of these groups of Indian graves. Some of the graves were situated so close to the running stream that a number of them were swept away by the torrents of high water.

The graves are all in rows similar to those of the Sioux at Camp McClellan. In the one nearest the bridge they are arranged in the form of a hollow square. We opened some of the graves. They were about five feet deep, and in each of them only one body had been buried, and no accompanying relics of any kind were discovered.

The fourth cemetery we explored is on the island near Milan. In digging a ditch for the use of a factory, built there some years since, a number of graves were disturbed, and many relics of glass and bronze were found similar in form and material to those usually found in modern Indian graves.

The fifth burying place we visited is situated about a mile above Milan, on the left of the river. Close by it is a sand-pit, and in digging

the sand a few skeletons were exposed, and rings and buckles of bronze were found, with a few arrow heads.

The graves in these five places vary from ten to twenty-five in number, but in the sixth are about 200. This latter cemetery is on Campbell's island in the Mississippi river, two miles above Moline. Here the graves were in even rows, and many of them adorned with shells, resembling somewhat the custom sometimes observed in modern grave-yards.

The shortness of the winter day prevented a more extended exploration, but by a second research in this region in a more favorable season, assisted by the information already gained, new discoveries will doubtless be made.

As a result of our labor I am encouraged to state :

1st. That I consider it an established fact that these graves were made by the Sacs and Foxes, the last inhabitants of the surrounding country, and

2d. That their custom in burying their dead was entirely different from that of the mound-builders ; and

3d. That the mounds in our vicinity were built by an entirely different nation or nations, and at a far earlier period.

The following address accidentally omitted from the Proceedings, Vol. I, page 55, is now printed on account of its value in preserving the history of the Academy.

President's Annual Address, January 7th, 1874.

BY DR. C. C. PARRY.

Gentlemen of the Academy: A duty constitutionally devolving on your presiding officer, of presenting at the annual meeting a statement of the general condition of the Academy, has, as far as my information goes, been a dead letter on our statute book. Perhaps the proper time has come for resuscitating this defunct by-law; at least I propose at this close of my official term, to leave to my successors no excuse for the non-fulfillment of this duty.

It is perhaps not altogether a matter of congratulation, that having accomplished little in the way of research, or publication, we have spent little. The account of the Treasurer to be presented in detail will show:

Amount received from all sources.....	\$302 20
Amount expended.....	168 13
Balance on hand, or available.....	\$134 07

By the commendable and persistent efforts of our present Treasurer, the annual dues from regular members, and initiation fees, on which the Academy depends for meeting current expenses have been collected as far as practicable up to the present time. The rule of striking out from the list of membership all who, on due notice, fail to meet their obligations, will hereafter be rigidly and impartially enforced. By vote of the Academy the privilege of securing life memberships, by the payment of \$100 has been established, but as yet we have no *life members*. The average attendance at the regular meetings during the present year has been seven, showing a slight increase over that of the previous year. Up to the present time out of an elected resident membership of ninety-two, sixty have been duly qualified by payment of initiation fees, and twenty-three are in full standing, being alone entitled to vote at the annual election of officers.

The collections of the Academy as far as provided with suitable cases, and store-room, are in good condition, and would no doubt be materially increased by donations or otherwise as soon as the proper means are provided for their safe reception and display. The Library now numbers 182 volumes and 129 unbound pamphlets. The single room at present occupied for meetings, the display of collections, and the library, is inconvenient of access, uncomforta-

ble, and in every way unfit for the purposes desired. An apparently well-devised effort, by co-operation with other kindred local associations, for securing a permanent and convenient location for these essential purposes, failed entirely of any practical results, and has been abandoned. The selection of suitable rooms for future use, is now in the hands of a committee who expect to present a final report, on which definite action can be taken.

The organization of the Academy, under its present constitution and by-laws, has been found in its practical working to be unnecessarily cumbersome, inconvenient and unsatisfactory. I refer particularly to the double organization of a board of independent trustees, and the Academy proper, the relative duties of which are incongruous and not clearly defined, the matter of revision being now in the hands of a Committee of Investigation, their report derived from an examination of the organization of a number of similar scientific bodies now in successful operation will, it is hoped, present the *data* for a more satisfactory reorganization. My attention was also been called by Mr. C. E. Putnam, one of the Trustees of the Academy, to some important defects in the articles of incorporation, which in his opinion destroy its legal value. I take pleasure in adding that Mr. Putnam has kindly volunteered to correct these important defects, and thus place the organization of the Academy on a proper legal basis. It is unnecessary to recommend to the Academy the grateful acceptance of this generous offer.

During the past season two of the officers of the Academy have been connected with the Scientific Corps of a United States Government Survey in Western Wyoming, the results of which are now in course of publication. One of our members has been engaged in geological examinations and collections in Missouri, the results of which have been in part communicated to the Academy, at its regular meetings.

Under the direct auspices of the Academy, some interesting and valuable ethnological investigations have been made of Indian mounds in this vicinity. These several examinations, and especially the last, which has added important material to our collections, have excited considerable interest both at home and abroad, and have served to give credit and reputation to the Academy, as evidenced in the receipt of various complimentary letters. It is to be hoped that such investigations may be still more energetically continued during the present year.

It has been proposed from several distinct sources to incorporate into the organization of the Academy, an historical division, with the view of collecting and storing for future use, any material especially bearing on Western or local history. It will be obvious to all that such collections including old newspapers, manuscripts, books, relics, &c., would increase in value year by year, and eventually form a very attractive feature, as well as afford the most satisfactory material for the use of the future historian. I therefore cordially commend this subject to your consideration.

To the above brief statements of the defects, the wants, and work of this association, it might be proper, did time allow, to add some pertinent suggestions on the educational scope of such institutions, as directly bearing on their future progress. That such institutions have a legitimate educational sphere, unappreciated it may be, but none the less real, is made only the more apparent by contrast with the much lauded and munificently supported schools and colleges of our day, that are still groping in the misty fog of medieval literature and abstract science; that they will eventually receive a fitting recognition is equally clear. It will be sufficient here to refer to the successful progress of similar institutions in other parts of the country, to draw the encouragement that persistent efforts, aided and directed by experience, will be everywhere eventually successful, and an Academy of Science be recognized as an essential part in the educational appliances of every intelligent community.

And although our *Davenport Peabody* has not yet made his appearance, to enrich with living gifts, or endow with testamentary bequests such an institution as ours, yet, pending his arrival, the harvest of natural truth must not be left entirely ungathered, though the fields may be broad and fruitful and the laborers few.

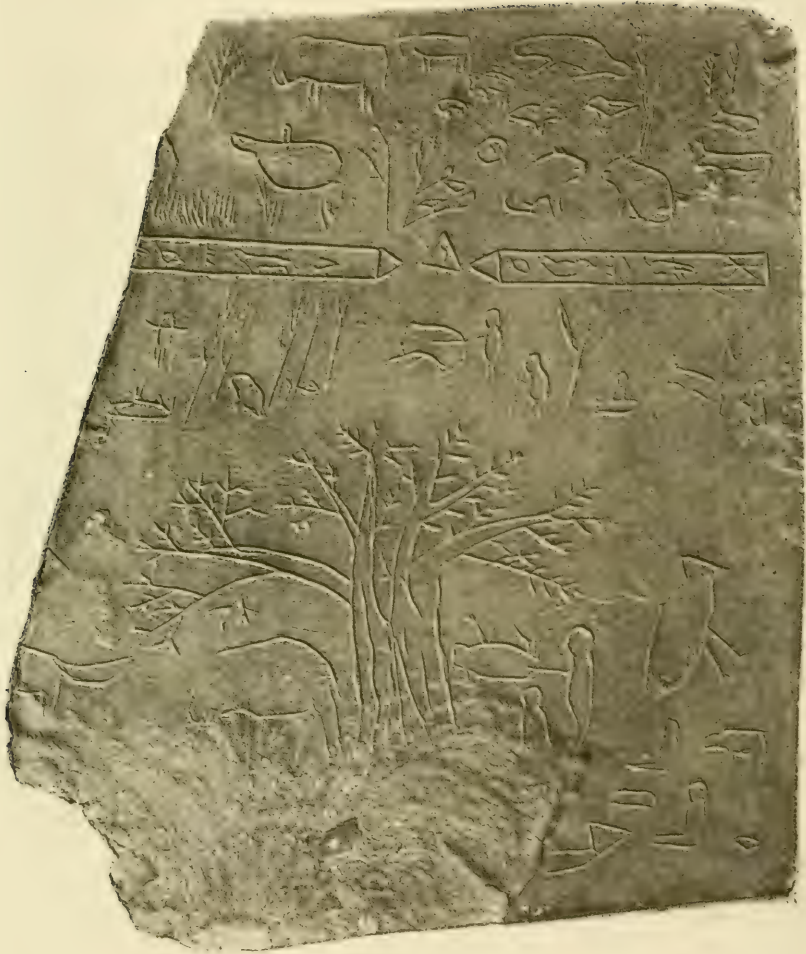
And now, gentlemen, having qualified myself by the performance of a long-neglected duty, to speak with sincerity and plainness, I will close by an earnest recommendation that, in accordance with the well-recognized republican rule of rotation in office, you will join me in selecting as my successor, one who will bring to the discharge of its duties a more active zeal and executive ability than I have been able to give, though yielding to no one in my earnest desire for the welfare and usefulness of the Davenport Academy of Sciences.

ERRATA.

- Page 5, line 3. After "Bric-a-Brac" insert "Club".
- Page 8, line 15. For "Herbrarium" read "Herbarium".
- Page 9, line 24. For "Hereptology" read "Herpetology".
- Page 17, line 10. For "were" read "was".
- Page 20, line 31. For "McGown" read "McKown".
- Page 29, line 39. For "Milwankee." read "Milwaukeec.".
- Page 37, line 5. For "including" read "not including".
- Page 41, line 37. For "it" read "is".
- Page 59, line 23. For "Eucalytus" read "Eucalyptus".
- Page 64, line 18. For "Canadiene" read "Canadien".
- Page 67, line 18. For "L. Hageboeck" read "A. Hageboeck".
- Page 81, line 16. For "Vereinde" read "Verein".
- Page 93, fig. 9. The black spot near the south-west corner of Grave B is to represent the copper axe No. 21, mentioned on page 96. The references were inadvertently omitted both here and in Fig. 8.
- Page 106, line 30. For "Phœnecian" read "Phœnician".
- Page 123, line 1. For "W. G. Gunning" read "W. D. Gunning".
- Page 123, line 3. For "Socillito" read "Sauzalito".
- Page 123, line 5. For "Hawkens" read "Hawkins".
- Page 123, line 12. For "Ingorsoll" read "Ingersoll".
- Page 123, line 39. For "Forman" read "Foreman".
- Page 123, line 46. For "Green" read "Greene".
- Page 159, line 26. Suppress the comma after "*Uniones*".
- Page 171, line 18. For "the remains" read "no remains".
- Page 188, line 34. For "older" read "alder".
- Page 189, line 5. For "*Heterorneles*" read "*Heteromeles*".
- Page 197, line 21. The institution here referred to is, we are glad to learn, still alive and flourishing.
- Page 217, line 27. For "746.19" read "745.19"—two places.
- Page 232, line 2. For "Vilado" read "Villada".
- Page 232, line 4. For "Guanajuato" read "Guanajuato".
- Page 236. Genus *MONOCERUS* should be *LEUCOZONIA*. No *Monocerus* is found on the east coast. No. 45, *M. Cingulata*, Lam., should be *Leucozonía cingulifera*, Lam., and placed after No. 25.
- Page 237. No 57 should be *Anachis simplicata*.
- Page 252. No. 296; after *B. heteroclita* read "Montague" instead of "Montl".
- Page 279. Headline; for "Perry" read "Parry".
- Page 281, line 8 from bottom. For "herberia" read "herbaria".
- Page 284, line 10 *et seq.* The remarks on the figures refer to the original lithographic plates. On the steel plates the drawings are more sharply defined, and Fig. 2 has been changed to a direct, instead of an oblique, side view.
- Page 286, line 24. The "pinnatifid structure" is brought out a little too strongly in the figure on the steel plate.
- Page 288, line 23. Fig. 9 has been entirely redrawn for the steel plate from other and better preserved specimens.
- Page 341. At end of first paragraph insert: "Dr. Packard writes me that this figure was introduced by Mr. Sanborn in the edition printed after Harris' death, that it certainly is not *C. adonidum*, and that the reference to the peach is also incorrect."
- Page 341. Between first and second paragraphs insert: "I have received from Miss Smith specimens of a *Pulvinaria* found on the gooseberry in Peoria, which is quite distinct from *P. innumerabilis*. It may possibly be the *P. ribesiae* of Signoret. In the *Canadian Entomologist*, Vol. XI, 1879, page 160, Wm. H. Ashmead has described, under the name of *Lecanium phyllococcus*, a bark louse found on the orange tree in Florida, which lays its eggs under a cotton-like substance, and which may possibly be a *Pulvinaria*."

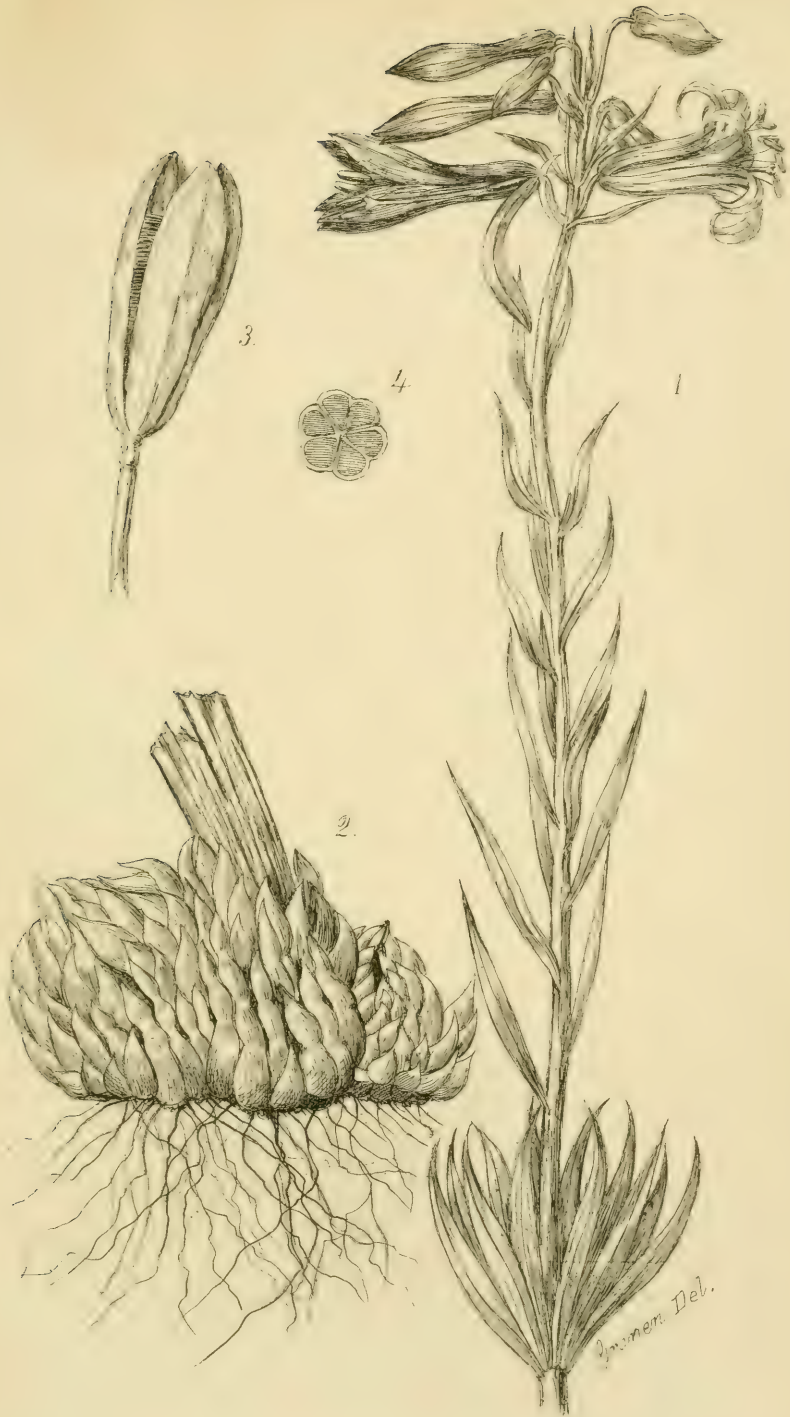
For additional errata see pages 288 and 347.











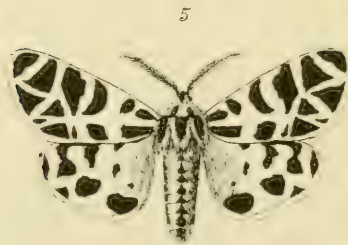


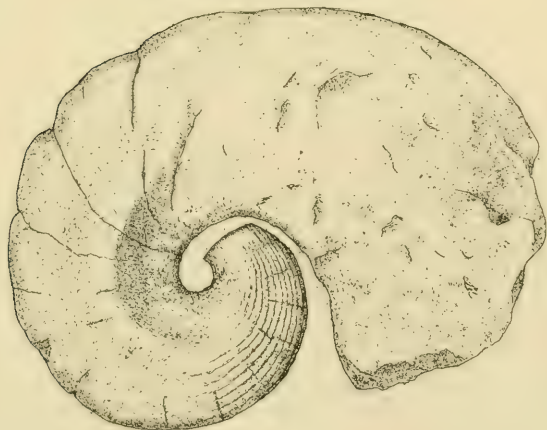
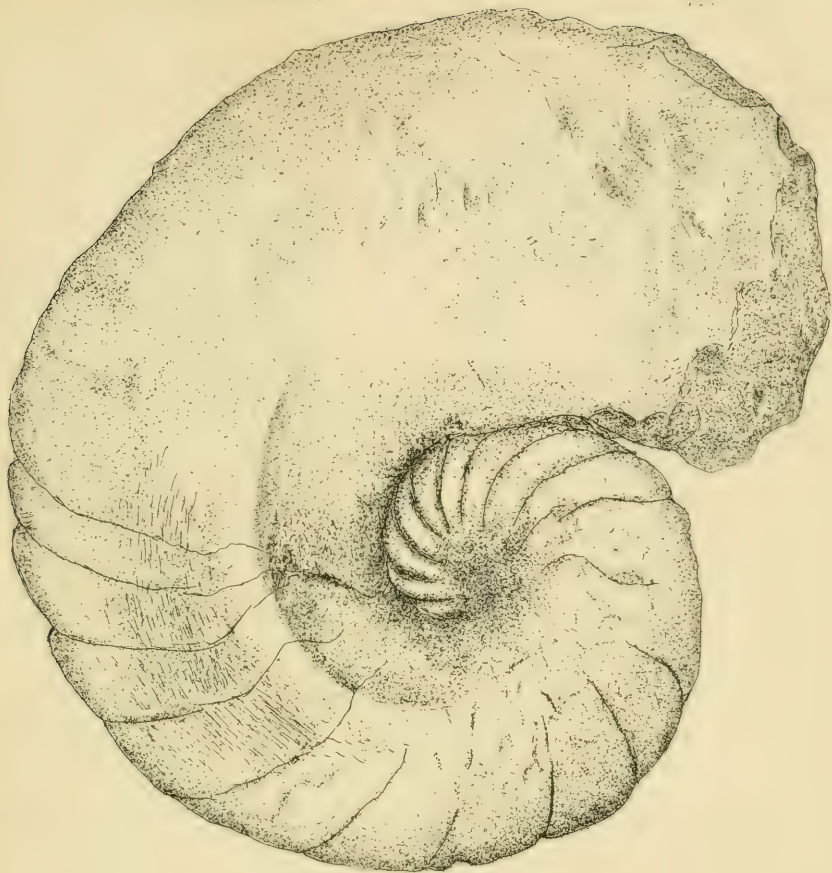
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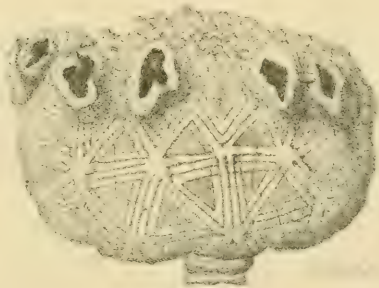
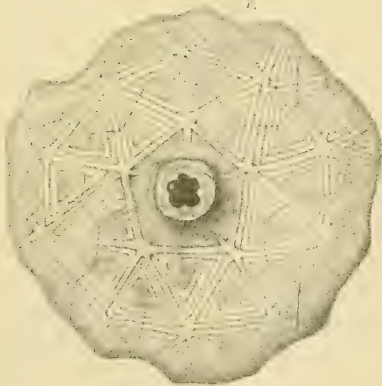
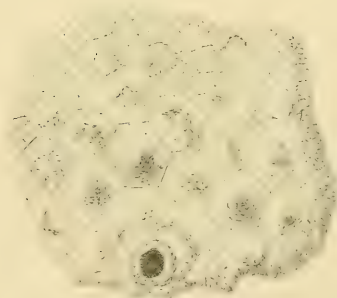
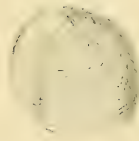
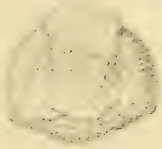
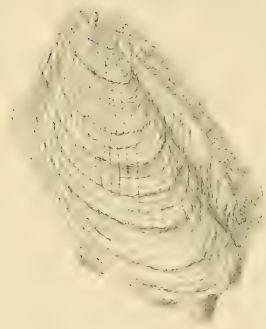
Negative By Hastings, White & Fisher, Davenport

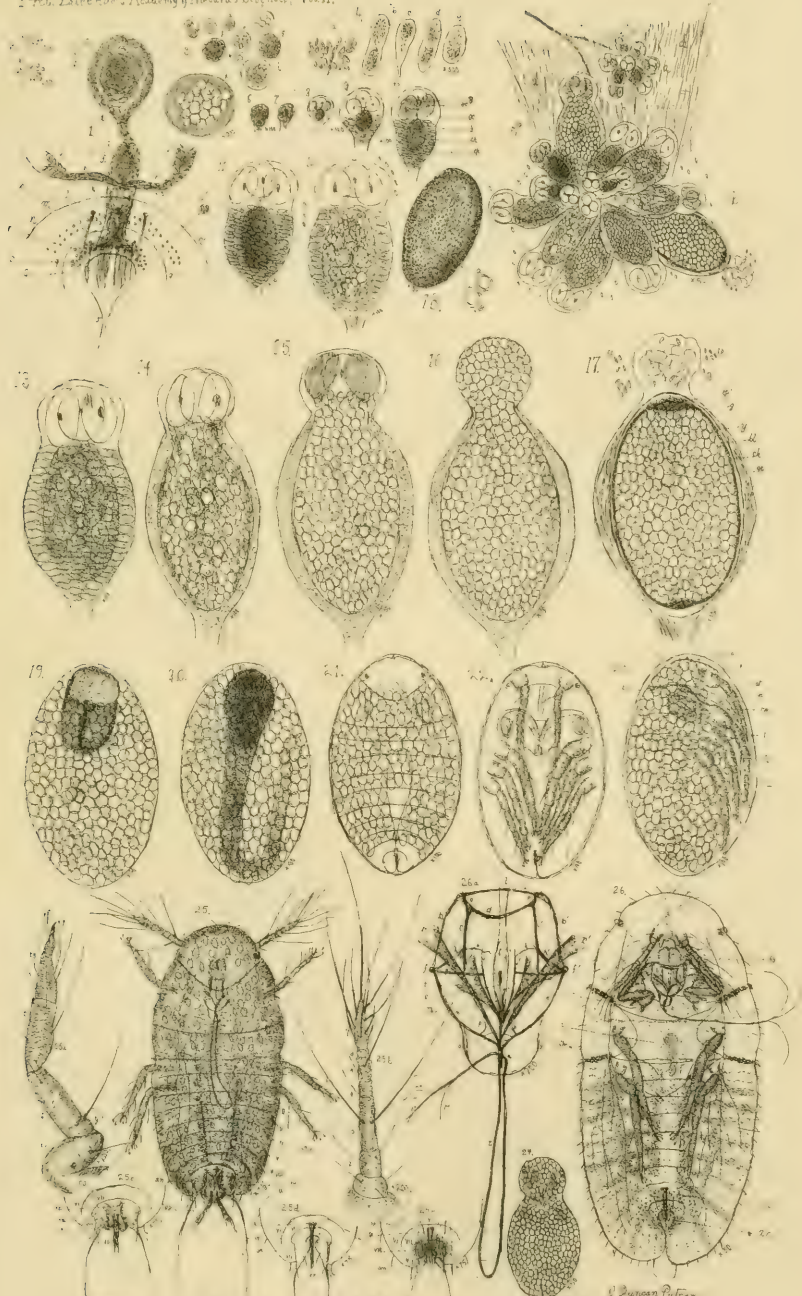






Barris: New Fossils.





*Development of *Calliphora vicina* Will.*

J. B. Sowerby delin.



Linnaeus

EXCHANCES SOLICITED.



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OF THE

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OF

NATURAL SCIENCES.

VOLUME II—PART I.

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CONTENTS.

RECORD OF PROCEEDINGS OF MEETINGS FROM JANUARY 3, 1876, TO
JUNE 29, 1877.

	PAGE.
Election of Officers for 1876.....	1
Standing Committees for 1876.....	6
Resolutions on the death of A. U. Barber.....	12
Horned Toads in the collection of the Academy. J. D. PUTNAM.....	22
On the Young of a species of <i>Lycosa</i> . J. D. PUTNAM.....	23
Exploration of a Mound near Utah Lake, Utah. JULIA J. WIET.....	28, 82
Notice of the late I. A. Lapham, LL. D. DR. C. C. PARRY.....	29
Manufacture of Pottery by Mojave Indian Women. DR. E. PALMER.....	32
Remarks on <i>Galeodes pallipes</i> Say. J. D. PUTNAM. Illustrated.....	35
Shell Money, and other Primitive Currencies. W. H. PRATT. Illustrated.....	38
Annual Meeting, Jan. 3d, 1877. Reports of Officers, etc.....	47-79
Additions to the Museum during 1876.....	50
Additions to the Library during 1876.....	57
President's Annual Address. REV. W. H. BARRIS.....	75
Election of Officers for 1877.....	77
Standing Committees for 1877.....	80
Mound Explorations in Jackson County, Iowa. C. T. LINDLEY. Illustrated.....	83
Remarks on Coral Formations. PROF. H. T. WOODMAN.....	85
Donation of Geological Collection by Prof. T. S. Parvin.....	89
Donation of a Deed of Land by Mrs. P. V. Newcomb.....	90
Exploration of Mound No. 3, Cook's Farm Group, and Discovery of Inscribed Tablets, by Rev. J. Gass. Illustrated.....	92
Call upon Mrs. Newcomb, and address by Rev. S. S. Hunting.....	99
On the Inscribed Tablets found by Rev. J. Gass. R. J. FARQUHARSON. Illustrated.....	103
Report of the Director of the Biological Section. J. D. PUTNAM.....	120
Description of <i>Caloptenus picticornis</i> N Sp. PROF. CYRUS THOMAS.....	125
Additions to the Flora of Iowa. J. C. ARTHUR.....	126
Mollusca collected in Colorado, Wyoming and Utah. ERNEST INGERSOLL.....	130
Recent find of Skulls and Skeletons in Ohio. REV. S. D. PEET.....	138
Exploration of Mound No. 10, Cook's Farm Group, by Rev. J. Gass. Illustrated.....	141
Description of Inscribed Stones found in Cleona Township, Scott County, Iowa, by Rev. J. Gass.....	142
Exploration of Mounds on the Farm of Col. Wm. Allen. W. H. PRATT.....	148
Reports of observations, collections, etc., etc.	

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ERRATA.

- Page 5, line 3. *After "Erie-a-Brac" insert Club.*
- Page 8, line 15. *For Herbarium read Herbarium.*
- Page 9, line 24. *For Hereptology read Herpetology.*
- Page 17, line 10. *For were read was.*
- Page 20, line 31. *For McGown read McKown.*
- Page 29, line 39. *After Milwaukee place a comma instead of a period.*
- Page 37, line 5. *Before including insert not.*
- Page 59, line 28. *For Eucalytus read Eucalyptus.*
- Page 64, line 18. *For Canadiene read Canadien.*
- Page 67, line 18. *For L. Hageboeck read A. Hageboeck.*
- Page 81, line 16. *For Vereinde read Verein.*
- Page 93, fig. 9. *The black spot near the southwest corner of Grave B is to represent the Copper Axe No. 21, mentioned on Page 96. The references have been inadvertently omitted both here and in Fig. 8.*
- Page 106, line 30. *For Phœnecean read Phœnician.*
- Page 128, line 1. *For W. G. Gunning read W. D. Gunning.*
- Page 128, line 3. *For Socilito read Sauzalito.*
- Page 128, line 5. *For Hawkens read Hawkins.*
- Page 128, line 12. *For Ingersoll read Ingersoll.*
- Page 128, line 39. *For Forman read Foreman.*
- Page 128, line 46. *For Green read Greene.*
-

The publication of this number has been delayed in order to obtain suitable illustrations of the Inscribed Tablets. These have been prepared by Mr. E. Bierstadt, of New York, under the direction of Prof. Spencer F. Baird, of the Smithsonian Institution, and will be found quite satisfactory. It should be mentioned that the photographs were obtained by throwing a light obliquely across the stones from above. This has caused the horizontal lines to appear heavier than the vertical lines, which is not the case in the originals. Plates I and II represent the opposite sides of the larger tablet, and are about two-fifths of the natural size. Plate III is about one-half the natural size.

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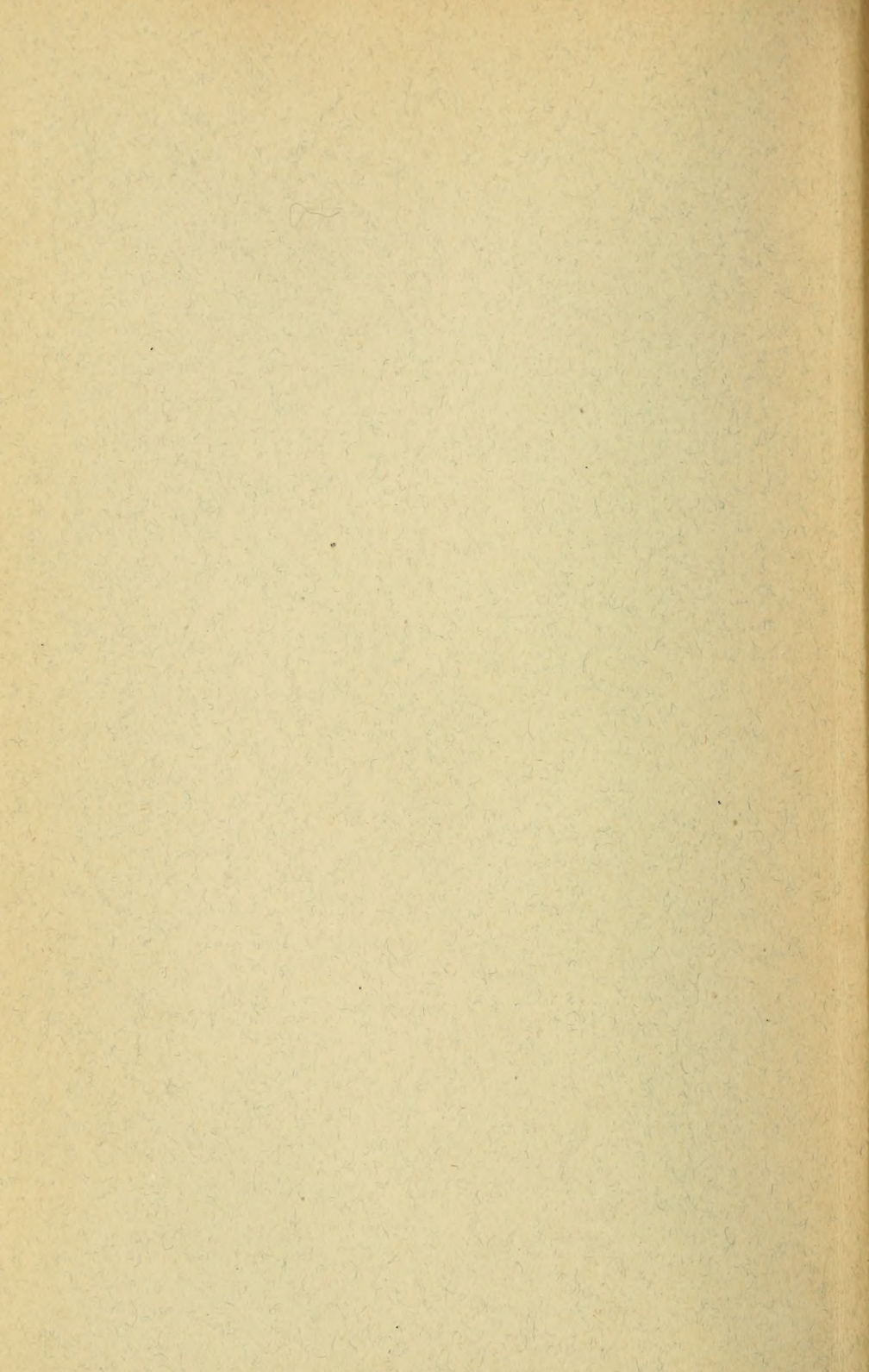
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