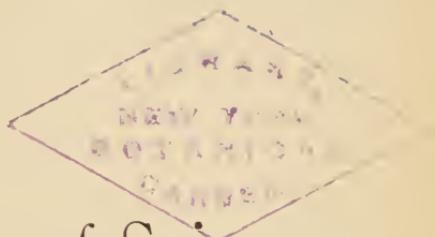


PROCEEDINGS

OF THE



Indiana Academy of Science

1897.

EDITOR, - - C. A. WALDO.

ASSOCIATE EDITORS:

J. C. ARTHUR, W. A. NOYES, C. H. EIGENMANN, A. W. DUFF,
V. F. MARSTERS, A. W. BUTLER, W. S. BLATCHLEY.

INDIANAPOLIS, IND.
1898.

AP
1888

INDIANAPOLIS:
W. M. B. BURFORD, PRINTER,
1898.

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AN ACT TO PROVIDE FOR THE PUBLICATION OF THE REPORTS AND PAPERS OF
THE INDIANA ACADEMY OF SCIENCE.

[Approved March 11, 1895.]

WHEREAS, The Indiana Academy of Science, a chartered
Preamble. scientific association, has embodied in its constitution a provision that it will, upon the request of the Governor, or of the several departments of the State government, through the Governor, and through its council as an advisory body, assist in the direction and execution of any investigation within its province, without pecuniary gain to the Academy, provided only that the necessary expenses of such investigation are borne by the State, and,

WHEREAS, The reports of the meetings of said Academy, with the several papers read before it, have very great educational, industrial and economic value, and should be preserved in permanent form, and,

WHEREAS, The Constitution of the State makes it the duty of the General Assembly to encourage by all suitable means intellectual, scientific and agricultural improvement, therefore,

SECTION 1. *Be it enacted by the General Assembly of the*
Publication of the reports of the Indiana Academy of Science. *State of Indiana,* That hereafter the annual reports of the meetings of the Indiana Academy of Science, beginning with the report for the year 1894, including all papers of scientific or economic value, presented at such meetings, after they shall have been edited and prepared for publication as hereinafter provided, shall be published by and under the direction of the Commissioners of Public Printing and Binding.

SEC. 2. Said reports shall be edited and prepared for publication without expense to the State, by a corps of editors to be selected and appointed by the Indiana Academy of Science, who shall not, by reason of such services, have any claim against the State for compensation. The form, style of binding, paper, typography and manner and extent of illustration of such reports, shall be determined by the editors, subject to the approval of the Commissioners of Public Printing and Stationery. Not less than 1,500 nor more than 3,000 copies of each of said reports shall be published, the size of the edition within said limits, to be determined by the

Editing reports.

Number of printed reports.

concurrent action of the editors and the Commissioners of Public Printing and Stationery: *Provided*, That not to exceed six hundred dollars (\$600) shall be expended for such publication in any one year, and not to extend beyond 1896: *Provided*, That no sums shall be deemed to be appropriated for the year 1894. Proviso.

SEC. 3. All except three hundred copies of each volume of said reports shall be placed in the custody of the State Librarian, who shall furnish one copy thereof to each public library in the State, one copy to each university, college or normal school in the State, one copy to each high school in the State having a library, which shall make application therefor, and one copy to such other institutions, societies or persons as may be designated by the Academy through its editors or its council. The remaining three hundred copies shall be turned over to the Academy to be disposed of as it may determine. In order to provide for the preservation of the same it shall be the duty of the Custodian of the State House to provide and place at the disposal of the Academy one of the unoccupied rooms of the State House, to be designated as the office of the Indiana Academy of Science, wherein said copies of said reports belonging to the Academy, together with the original manuscripts, drawings, etc., thereof can be safely kept, and he shall also equip the same with the necessary shelving and furniture. Disposition of reports.

SEC. 4. An emergency is hereby declared to exist for the immediate taking effect of this act, and it shall therefore take effect and be in force from and after its passage. Emergency.

AN ACT FOR THE PROTECTION OF BIRDS, THEIR NESTS AND EGGS.

[Approved March 5, 1891.]

SECTION 1. *Be it enacted by the General Assembly of the State of Indiana*, That it shall be unlawful for any person to kill any wild bird other than a game bird, or purchase, offer for sale any such wild bird after it has been killed, or to destroy the nests or the eggs of any wild bird. Birds.

SEC. 2. For the purpose of this act the following shall be considered game birds: the Anatidæ, commonly called swans, geese, brant, and river and sea ducks; the Rallidæ, commonly known as rails, coots, mudhens, and gallinules; the Limicolæ, commonly Game Birds.

known as shore birds, plovers, surf birds, snipe, woodcock and sand-pipers, tattlers and curlews; the Gallinae, commonly known as wild turkeys, grouse, prairie chickens, quail, and pheasants, all of which are not intended to be affected by this act.

Penalty. SEC. 3. Any person violating the provisions of Section 1 of this act shall, upon conviction, be fined in a sum not less than ten nor more than fifty dollars, to which may be added imprisonment for not less than five days nor more than thirty days.

Permits. SEC. 4. Sections 1 and 2 of this act shall not apply to any person holding a permit giving the right to take birds or their nests and eggs for scientific purposes, as provided in Section 5 of this act.

Permits to Science. SEC. 5. Permits may be granted by the Executive Board of the Indiana Academy of Science to any properly accredited person, permitting the holder thereof to collect birds, their nests or eggs for strictly scientific purposes. In order to obtain such permit the applicant for the same must present to said Board written testimonials from two well known scientific men certifying to the good character and fitness of said applicant to be entrusted with such privilege and pay to said Board one dollar to defray the necessary expenses attending the granting of such permit, and must file with said Board a properly executed bond in the sum of two hundred dollars, signed by at least two responsible citizens of the State as sureties. The bond shall be forfeited to the State and the permit become void upon proof that the holder of such permit has killed any bird or taken the nests or eggs of any bird for any other purpose than that named in this section and shall further be subject for each offense to the penalties provided in this act.

Bond. SEC. 6. The permits authorized by this act shall be in force for two years only from the date of their issue, and shall not be transferable.

Birds of prey. SEC. 7. The English or European house sparrow (passer domesticus), crows, hawks, and other birds of prey are not included among the birds protected by this act.

Acts repealed. SEC. 8. All acts or parts of acts heretofore passed in conflict with the provisions of this act are hereby repealed.

Emergency. SEC. 9. An emergency is declared to exist for the immediate taking effect of this act, therefore the same shall be in force and effect from and after its passage.

OFFICERS, 1897-98.

PRESIDENT,

C. A. WALDO.

VICE-PRESIDENT,

CARL H. EIGENMANN.

SECRETARY,

JOHN S. WRIGHT.

ASSISTANT SECRETARY,

A. J. BIGNEY.

PRESS SECRETARY,

GEO. W. BENTON.

TREASURER,

J. T. SCOVELL.

EXECUTIVE COMMITTEE.

C. A. WALDO,	THOMAS GRAY,	O. P. HAY,
C. H. EIGENMANN,	STANLEY COULTER,	T. C. MENDENHALL,
JOHN S. WRIGHT,	AMOS W. BUTLER,	JOHN C. BRANNER,
A. J. BIGNEY,	W. A. NOYES,	J. P. D. JOHN,
G. W. BENTON,	J. C. ARTHUR,	JOHN M. COULTER,
J. T. SCOVELL,	J. L. CAMPBELL,	DAVID S. JORDAN.

CURATORS.

BOTANY	J. C. ARTHUR.
ICHTHYOLOGY	C. H. EIGENMANN.
HERPETOLOGY }	AMOS W. BUTLER.
MAMMALOLOGY }	
ORNITHOLOGY }	
ENTOMOLOGY	W. S. BLATCHLEY.

COMMITTEES, 1897-98.

PROGRAM.

D. W. DENNIS,

A. J. BIGNEY.

MEMBERSHIP.

R. ELLSWORTH CALL,

D. W. DENNIS,

C. R. DRYER.

NOMINATIONS.

W. S. BLATCHLEY,

W. A. NOYES,

W. E. STONE.

AUDITING.

GEO. L. ROBERTS,

R. ELLSWORTH CALL.

STATE LIBRARY.

C. A. WALDO,

W. A. NOYES,

A. W. BUTLER.

A. W. DUFF,

J. S. WRIGHT.

LEGISLATION FOR THE RESTRICTION OF WEEDS.

J. C. ARTHUR,

STANLEY COULTER,

J. S. WRIGHT.

PROPAGATION AND PROTECTION OF GAME AND FISH.

C. H. EIGENMANN,

A. W. BUTLER,

W. S. BLATCHLEY.

EDITOR.

C. A. WALDO.

DIRECTORS OF BIOLOGICAL SURVEY.

C. H. EIGENMANN,

V. F. MARSTERS,

J. C. ARTHUR.

RELATIONS OF THE ACADEMY TO THE STATE.

C. A. WALDO,

A. W. BUTLER,

C. H. EIGENMANN.

GRANTING PERMITS FOR COLLECTING BIRDS.

A. W. BUTLER,

C. H. EIGENMANN,

W. S. BLATCHLEY.

DISTRIBUTION OF THE PROCEEDINGS.

A. W. BUTLER,

W. A. NOYES,

C. A. WALDO.

C. H. EIGENMANN,

V. F. MARSTERS,

J. S. WRIGHT

OFFICERS OF THE INDIANA ACADEMY OF SCIENCE.

	PRESIDENT.	SECRETARY.	ASST. SECRETARY.	PRESS SECRETARY.	TREASURER.
1885-6	David S. Jordan.	Amos W. Butler.	.....	.....	O. P. Jenkins.
1886-7	John M. Coulter.	Amos W. Butler.	.....	.....	O. P. Jenkins.
1887-8	J. P. D. John.	Amos W. Butler.	.....	.....	O. P. Jenkins.
1888-9	John C. Branner.	Amos W. Butler.	.....	.....	O. P. Jenkins.
1889-90	T. C. Mendenhall.	Amos W. Butler.	.....	.....	O. P. Jenkins.
1890-1	O. P. Hay.	Amos W. Butler.	.....	.....	O. P. Jenkins.
1891-2	J. L. Campbell.	Amos W. Butler.	.....	.....	C. A. Waldo.
1892-3	J. C. Arthur.	Amos W. Butler.	{ Stanley Coulter. W. W. Norman.	.....	C. A. Waldo.
1893-4	W. A. Noyes.	C. A. Waldo.	W. W. Norman.	.....	W. P. Shannon.
1894-5	A. W. Butler.	John S. Wright.	A. J. Bigney.	.....	W. P. Shannon.
1895-6	Stanley Coulter.	John S. Wright.	A. J. Bigney.	.....	W. P. Shannon.
1896-7	Thomas Gray.	John S. Wright.	A. J. Bigney.	.....	W. P. Shannon.
1897-8	C. A. Waldo.	John S. Wright.	A. J. Bigney.	Geo. W. Benton.	{ W. P. Shannon. J. T. Scovell.

CONSTITUTION.

ARTICLE I.

SECTION 1. This association shall be called the Indiana Academy of Science.

SEC. 2. The objects of this Academy shall be scientific research and the diffusion of knowledge concerning the various departments of science; to promote intercourse between men engaged in scientific work, especially in Indiana; to assist by investigation and discussion in developing and making known the material, educational and other resources and riches of the State; to arrange and prepare for publication such reports of investigation and discussions as may further the aims and objects of the Academy as set forth in these articles.

Whereas, the State has undertaken the publication of such proceedings, the Academy will, upon request of the Governor, or of one of the several departments of the State, through the Governor, act through its council as an advisory body in the direction and execution of any investigation within its province as stated. The necessary expenses incurred in the prosecution of such investigation are to be borne by the State; no pecuniary gain is to come to the Academy for its advice or direction of such investigation.

The regular proceedings of the Academy as published by the State shall become a public document.

ARTICLE II.

SECTION 1. Members of this Academy shall be honorary fellows, fellows, non-resident members or active members.

SEC. 2. Any person engaged in any department of scientific work, or in original research in any department of science, shall be eligible to active membership. Active members may be annual or life members. Annual members may be elected at any meeting of the Academy; they shall sign the constitution, pay an admission fee of two dollars, and thereafter an annual fee of one dollar. Any person who shall at one time

contribute fifty dollars to the funds of this Academy, may be elected a life member of the Academy, free of assessment. Non-resident members may be elected from those who have been active members but who have removed from the State. In any case, a three-fourths vote of the members present shall elect to membership. Applications for membership in any of the foregoing classes shall be referred to a committee on application for membership, who shall consider such application and report to the Academy before the election.

SEC. 3. The members who are actively engaged in scientific work, who have recognized standing as scientific men and who have been members of the Academy at least one year, may be recommended for nomination for election as fellows by three fellows or members personally acquainted with their work and character. Of members so nominated a number not exceeding five in one year may, on recommendation of the Executive Committee, be elected as fellows. At the meeting at which this is adopted, the members of the Executive Committee for 1894 and fifteen others shall be elected fellows, and those now honorary members shall become honorary fellows. Honorary fellows may be elected on account of special prominence in science, on the written recommendation of two members of the Academy. In any case a three-fourths vote of the members present shall elect.

ARTICLE III.

SECTION 1. The officers of this Academy shall be chosen by ballot at the annual meeting, and shall hold office one year. They shall consist of a president, vice-president, secretary, assistant secretary, press secretary, and treasurer, who shall perform the duties usually pertaining to their respective offices and in addition, with the ex-presidents of the Academy, shall constitute an executive committee. The president shall, at each annual meeting appoint two members to be a committee which shall prepare the programmes and have charge of the arrangements for all meetings for one year.

SEC. 2. The annual meeting of this Academy shall be held in the city of Indianapolis within the week following Christmas of each year, unless otherwise ordered by the executive committee. There shall also be a summer meeting at such time and place as may be decided upon by the executive committee. Other meetings may be called at the discretion of the executive committee. The past presidents, together with the

officers and executive committee, shall constitute the Council of the Academy, and represent it in the transaction of any necessary business not specially provided for in this constitution, in the interim between general meetings.

SEC. 3. This constitution may be altered or amended at any annual meeting by a three-fourths majority of attending members of at least one year's standing. No question of amendment shall be decided on the day of its presentation.

BY-LAWS.

1. On motion any special department of science shall be assigned to a curator, whose duty it shall be, with the assistance of the other members interested in the same department, to endeavor to advance knowledge in that particular department. Each curator shall report at such time and place as the Academy shall direct. These reports shall include a brief summary of the progress of the department during the year preceding the presentation of the report.

2. The president shall deliver a public address on the evening of one of the days of the meeting at the expiration of his term of office.

3. The press secretary shall attend to securing proper newspaper reports of the meetings and assist the secretary.

4. No special meeting of the Academy shall be held without a notice of the same having been sent to the address of each member at least fifteen days before such meeting.

5. No bill against the Academy shall be paid without an order signed by the president and countersigned by the secretary.

6. Members who shall allow their dues to remain unpaid for two years, having been annually notified of their arrearage by the treasurer, shall have their names stricken from the roll.

7. Ten members shall constitute a quorum for the transaction of business.

MEMBERS.

FELLOWS.

J. C. Arthur	*1893	Lafayette.
P. S. Baker	1893	Greencastle.
George W. Benton	1896	Indianapolis.
A. J. Bigney	1897	Moore's Hill.
A. W. Bitting	1897	Lafayette.
W. S. Blatchley	1893	Indianapolis.
J. C. Branner	1893	Stanford University, Cal.
Wm. Lowe Bryan	1895	Bloomington.
A. W. Butler	1893	Indianapolis.
R. E. Call	1894	Lawrenceburg.
J. L. Campbell	1893	Crawfordsville.
John M. Coptler	1893	Chicago, Ill.
Stanley Coulter	1893	Lafayette.
D. W. Dennis	1895	Richmond.
C. R. Dryer	1897	Terre Haute.
A. Wilmer Duff	1896	Lafayette.
C. H. Eigenmann	1893	Bloomington.
A. L. Foley	1897	Bloomington.
Katherine E. Golden	1895	Lafayette.
W. F. M. Goss	1893	Lafayette.
Thos. Gray	1893	Terre Haute.
A. S. Hathaway	1895	Terre Haute.
O. P. Hay	1893	Washington, D. C.
H. A. Huston	1893	Lafayette.
J. P. D. John	1893	Greencastle.
D. S. Jordan	1893	Stanford University, Cal.
Robert E. Lyons	1896	Bloomington.
V. F. Marsters	1893	Bloomington.
C. L. Mees	1894	Terre Haute.
T. C. Mendenhall	1893	Worcester, Mass.

*Date of election.

Joseph Moore	.....*	1896	.....	Richmond.
D. M. Mottier	.....	1893	.....	Bloomington.
W. A. Noyes	.....	1893	.....	Terre Haute.
L. J. Rettger	.....	1896	.....	Terre Haute.
J. T. Scovell	.....	1894	.....	Terre Haute.
†W. P. Shannon	.....	1893	.....	Greensburg.
Alex. Smith	.....	1893	.....	Chicago, Ill.
W. E. Stone	.....	1893	.....	Lafayette.
M. B. Thomas	.....	1893	.....	Crawfordsville.
L. M. Underwood	.....	1893	.....	New York City.
T. C. Van Nuys	.....	1893	.....	Bloomington.
C. A. Waldo	.....	1893	.....	Lafayette.
F. M. Webster	.....	1894	.....	Wooster, O.
H. W. Wiley	.....	1895	.....	Washington, D. C.
John S. Wright	.....	1894	.....	Indianapolis.

NON-RESIDENT MEMBERS.

D. H. Campbell	.....	Stanford University, Cal.
B. W. Evermann	.....	Washington, D. C.
Charles H. Gilbert	.....	Stanford University, Cal.
C. W. Green	.....	Stanford University, Cal.
C. W. Hargitt	.....	Syracure, N. Y.
Edward Hughes	.....	Stockton, Cal.
O. P. Jenkins	.....	Stanford University, Cal.
J. S. Kingsley	.....	Tufts College, Mass.
Alfred Springer	.....	Cincinnati, O.
Robert B. Warder	.....	Washington, D. C.
Ernest Walker	.....	Clemson College, S. C.

ACTIVE MEMBERS.

Frederick W. Andrews	.....	Bloomington.
R. J. Aley	.....	Bloomington.
George H. Ashley	.....	Indianapolis.
Timothy H. Ball	.....	Crown Point.

* Date of election.

† Deceased, December 16, 1897.

C. L. Barnes	Indianapolis.
J. A. Bergstrom	Bloomington.
Alexander Black	Greencastle.
Edwin M. Blake	Lafayette.
Lee F. Bennett	Valparaiso.
Donaldson Bodine	Crawfordsville.
M. A. Brannon	Grand Forks, N. D.
Frank P. Bronson	Indianapolis.
Charles C. Brown	Indianapolis.
H. L. Bruner	Irvington.
A. Hugh Bryan	Indianapolis.
Severance Burrage	Lafayette.
J. B. Burris	Cloverdale.
Noble C. Butler	Indianapolis.
Ada C. Campbell	South Bend.
J. T. Campbell	Rockville.
E. J. Chansler	Bicknell.
Fred. M. Chamberlain	Bloomington.
Walter W. Chipman	Warsaw.
J. Fred Clearwaters	Indianola, Ill.
George Clements	Crawfordsville.
H. J. Clements	Washington.
Charles Clickener	Tangier.
U. O. Cox	Mankato, Minn.
Albert B. Crowe	Ft. Wayne.
M. E. Crowell	Indianapolis.
Glenn Culbertson*	Hanover.
Will Cumback	Greensburg.
Alida M. Cunningham	Lafayette.
H. S. Cunningham	Indianapolis.
*George L. Curtiss	Columbus.
B. M. Davis	Los Angeles, Cal.
Martha Doan	Westfield.
J. P. Dolan	Syracuse.
Joseph Eastman	Indianapolis.
E. G. Eberhardt	Indianapolis.

* Deceased, March 31, 1898.

M. N. Elrod	Columbus.
F. L. Emory	Morgantown, W. Va.
Percy Norton Evans	Lafayette.
Samuel G. Evans	Evansville.
Carlton G. Ferris	Big Rapids, Mich.
E. M. Fisher	Urneyville.
J. J. Flather	Lafayette.
J. R. Francis	Indianapolis.
Austin Funk	Bloomington.
J. B. Garner	Crawfordsville.
Robert G. Gillum	Terre Haute.
U. F. Glick	Newbern.
Michael J. Golden	Lafayette.
W. E. Goldsborough	Lafayette.
S. S. Gorby	Franklin.
Vernon Gould	Rochester.
J. C. Gregg	Brazil.
Alden H. Hadley	Melbourne, Fla.
Wm. Perry Hay	Washington, D. C.
Franklin W. Hays	Indianapolis.
E. H. Heacock	Topeka, Kas.
Chas. A. Helvie	Chicago.
Flora Herr	Bloomington.
Robert Hessler	Indianapolis.
J. A. Hill	
T. E. Hibben	Indianapolis.
J. W. Hubbard	Bloomington.
Lucius M. Hubbard	South Bend.
Alex. Jameson	Indianapolis.
A. E. Jeessup	Carmel.
Sylvester Johnson	Irvington.
W. B. Johnson	Franklin.
Chancey Juday	Bloomington.
William J. Karlake	Irvington.
D. S. Kelley	Jeffersonville.
O. L. Kelso	Terre Haute.
Arthur Kendrick	Terre Haute.
E. M. Kindle	Bloomington.

Ph. Kirsch.....	Columbia City.
Charles T. Knipp.....	Bloomington.
Thomas Large.....	Evansville.
Daniel Layman	Indianapolis.
John Levering	Lafayette.
V. H. Lockwood	Indianapolis.
William A. Macbeth.....	Terre Haute.
Cora March	Lawrenceburg.
Herbert W. McBride	Indianapolis.
Robert Wesley McBride	Indianapolis.
Kate McCarthy	Wabash.
Rousseau McClellan	Bloomington.
D. T. McDougal.....	Minneapolis, Minn.
J. W. Marsee	Indianapolis.
G. W. Martin.....	Indianapolis.
Julius B. Meyer.....	Lafayette.
O. M. Meyneke	Brookville.
Franklin S. Miller.....	Brookville.
John A. Miller.....	Bloomington.
W. J. Moenkhaus	San Paulo, Brazil.
G. T. Moore	Cambridge, Mass.
J. P. Naylor	Greencastle.
Charles E. Newlin.....	Irvington.
John F. Newsom	Elizabethtown.
E. W. Olive.....	Indianapolis.
J. H. Oliver	Indianapolis.
D. A. Owen.....	Franklin.
Rollo J. Peirce.....	
W. H. Peirce	Chicago, Ill.
*Elwood Pleas	Dunreith.
James A. Price.....	Bloomfield.
Frank A. Preston	Indianapolis.
A. H. Purdue.....	Fayetteville, Ark.
Ryland Ratliff	Fairmount.
H. G. Reddick.....	Bloomington.
Bessie C. Ridgley.....	South Bend.

* Deceased, December 30, 1897.

D. C. Ridgley.....	Chicago, Ill.
Curtis A. Rinson	Bloomington.
George L. Roberts.....	Greensburg.
Adolph Rodgers.....	New Castle.
John F. Schnaible.....	Lafayette.
C. E. Schafer	Huntington.
E. A. Schultze	Ft. Wayne.
Howard Schurmann	Indianapolis.
John W. Shepherd	Terre Haute.
Claude Siebenthal.....	Bloomington.
G. W. Sloan	Indianapolis.
J. R. Slonaker	Bloomington.
Richard A. Smart	Lafayette.
Harold B. Smith	Worcester, Mass.
Theo. W. Smith.....	Indianapolis.
Lillian Snyder	Lafayette.
F. P. Stauffer	Logansport.
M. C. Stevens	Lafayette.
H. M. Stoops	Brookville.
Joseph Swain	Bloomington.
William Stewart	Lafayette.
George A. Talbert.	West Superior, Wis.
Frank B. Taylor	Ft. Wayne.
S. N. Taylor	West Lafayette.
Erastus Test	Lafayette.
F. C. Test	Chicago, Ill.
J. F. Thompson.....	Richmond.
William M. Thrasher.....	Irvington.
A. L. Treadwell.....	Oxford, Ohio.
Daniel J. Troyer	Goshen.
W. P. Turner.....	Lafayette.
A. B. Ulrey.....	North Manchester.
W. B. Van Gorder	Knightstown.
Arthur C. Veatch	Rockport.
H. S. Voorhees	Brookville.
J. H. Voris	Bloomington.
F. A. Walker	Anderson.
W. O. Wallace.....	Wabash.

Fred C. Whitcomb.....	Delphi.
William M. Whitten	South Bend.
J. R. Wiest	Richmond.
Mae Woldt	Irvington.
W. L. Wood	Covington.
William Watson Woollen.....	Indianapolis.
A. J. Woolman	Duluth, Minn.
J. F. Woolsey.....	Indianapolis.
P. A. Yoder	Vincennes.
A. C. Yoder	Vincennes.
O. B. Zell.....	Clinton.

Fellows.....	44
Non-resident members	11
Active members.....	160
Total.....	<u>215</u>
Deaths	3

In Memoriam.

WILLIAM POLLOCK SHANNON,

(Treasurer of the Indiana Academy of Science,
1893 to 1897.)

Died, Greensburg, Indiana, December Sixteenth, 1897.

In Memoriam.

GEORGE LEWIS CURTISS,

Died, Naples, Italy, March Thirty-first, 1898.

In Memoriam.

ELWOOD PLEAS,

Died, Dunreith, December Thirtieth, 1897.

LIST OF FOREIGN CORRESPONDENTS.

AFRICA.

Dr. J. Medley Wood, Natal Botanical Gardens, Berea Durban, South Africa.

South African Philosophical Society, Cape Town, South Africa.

ASIA.

China Branch Royal Asiatic Society, Shanghai, China.

Asiatic Society of Bengal, Calcutta, India.

Geological Survey of India, Calcutta, India.

Indian Museum of India, Calcutta, India.

India Survey Department of India, Calcutta, India.

Deutsche Gesellschaft für Natur und Volkerkunde Ostasiens, Tokio, Japan.

Imperial University, Tokio, Japan.

Koninklijke Naturkundige Vereeniging in Nederlandsch-Indie, Batavia, Java.

Hon. D. D. Baldwin, Honolulu, Hawaiian Islands.

EUROPE.

V. R. Tschusizu Schmidhoffen, Villa Tannenhof, Halle in Salzburg, Austria.

Herman von Vilas, Innsbruck, Austria.

Ethnologische Mittheilungen aus Ungarn, Budapest, Austro-Hungary.

Mathematische und Naturwissenschaftliche Berichte aus Ungarn, Budapest, Austro-Hungary.

K. K. Geologischen Reichsanstalt, Vienna (Wien), Austro-Hungary.

K. U. Naturwissenschaftliche Gesellschaft, Budapest, Austro-Hungary.

Naturwissenschaftlich-Medizinischer Verein in Innsbruck (Tyrol), Austro-Hungary.

Editors "Termeszetráji Füzetk," Hungarian National Museum, Budapest, Austro-Hungary.

Dr. Eugen Dadaí, Adj. am Nat. Mus., Budapest, Austro-Hungary.

Dr. Julius von Madarasz, Budapest, Austro-Hungary.

K. K. Naturhistorisches Hofmuseum, Vienna (Wien), Austro-Hungary.

Ornithological Society of Vienna (Wien), Austro-Hungary.

Zoölogische-Botanische Gesellschaft in Wien, Wien, Austro-Hungary.

Dr. J. von Csato, Nagy Enyed, Austro-Hungary.

Malacological Society of Belgium, Brussels, Belgium.

Royal Academy of Science, Letters and Fine Arts, Brussels, Belgium.

Royal Linnean Society, Brussels, Belgium.

Société Belge de Géologie, de Palaeontologie et Hydrologie, Brussels, Belgium.

Société Royale de Botanique, Brussels, Belgium.

Société Géologique de Belgique, Liège, Belgium.

Prof. Christian Frederick Lutken, Copenhagen, Denmark.

Bristol Naturalists' Society, Bristol, England.

Geological Society of London, London, England.

Linnean Society of London, London, England.

Liverpool Geological Society, Liverpool, England.

Manchester Literary and Philosophical Society, Manchester, England.

"Nature," London, England.

Royal Botanical Society, London, England.

Royal Geological Society of Cornwall, Penzance, England.

Royal Microscopical Society, London, England.

Zoölogical Society, London, England.

Lieut.-Col. John Biddulph, 43 Charing Cross, London, England.

Dr. G. A. Boulenger, British Mus. (Nat. Hist.), London, England.

F. DuCane Godman, 10 Chandos St., Cavendish Sq., London, England.

Hon. E. L. Layard, Budleigh Salterton, Devonshire, England.

Mr. Osbert Salvin, Hawksfold, Fernhurst, Haslemere, England.

Mr. Howard Saunders, 7 Radnor Place, Hyde Park, London W., England.

Phillip L. Sclater, 3 Hanover Sq., London W., England.

Dr. Richard Bowlder Sharpe, British Mus. (Nat. His.), London, England.
 Prof. Alfred Russell Wallace, Corfe View, Parkstone, Dorset, England.

Botanical Society of France, Paris, France.
 Ministère de l'Agriculture, Paris, France.
 Société Entomologique de France, Paris, France.
 L'Institut Grand Ducal de Luxembourg, Luxembourg, Lux, France.
 Soc. de Horticulture et de Botan. de Marseille, Marseilles, France.
 Société Linneenne de Bordeaux, Bordeaux, France.
 La Soc. Linneenne de Normandie, Caen, France.
 Soc. des Naturelles, etc., Nantes, France.
 Zoölogical Society of France, Paris, France.
 Baron Louis d' Hamonville, Meurthe et Moselle, France.
 Prof. Alphonse Milne-Edwards, Rue Cuvier, 57, Paris, France.

Botanischer Verein der Provinz Brandenburg, Berlin, Germany.
 Deutsche Geologische Gesellschaft, Berlin, Germany.
 Entomologischer Verein in Berlin, Berlin, Germany.
 Journal für Ornithologie, Berlin, Germany.
 Prof. Dr. Jean Cabanis, Alte Jacob Strasse, 103 A., Berlin, Germany.
 Augsburger Naturhistorischer Verein, Augsburg, Germany.
 Count Hans von Berlepsen, Münden, Germany.
 Braunschweiger Verein für Naturwissenschaft, Braunschweig, Germany.
 Bremer Naturwissenschaftlicher Verein, Bremen, Germany.
 Kaiserliche Leopoldische-Carolinische Deutsche Akademie der Naturfor-
 cher, Halle, Saxony, Germany.
 Königlich-Sächsische Gesellschaft der Wissenschaften, Mathematische-
 Physische Classe, Leipzig, Saxony, Germany.
 Naturhistorische Gesellschaft zu Hanover, Hanover, Prussia, Germany.
 Naturwissenschaftlicher Verein in Hamburg, Hamburg, Germany.
 Verein für Erdkunde, Leipzig, Germany.
 Verein für Naturkunde, Weisbaden, Prussia.

Belfast Natural History and Philosophical Society, Belfast, Ireland.
 Royal Dublin Society, Dublin.

Societa Entomologica Italiana, Florence, Italy.
 Prof. H. H. Giglioli, Museum Vertebrate Zoölogy, Florence, Italy.
 Dr. Alberto Perngia, Museo Civico di Storia Naturale, Genoa, Italy.
 Societa Italiana de Scienze Naturali, Milan, Italy.
 Societa Africana d' Italia, Naples, Italy.
 Dell 'Academia Pontificio de Nuovi Lincei, Rome, Italy.
 Minister of Agriculture, Industry and Commerce, Rome, Italy.
 Rassegna della Scienze Geologiche in Italia, Rome, Italy.
 R. Comitato Geologico d' Italia, Rome, Italy.
 Prof. Count. Tomasso Salvadori, Zoölog. Museum, Turin, Italy.

Royal Norwegian Society of Sciences, Thronhjelm, Norway.
 Dr. Robert Collett, Kongl. Frederiks Univ., Christiania, Norway.

Academia Real des Sciencias de Lisboa (Lisbon), Portugal.

Comité Geologique de Russie, St. Petersburg, Russia.
 Imperial Academy of Sciences, St. Petersburg, Russia.
 Imperial Society of Naturalists, Moscow, Russia.

The Botanical Society of Edinburgh, Edinburgh, Scotland.
 John J. Dalgleish, Brankston Grange, Bogside Sta., Sterling, Scotland.
 Edinburgh Geological Society, Edinburgh, Scotland.
 Geological Society of Glasgow, Scotland.
 John A. Harvie-Brown, Duniplace House, Larbert, Stirlingshire, Scotland.
 Natural History Society, Glasgow, Scotland.
 Philosophical Society of Glasgow, Glasgow, Scotland.
 Royal Society of Edinburgh, Edinburgh, Scotland.
 Royal Physical Society, Edinburgh, Scotland.

Barcelona Academia de Ciencias y Artes, Barcelona, Spain.
 Royal Academy of Sciences, Madrid, Spain.
 Institut Royal Geologique de Suède, Stockholm, Sweden.
 Societé Entomologique à Stockholm, Stockholm, Sweden.
 Royal Swedish Academy of Science, Stockholm, Sweden.

Naturforschende Gesellschaft, Basel, Switzerland.
 Naturforschende Gesellschaft in Berne, Berne, Switzerland.
 La Societ  Botanique Suisse, Geneva, Switzerland.
 Societ  Helveticque de Sciences Naturelles, Geneva, Switzerland.
 Societ  de Physique et d' Historie Naturelle de Geneva, Geneva, Switzerland.
 Concilium Bibliographicum, Z rich-Oberstrasse, Switzerland.
 Naturforschende Gesellschaft, Z rich, Switzerland.
 Schweizerische Botanische Gesellschaft, Z rich, Switzerland.
 Prof. Herbert H. Field, Z rich, Switzerland.

AUSTRALIA.

Linnean Society of New South Wales, Sidney, New South Wales.
 Royal Society of New South Wales, Sidney, New South Wales.
 Prof. Liveridge, F. R. S., Sidney, New South Wales.
 Hon. Minister of Mines, Sidney, New South Wales.
 Mr. E. P. Ramsey, Sidney, New South Wales.
 Royal Society of Queensland, Brisbane, Queensland.
 Royal Society of South Australia, Adelaide, South Australia.
 Victoria Pub. Library, Museum and Nat. Gallery, Melbourne, Victoria.
 Prof. W. L. Buller, Wellington, New Zealand.

NORTH AMERICA.

Natural Hist. Society of British Columbia, Victoria, British Columbia.
 Canadian Record of Science, Montreal, Canada.
 McGill University, Montreal, Canada.
 Natural Society, Montreal, Canada.
 Natural History Society, St. Johns, New Brunswick.
 Nova Scotia Institute of Science, Halifax, N. S.
 Manitoba Historical and Scientific Society, Winnipeg, Manitoba.
 Dr. T. McIlwraith, Cairnbrae, Hamilton, Ontario.
 The Royal Society of Canada, Ottawa, Ontario.
 Natural History Society, Toronto, Ontario.
 Hamilton Association Library, Hamilton, Ontario.
 Canadian Entomologist, Ottawa, Ontario.

Department of Marine and Fisheries, Ottawa, Ontario.
 Ontario Agricultural College, Guelph, Ontario.
 Canadian Institute, Toronto.
 Ottawa Field Naturalists' Club, Ottawa, Ontario.
 University of Toronto, Toronto.
 Geological Survey of Canada, Ottawa, Ontario.
 La Naturaliste Canadian, Chicoutini, Quebec.
 La Naturelle Za, City of Mexico.
 Mexican Society of Natural History, City of Mexico.
 Museo Nacional, City of Mexico.
 Sociedad Científica Antonio Alzate, City of Mexico.
 Sociedad Mexicana de Geographia y Estadística de la República Mexicana, City of Mexico.

WEST INDIES.

Victoria Institute, Trinidad, British West Indies.
 Museo Nacional, San Jose, Costa Rica, Central America.
 Dr. Anastasia Alfaro, Secy. National Museum, San Jose, Costa Rica.
 Rafael Arango, Havana, Cuba.
 Jamaica Institute, Kingston, Jamaica, West Indies.

SOUTH AMERICA.

Argentina Historia Natural Florentine Amegline, Buenos Ayres, Argentine Republic.
 Musée de la Plata, Argentine Republic.
 Nacional Academia des Ciencias, Cordoba, Argentine Republic.
 Sociedad Científica Argentina, Buenos Ayres.

Museo Nacional, Rio de Janeiro, Brazil.
 Sociedad de Geographia, Rio de Janeiro, Brazil.
 Dr. Herman von Jhering, Dir. Zoöl. Sec. Con. Geog. e Geol. de Sao Paulo.
 Rio Grande do Sul, Brazil.
 W. J. Moenkhaus, Museu Paulista, Sao Paulo, Brazil.

Deutscher Wissenschaftlicher Verein in Santiago, Santiago, Chili.
 Societé Scientifique du Chili, Santiago, Chili.
 Sociedad Guatemalteca de Ciencias, Guatemala, Guatemala.

. . . PROGRAM . . .

OF THE

THIRTEENTH ANNUAL MEETING

OF THE

Indiana Academy of Science,

STATE HOUSE, INDIANAPOLIS,

December 29 and 30, 1897.

OFFICERS AND EX-OFFICIO EXECUTIVE COMMITTEE.

THOMAS GRAY, President,	C. A. WALDO, Vice-President,	JOHN S. WRIGHT, Secretary,	
A. J. BIGNEY, Asst. Secretary,		W. P. SHANNON, Treasurer.	
STANLEY COULTER,	AMOS W. BUTLER,	W. A. NOYES,	J. C. ARTHUR,
J. L. CAMPBELL,	O. P. HAY,	T. C. MENDENHALL,	JOHN C. BRANNER,
J. P. D. JOHN,	JOHN M. COULTER,	DAVID S. JORDAN.	

The sessions of the Academy will be held in the State House in the rooms of the State Board of Agriculture.

Headquarters will be at the Bates House. A rate of \$2.00 and up per day will be made to all persons who make it known at the time of registering that they are members of the Academy.

Reduced railroad rates for the members can not be obtained under the present rulings of the Traffic Association. Many of the colleges can secure special rates on the various roads. Those who can not do this could join the State Teachers' Association and thus secure the one and one-third round trip fare accorded to them.

W. P. SHANNON,
R. E. LYONS,
Committee.

GENERAL PROGRAM.

TUESDAY, DECEMBER 28.

Meeting of Executive Committee at the Hotel Headquarters 8 p. m.

WEDNESDAY, DECEMBER 29.

General Session 9 a. m. to 12 m.
 Sectional Meetings 2 p. m. to 5 p. m.
 Address by President Thomas Gray 7 p. m.

THURSDAY, DECEMBER 31.

General Session, followed by Sectional Meetings 9 a. m. to 12 m.
 General Session 2 p. m. to 4 p. m.

LIST OF PAPERS TO BE READ.

ADDRESS BY THE RETIRING PRESIDENT,

PROFESSOR THOMAS GRAY,

At 7 o'clock Wednesday evening.

Subject: "The Development of Electrical Science."

The address has been placed at this early hour in order that other engagements for the usual hours of evening entertainment may not keep the members of the Academy and their friends from being present.

The following papers will be read in the order in which they appear on the program except that certain papers will be presented "*pari passu*" in sectional meetings. In order that the labor of presentation may be relieved, papers presented by the same authors have been separated, unless such separation would impair the value of the papers. When a paper is called and the reader is not present it will be dropped to the end of the list, unless by mutual agreement an exchange can be made with another whose time is approximately the same. Where no time was sent with the papers, they have been uniformly assigned ten minutes. Opportunity will be given after the reading of each paper for a brief discussion.

N. B.—By the order of the Academy, no paper can be read until an abstract of its contents or the written paper has been placed in the hands of the Secretary.

GENERAL SUBJECTS.

1. Lake Maxinkuckee soundings, 12 m.....J. T. Scovell.
2. Photometric measurements of different samples of oil, 5 m..
C. T. Knipp.
3. Pure yeast in bread, 10 m.....Miss Katherine Golden.
4. A new laboratory and its work, 6 m.....Robert Hessler.
5. A case of microcephaly, 10 m.....D. W. Dennis.
6. The relation of geography to natural science and education,
15 m.....C. R. Dryer.
7. The Academy as a possible factor in the biological instruction in our secondary schools, 10 m.....L. J. Rettger.
8. Susceptibility of different starches to digestive ferments,
15 m.....W. E. Stone.
9. A new apparatus for photomicroscopy, 10 m.....A. W. Bitting.
Illustrated by photographs.

MATHEMATICAL AND PHYSICAL SUBJECTS.

10. An infinite system of forms, satisfying the requirements of Hilbert's Law, 10 m.....J. A. Miller.
11. Decrease of intensity of shrill sounds with time, 15 m..A. W. Duff.
12. The constant radiation of air, 5 m.....A. W. Duff
13. Preliminary results with an apparatus for the study of impact, 15 m.....A. W. Duff and J. B. Meyer.
14. Variations on the spectrum of the open and closed electric arc, 15 m.....A. L. Foley
15. The spectrum of cyanogen, 10 m.....A. L. Foley.
16. The electrolytic nature of the electric arc, 15 m.....A. L. Foley.
17. Note on Charles Smith's definition of multiplication, 2 m..R. J. Aley.
18. Collinear sets of three points connected with the triangle, 15 m.....R. J. Aley.
- *19. Note on the theorem of Magnus concerning the relation of linear transformation to projection, 10 m.....S. C. Davisson.
20. On the reduction of irrational algebraic integrals, 10 m..J. B. Faught.
- *21. Three proofs of the proposition—"The tangents to a point conic are lines of a line conic," 15 m.....U. S. Hanna.
- *22. Some tests on ball bearings, 10 m.....M. J. Golden.
23. Alternate processes, 15 m.....A. S. Hathaway.
24. A new form of galvanometer, 10 m.....J. Henry Lendi.
25. A relation between elastic limit in flexure and tension..W. K. Hatt.
26. Behavior of wrought iron under compression.....W. K. Hatt.

CHEMICAL AND BACTERIOLOGICAL SUBJECTS.

27. Camphoric acid, 15 m.....W. A. Noyes.
28. Certain combustion products of natural gas, 5 m.....P. N. Evans.
- *29. The melting point of cane-sugar, 5 m.....W. H. Test.
30. Nitro derivatives of low-boiling paraffines, 5 m.....R. G. Worstall.
31. Occurrence of nitrogen in gases derived from bacterial fermentation, 5 m.....S. Burrage and A. H. Bryan.
32. Micro-organisms in flour, 10 m.....C. G. Ferris.
33. The number of colonies of bacteria and moulds obtained in the testing of air, milk and water by different culture media, 10 m.....A. W. Bitting.

58. Structure of the heart of lungless salamanders, 10 m..H. L. Bruner.
 59. The pulmonary arch of lungless salamanders, 12 m..Miss MacWoldt.
 *60. Methods of staining to show centrosomes in egg cells. (Illustrations), 12 m.....L. J. Rettger.
 61. An instance of bird ferocity, 2 m.....G. Culbertson.
 *62. A revision of the genus *Io*, 10 m.....R. E. Call.
 63. Material for the study of variation in *Etheostoma caprodes*,
 15 m.....J. N. Moenkhaus.
 64. Origin of cave fauna, 15 m.....C. H. Eigenmann.
 65. The eyes of the Amblyopsidae, 15 m.....C. H. Eigenmann.
 66. A new species of blind fishes from the caves of Missouri,
 5 m..... C. H. Eigenmann.
 67. The habits of *Amblyopsis*, 15 m.....C. H. Eigenmann.
 68. The blind salamanders of North America, with specimens,
 5 m.....C. H. Eigenmann.
 69. Embryology of *Paragordius (Gordius) aquaticus*.....A. B. Ulrey.

GEOLOGICAL SUBJECTS.

70. Formation of quicksand pockets in the blue clay of South Bend, 10 m.....W. M. Whitten.
 71. The Cady marsh, 8 m.....F. H. Ball.
 72. Preliminary work for the approximate determination of the time since the retreat of the first great ice sheet, 8 m.
 G. Culbertson.
 73. Note on fault structure in Indiana.....George H. Ashley.
 *74. Notes on the geology of Mammoth Cave, 10 m.....R. E. Call.
 75. A section from Hanover to Vincennes, 10 m.....J. F. Newsom.
 76. The Knobstone groups in the region of New Albany, 10 m.
 J. F. Newsom.
 77. The upper limits of the Knobstone in the region of Borden,
 8 m.....L. H. Jones.
 78. Four sections across the Knobstone group, 15 m....L. F. Bennett.
 79. Notes on Indiana geology, 10 m.....J. A. Price.
 80. An old river channel in Spencer county, 15 m.....A. C. Veatch.

* Author absent; paper not presented.

THIRTEENTH ANNUAL MEETING OF THE INDIANA ACADEMY OF SCIENCE.

The thirteenth annual meeting of the Indiana Academy of Science was held in Indianapolis, Wednesday and Thursday, December 29th and 30th, 1897, preceded by a session of the Executive Committee of the Academy, 8 p. m., Tuesday, December 29th.

At 9 a. m., December 29th, President Thomas Gray called the Academy to order in general session, at which committees were appointed and much other routine and miscellaneous business transacted. After the disposition of these affairs the reading and discussion of papers of the printed program, under the title of "General Subjects" occupied the time until adjournment at 12 m.

The Academy met at 2 p. m. in two sections, biological and physico-chemical, for the reading and discussion of papers. President Thomas Gray presided over the physico-chemical section and Vice-President C. A. Waldo over the biological section. At 5 p. m. the section meeting adjourned to meet in general session of the Academy at 7 p. m.

The Executive Committee met at 5:30 p. m., holding a brief business session.

Academy met 2 p. m. Following the disposition of committee reports and the transaction of other business the retiring president, Dr. Thomas Gray addressed the Academy on "The Development of Electrical Science."

Thursday, December 30th, 9:20 a. m., the Academy met in general session for the transaction of business, after which it divided into sections for the consideration of papers. President Gray acted as chairman of the physico-chemical section, Vice-President Waldo presided over the biological.

Adjournment of physico-chemical section, 10:20 a. m.

Adjournment of biological section, 12:15 p. m.

THE FIELD MEETING OF 1897.

The Field meeting of 1897 was held Thursday and Friday, May 27th and 28th at Lafayette, Indiana. On the evening of the 28th the executive committee of the Academy met and transacted miscellaneous business.

Thursday morning, May 27th, the members started into the field, going by conveyance into the vicinity of Battle Ground, where they divided into sections for special work. At noon all met at Tecumseh's Trail, where luncheon was served, after which the Academy visited the State Soldiers' Home. On the return to the city the country home of Mr. Mortimer Levering was visited, where a reception was given to the members.

Thursday evening, at 8 p. m., the Academy met in the chapel of Purdue University and was addressed by Dr. Frederick Starr on "Dress and Adornment." Following the lecture a short business session was held.

Friday morning, May 28th, the members visited the laboratories of Purdue University, after which they took conveyances and drove to the site of Fort Ouiatenon, where special field work was done.

The Academy is greatly indebted to the Lafayette members and their friends, whose energy and generosity made the field meeting of 1897 a marked success.

