

PROCEEDINGS

OF THE

Indiana Academy of Science

1916

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LEE F. BENNETT, Editor

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1917



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# 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 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. Application 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 programs 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 especially 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 the attending members of at least one year's standing. No question of amendment shall be decided on the day of its presentation.

## By-Laws

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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 morning of one of the days of the meeting at the expiration of his term of office.

3. The Press Secretary shall attend to the securing of 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.

### 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 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 board, 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 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 service, 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 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.

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 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.

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.

#### APPROPRIATION FOR 1916-1917.

The appropriation for the publication of the proceedings of the Academy during the years 1916 and 1917 was increased by the Legislature in the General Appropriation bill, approved March 8, 1915. That portion of the



law fixing the amount of the appropriation for the Academy is herewith given in full.

For the Academy of Science: For the printing of the proceedings of the Indiana Academy of Science twelve hundred dollars: *Provided*, That any unexpended balance in 1916 shall be available for 1917 and that any unexpended balance in 1916 shall be available in 1917.

#### PUBLIC OFFENSES—HUNTING WILD BIRDS—PENALTY.

(Approved March 15, 1913.)

SECTION 1. *Be it enacted by the General Assembly of the State of Indiana*, That section six (6) of the above entitled act be amended to read as follows: Section 6. That section six hundred two (602) of the above entitled act be amended to read as follows: Section 602. It shall be unlawful for any person to kill, trap or possess any wild bird, or to purchase or offer the same for sale, or to destroy the nest or eggs of any wild bird, except as otherwise provided in this section. But this section shall not apply to the following named game birds: The Anatidae, commonly called swans, geese, brant, river and sea duck; the Rallidae, commonly known as rails, coots, mud-hens and gallinules; the Limicolae, commonly known as shore birds, plovers, surf birds, snipe, woodcock, sandpipers, tattlers and curlews; the Gallinae, commonly called wild turkeys, grouse, prairie chickens, quails, and pheasants; nor to English or European house sparrows, blackbirds, crows, hawks or other birds of prey. Nor shall this section apply to any person taking birds or their nests or eggs for scientific purposes under permit as provided in the next section. Any person violating the provisions of this section shall, on conviction, be fined not less than ten dollars (\$10.00) nor more than fifty dollars (\$50.00).

# INDIANA ACADEMY OF SCIENCE

## OFFICERS, 1916-1917.

PRESIDENT,  
W. J. MOENKHAUS.  
VICE-PRESIDENT,  
EDWIN MORRISON.  
SECRETARY,  
HOWARD E. ENDERS.  
ASSISTANT SECRETARY,  
PHILIP A. TETRAULT.  
PRESS SECRETARY,  
FRANK B. WADE.  
TREASURER,  
WILLIAM M. BLANCHARD.  
EDITOR,  
LEE F. BENNETT.

## EXECUTIVE COMMITTEE:

ARTHUR, J. C.,	DRYER, CHAS. R.,	MOENKHAUS, W. J.,
BIGNEY, A. J.,	EIGENMANN, C. H.,	MOTTIER, DAVID M.,
BLANCHARD, W. M.,	ENDERS, HOWARD E.	MENDENHALL, T. C.,
BLATCHLEY, W. S.,	EVANS, P. N.,	NAYLOR, JOSEPH P.,
BRANNER, J. C.,	FOLEY, A. L.,	NOYES, W. A.,
BURRAGE, SEVERANCE,	HAY, O. P.,	WADE, F. B.,
BUTLER, AMOS W.,	HESSLER, ROBERT,	WALDO, C. A.,
COGSHALL, W. A.,	JORDAN, D. S.,	WILEY, H. W.,
COULTER, JOHN M.,	MCBETH, W. A.,	WILLIAMSON, E. B.,
COULTER, STANLEY,	MEES, CARL L.,	WRIGHT, JOHN S.
CULBERTSON, GLENN,		

## CURATORS:

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

COMMITTEES ACADEMY OF SCIENCE, 1916-1917.

*Program.*

F. M. ANDREWS, Bloomington.  
STANLEY COULTER, Lafayette.  
H. L. BRUNER, Indianapolis.

*Nominations.*

WILL SCOTT, Bloomington.  
J. H. RANSOM, West Lafayette.  
U. O. COX, Terre Haute.

*State Library.*

W. S. BLATCHLEY, Indianapolis.  
A. L. FOLEY, Bloomington.  
A. W. BUTLER, Indianapolis.

*Biological Survey.*

C. C. DEAM, Bluffton.  
H. W. ANDERSON, Crawfordsville.  
GEORGE N. HOFFER, West Lafayette.  
U. O. COX, Terre Haute.  
J. N. NIEUWLAND, Notre Dame.

*Distribution of Proceedings.*

H. E. ENDERS, West Lafayette.  
JOHN B. DUTCHER, Bloomington.  
A. W. BUTLER, State House, Indian-  
apolis.  
W. M. BLANCHARD, Greencastle.

*Membership.*

J. P. NAYLOR, Greencastle.  
D. A. ROTHROCK, Bloomington.  
L. J. RETTGER, Terre Haute.

*Auditing.*

P. N. EVANS, West Lafayette.  
A. HATHAWAY, Terre Haute.

*Restriction of Weeds and Diseases.*

B. D. MYERS, Bloomington.  
J. N. HURTY, Indianapolis.  
A. W. BUTLER, Indianapolis.  
STANLEY COULTER, Lafayette.  
D. M. MOTTIER, Bloomington.

*Academy to State.*

R. W. MCBRIDE, Indianapolis.  
GLENN CULBERTSON, Hanover.  
H. E. BARNARD, Indianapolis.  
J. S. WRIGHT, Indianapolis.  
W. W. WOOLLEN, Indianapolis.

*Publication of Proceedings.*

LEE F. BENNETT, Editor, Valparaiso.  
C. R. DRYER, Fort Wayne.  
R. R. RAMSEY, Bloomington.  
R. R. HYDE, Terre Haute.  
J. S. WRIGHT, Indianapolis.

*Advisory.*

JOHN S. WRIGHT, Indianapolis.  
ROBT. W. MCBRIDE, Indianapolis.  
GLENN CULBERTSON, Hanover.  
STANLEY COULTER, Lafayette.  
WILBUR A. COGSHALL, Bloomington.

OFFICERS OF THE INDIANA ACADEMY OF SCIENCE.

YEARS.	PRESIDENT.	SECRETARY.	ASST. SECRETARY.	PRESS SECRETARY.	TREASURER.
1885-1886	David S. Jordan...	Amos W. Butler...			O. P. Jenkins.
1886-1887	John M. Coulter...	Amos W. Butler...			O. P. Jenkins.
1887-1888	J. P. D. John...	Amos W. Butler...			O. P. Jenkins.
1888-1889	John C. Branner...	Amos W. Butler...			O. P. Jenkins.
1889-1890	T. C. Mendenhall...	Amos W. Butler...			O. P. Jenkins.
1890-1891	O. P. Hay...	Amos W. Butler...			O. P. Jenkins.
1891-1892	J. L. Campbell*...	Amos W. Butler...			C. A. Waldo.
1892-1893	J. C. Arthur.....	Amos W. Butler...	Stanley Coulter W. W. Norman		C. A. Waldo.
1893-1894	W. A. Noyes.....	C. A. Waldo.....	W. W. Norman		W. P. Shannon.
1894-1895	A. W. Butler.....	John S. Wright....	A. J. Bigney.....		W. P. Shannon.
1895-1896	Stanley Coulter...	John S. Wright....	A. J. Bigney.....		W. P. Shannon.
1896-1897	Thomas Gray*.....	John S. Wright....	A. J. Bigney.....		W. P. Shannon.
1897-1898	C. A. Waldo.....	John S. Wright....	A. J. Bigney.....	Geo. W. Benton....	J. T. Seovell.*
1898-1899	C. H. Eigenmann...	John S. Wright....	E. A. Schultze....	Geo. W. Benton....	J. T. Seovell.
1899-1900	D. W. Dennis.....	John S. Wright....	E. A. Schultze....	Geo. W. Benton....	J. T. Seovell.
1900-1901	M. B. Thomas*.....	John S. Wright....	E. A. Schultze....	Geo. W. Benton....	J. T. Seovell.
1901-1902	Harvey W. Wiley...	John S. Wright....	Donaldson Bodine.	Geo. W. Benton....	J. T. Seovell.
1902-1903	W. S. Blatchley...	John S. Wright....	Donaldson Bodine.	G. A. Abbott.....	W. A. MeBeth.
1903-1904	C. L. Mees.....	John S. Wright....	J. H. Ransom.....	G. A. Abbott.....	W. A. MeBeth.
1904-1905	John S. Wright....	Lynn B. McMullen	J. H. Ransom.....	G. A. Abbott.....	W. A. MeBeth.
1905-1906	Robert Hessler....	Lynn B. McMullen	J. H. Ransom.....	Charles R. Clark...	W. A. MeBeth.
1906-1907	D. M. Mottier....	Lynn B. McMullen	J. H. Ransom.....	G. A. Abbott.....	W. A. MeBeth.
1907-1908	Glenn Culbertson...	J. H. Ransom.....	A. J. Bigney.....	G. A. Abbott.....	W. A. MeBeth.
1908-1909	A. L. Foley.....	J. H. Ransom.....	A. J. Bigney.....	G. A. Abbott.....	W. A. MeBeth.
1909-1910	P. N. Evans.....	Geo. W. Benton....	A. J. Bigney.....	John W. Woodhams	W. J. Moenkhaus.
1910-1911	C. R. Dryer.....	A. J. Bigney.....	E. B. Williamson..	Milo H. Stuart.....	W. J. Moenkhaus.
1911-1912	J. P. Naylor.....	A. J. Bigney.....	E. B. Williamson..	Milo H. Stuart.....	W. J. Moenkhaus.
1912-1913	Donaldson Bodine*...	A. J. Bigney.....	C. M. Smith.....	F. B. Wade.....	W. J. Moenkhaus.
1913-1914	Severance Burrage...	A. J. Bigney.....	Howard E. Enders.	F. B. Wade.....	W. A. Cogshall.
1914-1915	Wilbur A. Cogshall.	A. J. Bigney.....	Howard E. Enders.	F. B. Wade.....	Wm. M. Blanchard
1915-1916	A. J. Bigney.....	Howard E. Enders.	E. B. Williamson..	F. B. Wade.....	Wm. M. Blanchard
1917-1918	W. J. Moenkhaus...	Howard E. Enders.	P. A. Tetrault....	F. B. Wade.....	Wm. M. Blanchard

\*Deceased.

## MEMBERS.\*

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### FELLOWS.

Anderson, H. W., Urbana, Ill. ....	1912
Botany.	
Andrews, F. M., 744 E. Third St., Bloomington. ....	1911
Assistant Professor of Botany, Indiana University.	
Botany.	
Arthur, Joseph C., 915 Columbia St., Lafayette. ....	1893
Professor of Vegetable Physiology and Pathology, Purdue Univ.	
Botany.	
Barnard, H. E. Room 20 State House, Indianapolis. ....	1910
Chemist to Indiana State Board of Health.	
Chemistry, Sanitary Science, Pure Foods.	
Beede, Joshua W., 404 W. 38 St., Austin, Texas. ....	1906
Bureau of Economic Geology and Technology.	
Stratigraphic Geology, Physiography.	
Bennett, Lee F., 825 Laporte Ave., Valparaiso. ....	1916
Professor of Geology and Zoology, Valparaiso University.	
Geology, Zoology.	
Benton, George W., 100 Washington Square, New York, N. Y. ....	1896
Editor in Chief, American Book Company.	
Bigney, Andrew J., Moores Hill, Ind. ....	1897
Professor of Biology and Geology, Moores Hill College.	
Biology, Geology.	
Bitting, Katherine Golden, Washington, D. C. ....	1895
Microscopic Expert, Pure Food, National Canners Laboratory.	
Botany.	
Blanchard, William M., 1008 S. College Ave., Greencastle, Ind. ....	1914
Professor of Chemistry, DePauw University, Greencastle, Ind.	
Organic Chemistry.	
Blatchley, W. S., 1558 Park Ave., Indianapolis. ....	1893
Naturalist.	
Botany, Entomology, and Geology.	

\*Every effort has been made to obtain the correct address and occupation of each member, and to learn in what line of science he is interested. The first line contains the name and address; the second line the occupation; the third line the branch of science in which he is interested. The omission of an address indicates that mail addressed to the last printed address was returned as uncalled for. Information as to the present address of members so indicated is requested by the secretary. The custom of dividing the list of members has been followed.

†Date of election.

Breeze, Fred J., Bloomington.....	1910
Graduate School, Indiana University.	
Geography.	
Bruner, Henry Lane, 324 S. Ritter Ave., Indianapolis.....	1899
Professor of Biology, Butler College.	
Comparative Anatomy, Zoology.	
Bryan, William Lowe, Bloomington.....	1914
President Indiana University.	
Psychology.	
Burrage, Severance, Massachusetts Institute of Technology, Boston, Mass.....	1898
Bacteriology, Sanitary Science.	
Butler, Amos W., 52 Downey Ave., Irvington.....	1893
Secretary, Indiana Board of State Charities.	
Vertebrate Zoology, Anthropology, Sociology.	
Cogshall, Wilbur A., 423 S. Fess Ave., Bloomington.....	1906
Associate Professor of Astronomy, Indiana University.	
Astronomy.	
Coulter, Stanley, 213 S. Ninth St., Lafayette.....	1893
Dean School of Science, Purdue University.	
Botany, Forestry.	
Cox, Ulysses O., P. O. Box 81, Terre Haute.....	1908
Head Department Zoology and Botany, Indiana State Normal.	
Botany, Zoology.	
Culbertson, Glenn, Hanover.....	1899
Chair Geology, Physics and Astronomy, Hanover College.	
Geology.	
Cumings, Edgar Roseoe, 327 E. Second St., Bloomington.....	1906
Professor of Geology, Indiana University.	
Geology, Paleontology.	
Davisson, Schuyler Colfax, Bloomington.....	1908
Professor of Mathematics, Indiana University.	
Mathematics.	
Deam, Charles C., Bluffton.....	1910
Druggist.	
Botany.	
Dryer, Charles R., Oak Knoll, Fort Wayne.....	1897
Geography.	
Dutcher, J. B., Bloomington.....	1914
Assistant Professor of Physics, Indiana University.	
Physics.	
Eigenmann, Carl H., 630 Atwater St., Bloomington.....	1893
Professor of Zoology, Dean of Graduate School, Indiana University.	

Embryology, Degeneration, Heredity, Evolution and Distribution of American Fish.	
Enders, Howard Edwin, 107 Fowler Ave., Lafayette.....	1912
Associate Professor of Zoology, Purdue University. Zoology.	
Evans, Percy Norton, West Lafayette.....	1901
Director of Chemical Laboratory, Purdue University. Chemistry.	
Foley, Arthur L., Bloomington.....	1897
Head of Department of Physics, Indiana University. Physics.	
Golden, M. J., West Lafayette.....	1899
Director of Laboratories of Practical Mechanics, Purdue Univer- sity. Mechanics.	
Hathaway, Arthur S., 2206 N. Tenth St., Terre Haute.....	1895
Professor of Mathematics, Rose Polytechnic Institute. Mathematics, Physics.	
Hessler, Robert, Logansport.....	1899
Physician. Biology.	
Hoffer, George N., Littleton St., West Lafayette.....	1913
Associate Professor of Botany, Purdue University.	
Hufford, Mason E., Bloomington.....	1916
Physics.	
Hurty, J. N., Indianapolis.....	1910
Secretary, Indiana State Board of Health. Sanitary Science, Vital Statistics, Eugenics.	
Hyde, Roscoe Raymond, Terre Haute.....	1909
Assistant Professor Physiology and Zoology, Indiana State Normal. Zoology, Physiology, Bacteriology.	
Kenyon, Alfred Monroe, 315 University St., West Lafayette.....	1914
Professor of Mathematics, Purdue University. Mathematics.	
Kern, Frank D., State College Pa.....	1912
Professor of Botany, Pennsylvania State College. Botany.	
Lyons, Robert E., 630 E. Third St., Bloomington.....	1896
Head of Department of Chemistry, Indiana University. Organic and Biological Chemistry.	
McBeth, William A., 905 N. Eighth St., Terre Haute.....	1904
Assistant Professor Geography, Indiana Normal School. Geography, Geology, Scientific Agriculture.	

McBride, Robert W., 1239 State Life Building, Indianapolis . . . . .	1916
Lawyer.	
Mees, C. L., Terre Haute . . . . .	1894
President of Rose Polytechnic Institute.	
Middleton, A. R., West Lafayette . . . . .	1908
Professor of Chemistry, Purdue University.	
Chemistry.	
Moenkhaus, William J., 501 Fess Ave., Bloomington . . . . .	1901
Professor of Physiology, Indiana University.	
Physiology.	
Morrison, Edwin, 80 S. W. Seventh St., Richmond . . . . .	1915
Professor of Physies, Earlham College.	
Physies and Chemistry.	
Mottier, David M., 215 Forest Place, Bloomington . . . . .	1893
Professor of Botany, Indiana University.	
Morphology, Cytology.	
Naylor, J. P., Greencastle . . . . .	1903
Professor of Physies, DePauw University.	
Physies, Mathematics.	
Nieuwland, J. N., The University, Notre Dame . . . . .	1914
Professor of Botany, Editor Midland Naturalist.	
Systematic Botany, Plant Histology, Organic Chemistry.	
Payne, F., 620 S. Fess Ave., Bloomington . . . . .	1916
Associate Professor of Zoology, Indiana University.	
Cytology and Embryology.	
Pohlman, Augustus G., 402 S. Grand Ave., St. Louis, Mo. . . . .	1911
Professor of Anatomy.	
Embryology, Comparative Anatomy.	
Ramsey, Rolla R., 615 E. Third St., Bloomington . . . . .	1906
Associate Professor of Physies, Indiana University.	
Physies.	
Ransom, James H., 323 University St., West Lafayette . . . . .	1902
Professor of General Chemistry, Purdue University.	
General Chemistry, Organic Chemistry, Teaching.	
Rettger, Louis J., 31 Gilbert Ave., Terre Haute . . . . .	1896
Professor of Physiology, Indiana State Normal.	
Animal Physiology.	
Rothrock, David A., Bloomington . . . . .	1906
Professor of Mathematics, Indiana University.	
Mathematics.	
Scott, Will, 731 Atwater St., Bloomington . . . . .	1911
Assistant Professor of Zoology, Indiana University.	
Zoology, Lake Problems.	



- Shannon, Charles W., 518 Lahoma Ave., Norman, Okla. . . . . 1912  
 With Oklahoma State Geological Survey.  
 Soil Survey, Botany.
- Smith, Albert, University St., West Lafayette. . . . . 1908  
 Professor of Structural Engineering.  
 Physics, Mechanics.
- Smith, Charles Marquis, 152 Sheetz St., West Lafayette. . . . . 1912  
 Professor of Physics, Purdue University.  
 Physics.
- Stone, Winthrop E., Lafayette. . . . . 1893  
 President of Purdue University.  
 Chemistry.
- Van Hook, James M., 939 N. College Ave., Bloomington. . . . . 1911  
 Assistant Professor of Botany, Indiana University.  
 Botany.
- Wade, Frank Bertran, 1039 W. Twenty-seventh St., Indianapolis. . . . . 1914  
 Head of Chemistry Department, Shortridge High School.  
 Chemistry, Physics, Geology, and Mineralogy.
- Waterman, Luther D., 226 Pratt St., Indianapolis. . . . . 1916  
 Physician.
- Williamson, E. B., Bluffton. . . . . 1914  
 Cashier, The Wells County Bank.  
 Dragonflies.
- Woollen, William Watson, Indianapolis. . . . . 1908  
 Lawyer.  
 Birds and Nature Study.
- Wright, John S., care Eli Lilly Co., Indianapolis. . . . . 1894  
 Manager of Advertising Department, Eli Lilly Co.  
 Botany.

*NON-RESIDENT MEMBERS AND FELLOWS.*

- Abbott, G. A., Grand Forks, N. Dak., Fellow. . . . . 1908  
 Professor of Chemistry, University of North Dakota.  
 Chemistry.
- Aley, Robert J., Orono, Me., Fellow. . . . . 1908  
 President of University of Maine.  
 Mathematics and General Science.
- Ashley, George H., Washington, D. C.
- Bain, H. Foster, London, Eng.  
 Editor Mining Magazine.
- Branner, John Casper, Stanford University, Calif.  
 Geology.

- Brannon, Melvin A., President University of Idaho, Boise, Ida.  
 Professor of Botany.  
 Plant Breeding.
- Campbell, D. H., Stanford University, Calif.  
 Professor of Botany, Stanford University.  
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 Botany, Plant Pathology, Entomology.
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 Physics, Discharge of Electricity through Gases.
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Agronomy.
- Wiley, Ralph Benjamin, West Lafayette.  
Hydraulic Engineering, Purdue University.
- Williams, A. A., Valparaiso.  
Mathematics, Valparaiso University.
- Williams, Kenneth P., Bloomington.  
Instruction Mathematics, Indiana University.  
Mathematics, Astronomy.
- Wilson, Charles E., Gainsville, Florida.  
State Plant Board.  
Zoology and Economic Entomology.
- Wilson, Mrs. Etta L., 1044 Congress Ave., Indianapolis, Ind.  
Botany and Zoology.
- Wilson, Guy West, Carmel.  
Mycology and Plant Pathology.
- Wisner, Eber Hugh, Valparaiso.  
Pharmacy, Valparaiso University.
- Wissler, W. A., Cambridge City.  
Chemistry.
- Wood, Harry W., 117 Dewey Ave., Joliet, Ill.
- Wootery, Ruth, Bloomington.
- Wynn, Frank B., Indianapolis.  
Professor of Pathology, Indiana University School of Medicine.
- Yoeman, R. C., Lafayette.  
Assistant Professor of Highway Engineering, Purdue University.
- Young, Gilbert A., 739 Owen St., Lafayette.  
Head of Department of Mechanical Engineering, Purdue University.
- Young, Simon J., Valparaiso.  
Physician.

Zehring, William Arthur, 303 Russell St., West Lafayette.

Assistant Professor of Mathematics, Purdue University.

Mathematics.

Zufall, C. J., Pharmacognosy Laboratory, Bureau of Chemistry, Washington, D. C.

Pharmacognosy.

Fellows . . . . .	78
Members, Active . . . . .	273
Members, Non-resident . . . . .	27
	<hr/>
Total . . . . .	378

MINUTES OF THE SPRING MEETING  
OF THE  
INDIANA ACADEMY OF SCIENCE.

JUNE 1, 2, AND 3, 1916.

A public meeting of the Indiana Academy of Science was held in the Auditorium of Valparaiso University on the evening of June 1st. The meeting was addressed by Dr. E. S. Riggs of the Field Columbian Museum of Chicago upon the subject: "The Story of the Horse." Total attendance twenty-four members of the Academy and about five hundred students, faculty and townspeople.

Friday June 2nd citizens of Valparaiso and members of the Faculty of Valparaiso University conducted the members of the academy on an automobile tour of northern Porter county. This afforded an opportunity to view the lakes, marshes, sand dunes and hills of the Valparaiso Moraine.

Luncheon was served by the university faculty on the shores of Lake Michigan. A business session was held after the luncheon.

BUSINESS SESSION—VALPARAISO.

WAVERLEY BEACH, IND.,

June 2, 1916.

The meeting was called to order by the President, Andrew J. Bigney, after which the membership committee reported the following named persons for membership.

- Homer Francis Black, Valparaiso, Teacher—Mathematics.
- J. H. Cloud, Valparaiso, Teacher—Physics.
- Oliver E. Damron, Valparaiso, Teacher—Mathematics and Zoology.
- Earl Pinkerton, Valparaiso, Teacher—Zoology.
- Earl Price, Valparaiso, Teacher—Agriculture.
- S. A. Rifenburgh, Valparaiso, Teacher—Botany.
- George D. Timmons, Valparaiso, Teacher—Chemistry.
- A. A. Williams, Valparaiso, Teacher—Mathematics.
- Eber Hugh Wisner, Valparaiso, Teacher—Pharmacy.
- R. C. Yeoman, Valparaiso, Teacher—Engineering.
- Simon J. Young, Valparaiso, Teacher and Physician.
- C. A. Behrens, Purdue University, West Lafayette—Bacteriology.
- J. F. Barnhill, Indiana University School of Medicine, Indianapolis—  
Professor of Surgery.
- George L. Bond, Indiana University School of Medicine, Indianapolis—  
Professor of Medicine.

J. R. Eastman, Indiana University School of Medicine, Indianapolis,—  
Professor of Surgery.

Murray Hadley, Indiana University School of Medicine, Indianapolis—  
Professor of Surgery.

B. B. Turner, Indiana University School of Medicine, Indianapolis—  
Professor of Pharmacology.

Upon motion duly passed they were elected to membership.

On motion of Mr. Dryer, the following committee was appointed on memorial on the death of Doctor Dennis: Stanley Coulter, chairman, Amos Butler, Charles R. Dryer.

On motion of E. R. Cummings the matter of recommending the national adoption of the Centigrade Scale was referred to the Executive Committee for consideration at the December Meeting.

On motion of J. W. Beede, a special committee was appointed to prepare resolutions to recommend the preservation of Dune Park and to co-operate with the Chicago Geographical Society and the Chicago Prairie Club. The President appointed the following committee: Lee F. Bennett, chairman, Dr. Stoltz, Charles R. Dryer.

On motion of Mr. Beede the President appointed the Secretary, and Messrs. McBeth and Cummings as a committee to prepare resolutions which are to be read at the banquet.

Dr. J. A. Aldrich spoke on a scientific project which is now under way of formation and which is given the support of the Entomological Society of America (Membership 550). At present there seems no ready means of publishing the works of an increasing number of workers. It is the plan of a number of workers to establish the Thomas Say Foundation in recognition of the fine work of Thomas Say an Indiana worker. The plan is to interest men of means in the matter and urge them to endow a foundation which may have Indiana as its center and thus bring worthy recognition upon one of its workers. The plan was favorably endorsed at the December Meeting in 1915.

Adjournment.

ANDREW J. BIGNEY, President.

HOWARD E. ENDERS, Secretary.

Upon return from the automobile tour the members of the Academy and others were guests of the University at the Banquet at 6:30 p. m. in Altruria Hall.

President Bigney called the meeting to order and in an appropriate manner voiced the appreciation of the members of the Academy of the courtesies extended by Valparaiso University. He then called for the report of the Committee on Resolutions.

RESOLVED, That the visiting members of the Indiana Academy of Science hereby express their gratitude for the hospitality extended by the Officers and Faculty of Valparaiso University, for the bountiful noon luncheon served

by the ladies on the shore of Lake Michigan, and for the transportation and entertainment furnished by citizens of the town.

BE IT FURTHER RESOLVED, That the Academy especially acknowledge the kindly interest and splendid hospitality of President Brown and Mr. Kinsey.

Dr. Charles Dryer then spoke on "The Geological Formations Visited During the Day."

Mr. W. E. Pinney gave "Greetings from the Citizens of Valparaiso to the Indiana Academy of Science."

Professor Bennett of the University, and Chairman of the Local Committee spoke for the Program Committee.

Dr. Riggs of the Field Columbian Museum, Chicago, spoke of his own personal enjoyment of the day.

Vice-President Kinsey on "Appreciation of the Presence of the Indiana Academy of Science as Guests."

(Attendance at the banquet about one hundred persons, including twenty-four members of the Academy.)

ANDREW J. BIGNEY, President.

Adjournment.

HOWARD E. ENDERS, Secretary.

On Saturday morning, June 3rd, fifteen members visited the steel mills at Gary.

The following named members attended the Spring Meeting.

J. M. Aldrich	W. F. Baker
J. H. Clark	J. W. Beede
E. R. Clarke	L. F. Bennett
J. H. Cloud	A. J. Bigney
E. R. Cummings	A. A. Bourke
Chas. C. Deam	Homer F. Black
Chas. R. Dryer	S. A. Rifenburgh
Howard E. Enders	G. D. Timmons
Irene Graybrook	M. L. Weems
Wm. A. McBeth	A. A. Williams
Earl Pinkerton	Simon J. Young
Earl Price	Ray C. Yeoman

## MINUTES OF THE EXECUTIVE COMMITTEE

Claypool Hotel,

Indianapolis, Ind., December 7, 1916.

The executive committee of the Indiana Academy of Science met in the Moorish Room of the Claypool and was called to order at 7:30 p. m., by the President, Andrew J. Bigney. The following members were present: Andrew J. Bigney, Stanley Coulter, Amos Butler, Wm. M. Blanchard, W. A. Cogshall, W. S. Blatchley, C. C. Deam, J. P. Naylor, R. W. McBride, H. L. Bruner, D. M. Mottier, A. L. Foley, C. H. Eigenmann, and Howard E. Enders.

The minutes of the executive committee of 1915 were read and approved. The reports of the standing committees were then taken up. *Program Committee*—Stanley Coulter, chairman, reported that the committee has by invitation arranged for the consideration of "A Century of Science in Indiana," as the theme of the general program in celebration of the first hundred years of scientific work in the State. The program as arranged bears fifty-eight papers to which three additional titles were added on motion of the chairman.

On motion Professor James Troop of Lafayette is asked to prepare a memorial on Dr. F. N. Webster, for publication in the 1916 Proceedings. On motion there shall be two sections for the consideration of papers: Section 1 shall include Bacteriology, Botany and Zoology; and Section 2 shall include Geology and Geography, Chemistry, Physics, Mathematics and Engineering.

On motion the out-of-State speakers on the general program shall be guests of the Academy at the Dinner.

The report of the program committee was received and passed.

The treasurer, Wm. M. Blanchard reported as follows:

December 1, 1915 to December 2, 1916.	
Balance from 1915 . . . . .	\$327.00
Dues collected . . . . .	247.00
	<hr/>
Total . . . . .	\$574.00
Expenditures to December 2, 1916. . . . .	196.49
	<hr/>
Balance . . . . .	\$377.51

Upon motion duly passed the report was received and turned over to the Auditing Committee.

*Committee on State Library*.—W. S. Blatchley, Chairman, reported that the State Librarian has not done any binding of either domestic or foreign publications because of the irregular receipt of foreign works during the war. All bound books are cataloged and properly shelved. The report was received.

*Biological Survey*.—C. C. Deam, Chairman, read a summary of bibliography of the work on animals and plants of Indiana. Much work has been done on vertebrates and the higher plants but much remains untouched, particularly on the lower animals and the lower plants. The work thus far done has devolved upon persons who have been busy with other pursuits. After a discussion of the report it was proposed that a resolution be prepared to recommend that the scientific bureaus of the State be manned by persons of recognized scientific attainment, and that the Indiana Academy of Science endeavor to use its influence to this end.

On motion, C. H. Eigenmann, Stanley Coulter and W. R. Blatchley are hereby asked to present such resolution at the general session.

*Distribution of Proceedings.*—Howard E. Enders, Chairman, reported delay and difficulties in printing that will delay the appearance of the Proceedings a month or more.

*Membership Committee*—No report.

The failure of persons to pay their initiation fee and dues upon their election to membership was discussed.

On motion the Secretary is authorized to prepare a form to be sent to new members informing them of their election and that their names will be enrolled upon the payment of the initiation fee and dues.

*Auditing Committee*—J. P. Naylor, Chairman, reports the correctness of the Treasurer's report.

*Restriction of Weeds and Diseases*—Stanley Coulter and D. M. Mottier, members, reported informally that no work had been done.

*Relation of the Academy to the State*—R. W. McBride, chairman, reported informally.

*Publication of Proceedings.*—No report.

On motion the following members are recommended as Fellows: Luther D. Waterman, Retired Physician, Scientist, Indianapolis; Judge R. W. McBride, Indianapolis; Lee F. Bennett, Professor of Zoology, Valparaiso University; Mason E. Hufford, Department of Physics, Indiana University; Fernandus Payne, Associate Professor of Zoology, Indiana University.

The Spring Meeting of the Academy was discussed and the following places were suggested: by D. M. Mottier, Turkey Run; by W. S. Blatchley, Spencer; and by Stanley Coulter, Purdue University and the dedication of its new biological building. The matter is referred to the new Program Committee with power to act.

Dr. Henry Bruner spoke upon the matter of the establishment of an *Academy Foundation* for furthering research among its members and affording a ready means of publishing valued papers for which the American journals now seem overcrowded. Possibly such Foundation would stimulate persons to provide portions of legacies towards this cause.

The matter was discussed favorably by Mr. Wright who suggested that patrons of the Academy and charitably inclined persons might be appealed to.

On motion the following *Committee on Academy Foundation* is to report to the executive committee next year: John S. Wright, Henry L. Bruner, Judge Robert W. McBride.

Motions from the Spring Meeting were considered:

- (a) Memorial on the death of Dr. Dennis;
- (b) Adoption of the Centigrade Scale;
- (c) Special committee on Preservation of the Sand Dunes.

(a) Memorial on the death of Dr. Dennis has been provided for on the general program;

(b) On motion the Indiana Academy of Science endorses the general adoption of the Centigrade Scale in the United States.

(c) A letter from Professor Lee F. Bennett, chairman of the special committee, was read in which he reported very favorably upon a movement now inaugurated to make the Dune Park a National Park.

Adjournment.

ANDREW J. BIGNEY, President.

HOWARD E. ENDERS, Secretary.

GENERAL SESSION—Assembly Room, 9:15 a. m., December 8.

The meeting was called to order by Andrew J. Bigney, President. The minutes of the executive committee were read and approved.

On motion duly passed the five persons who were recommended by the executive committee were elected Fellows of the Indiana Academy of Science.

The following resolution was presented by the Chairman, C. H. Eigenmann of the Resolution Committee:

Resolved, That a permanent Advisory Council, or Committee of Five, be appointed; second, that the Academy express its conviction that appointive officers of the scientific Bureaus of the State should be persons of recognized scientific attainments; and third, that the newly elected Governor be informed of the existence of the committee and of its readiness to help if the governor finds it desirable to call for co-operation.

The following Committee of Five, or Advisory Council, was named: John S. Wright, chairman; Robert W. McBride, Glenn Culbertson, Stanley Coulter and Wilbur A. Cogshall.

The regular program was then taken up, as follows: David Worth Dennis—An Appreciation, by Allen D. Hole; John Pierce Durbin—An Appreciation, by Wm. M. Blanchard.

On motion, the Academy expressed its unanimous appreciation of the excellent papers of Professors Hole and Blanchard.

After the reading of the papers by Professor Lindley and Mr. Blatchley, the meeting adjourned.

#### AFTERNOON SESSION, 1:30 P. M.

The *Committee on Membership* proposed the names of the following persons for membership:

Floyd E. Beghtel, 204 E. 3rd St., Bloomington, Teacher.

Alfred L. Bushey, West Lafayette, Instructor in Agriculture.

Forrest F. Craig, 527 E. 6th St., Bloomington, Student.

Aline Cullison, Lyons, Student.

Tobias Dantzig, Bloomington, Instructor in Mathematics.

Juan B. Demaree, Room 130 State House, Indianapolis. Botanist.

Martha Doan, Earlham College, Richmond. Professor of Chemistry.



William F. Epple, 234 Pierce St., West Lafayette. Dairy Chemist.

Arthur H. Estabrook, 219 E. 17th St., Indianapolis. Geneticist.

Francis Albert Federer, care of Eli Lilly Co., Indianapolis. Botanist.

Harry T. Folger, 727 Atwater Ave., Bloomington. Student.

Albert H. Froemming, 727 Atwater, Bloomington. Student.

Francis C. Guthrie, Bloomington. Student.

Hazel Hansford, 710 S. Fess Avenue, Bloomington. Student.

John E. Hemmer, Bloomington. Student.

H. V. Houseman, 902 W. Main St., Crawfordsville, Instructor in Chemistry.

Howard Leigh, 307 N. 7th St., Richmond. Student.

Jesse G. Liston, Lewis. Teacher.

Wm. N. Logan, 320 S. Fess Ave., Bloomington. Associate Professor of Geology.

Nathaniel E. Loomis, 127 Waldron St., West Lafayette. Assistant Professor of Chemistry.

Lester McKinley, Bloomington. Student.

Edward G. Mahin, 27 Russell St., West Lafayette. Professor Analytic Chemistry.

E. B. Mains, 427 Wood St., West Lafayette. Assistant Botanist, Experiment Station.

Burton J. Malott, 2206 Calhoun St., Ft. Wayne. Teacher.

Charles E. Montgomery, 213 University St., West Lafayette. Instructor.

Bruse V. Moore, 810 S. Fess Avenue, Bloomington. Psychology Assistant.

Harry A. Noyes, 705 Russell St., West Lafayette. Bacteriologist.

Aute Richards, Crawfordsville. Professor of Zoology.

Katharine Riley, 56 Whittier Place, Indianapolis. Student.

William R. M. Scott, 114 Marstellar St., West Lafayette. Botany Assistant.

William H. Sheak, Ijamsville. Lecturer on Birds and Mammals.

Philip Spong, 3873 E. Washington St., Indianapolis. Student.

Emma Louise Tevis, 122 W. 18th St., Indianapolis. Student.

Elliott R. Tibbets, 2445 N. Penna. St., Indianapolis. Printer.

Frank B. Wynn, Hume-Mansur Building, Indianapolis. Professor of Pathology.

On motion they were duly elected to membership.

C. H. Eigenmann reported informally upon the Pan-American Scientific Congress which he attended at Washington, D. C., last year during the holiday season as delegate from the Indiana Academy of Science.

He also reported that the Biological Survey of the Lake Maxinkuckee Region, undertaken under the direction of Doctor Evermann, has not been published. The work is voluminous and there is a wish to publish it as a whole rather than to subdivide it. Thus far there has been difficulty in providing for its publication.

The regular program was then taken up. Paper numbered 33 was read in the general session after which the Academy separated into two sections as follows: Section 1—Bacteriology, Botany and Zoology, presided over by President Andrew J. Bigney, Howard E. Enders, Secretary; Section 2—Chemistry, Engineering, Geology and Geography, Mathematics, and Physics, presided over by W. A. Cogshall, chairman, and Edwin Morrison, Secretary.

The sectional meeting adjourned at 5:30 for the Academy Dinner at 6:15, at which President Bigney gave the address on "The Advancement of Scientific Thought During the Century."

Seventy-two members and guests attended the dinner.

#### EVENING SESSION, 8:00 P. M.

The Academy and a representative gathering met in the Assembly Room to hear the papers by Doctor Harvey Wiley, George S. Bliss and Barton W. Evermann.

#### SATURDAY, DECEMBER 9, 10:00 A. M.

Business.

The report of the Nominating Committee was as follows:

President—W. J. Moenkhaus, Bloomington.

Vice-President—Edwin Morrison, Richmond;

Secretary—Howard E. Enders, West Lafayette.

Assistant Secretary—Philip A. Tetrault, West Lafayette;

Press Secretary—F. B. Wade, Shortridge H. S., Indianapolis.

Treasurer—Wm. M. Blanchard, Greencastle;

Editor of Proceedings—Lee F. Bennett, Valparaiso.

In the name of Indiana University Professor Eigenmann invited the Academy to hold its next Fall Meeting at Bloomington.

On motion, duly passed, it was the sense of the Academy that it accept the invitation, and referred the matter to the Executive Committee for consideration.

It was moved and passed that the Program Committee shall print in the program the names and addresses of persons who present papers at the meetings of the Academy.

On motion, the Advisory Committee is requested to introduce itself to the governor by way of advising greater dispatch in the publication of the Proceedings.

#### *General Program.*

The general program was then taken up. After the paper by Lee F. Bennett the following resolution was adopted:

WHEREAS, There is an attempt to establish a National Park in the Sand Dune area of Northern Indiana, and

WHEREAS, This is a movement which should be highly commended because such a Park would supply the need for a place for recreation for millions of people who can not afford to visit other similar places of interest in the United States, and

WHEREAS, This Dune Region should be preserved because of its position on the Shore of Lake Michigan and because of its great natural history value, and

WHEREAS, There is need for immediate action on the part of Congress because it will soon be too late to obtain land for such purposes on account of its value as sites for manufacturing plants.

THEREFORE BE IT RESOLVED, that we, the members of the Indiana Academy of Science do respectfully and earnestly ask the Senators and Congressmen from Indiana, the Governor and all of the members of the legislature of Indiana to vote for and to help in every other possible way this movement to establish a National Park within the Sand Dune area of Northern Indiana.

Adjournment to sections to complete the reading of papers.

General adjournment.

ANDREW J. BIGNEY, President.

HOWARD E. ENDERS, Secretary.

#### REPORT BIOLOGICAL COMMITTEE INDIANA ACADEMY SCIENCE 1916.

Mr. President:

Your committee on biological survey submits the following report.

It is believed that the importance of a biological survey of Indiana is not underestimated, but that it has been sadly neglected. Certain forms of animal life are rapidly disappearing in Indiana, and, in fact, some have already disappeared. The higher forms of plant life of the State are threatened by the ax, plow and grazing; and some forms, no doubt, are already extinct. The aquatic forms of plant life as well as animal life are having a struggle against drainage and poisoning by sewage contamination.

It is believed the real importance of the work to be done can be best realized by briefly giving what has been done, and calling attention to the groups that have not been worked.

Of the work done on the fauna of Indiana, I will give the titles in chronological order with the name of the author and the date and place of publication.

The Batrachians and Reptiles of Indiana by O. P. Hay; published in the Ind. Geol. Rept. Vol. 17: 409-610:1892. Subsequent papers by Blatchley have added much to the preceding paper.

The Lampreys and Fishes of Indiana by O. P. Hay; published in the Ind. Geol. Rept. Vol. 19: 146-296:1894. Considerable work has since been done on this subject by several authors, especially on the ecological and economic lines.

The Crawfishes of Indiana by W. P. Hay in the Ind. Geol. Rept. Vol. 20:

475-507:1896. Since this publication E. B. Williamson has described a new species from Wells County.

The Caves of Indiana and their Fauna by W. S. Blatchley in the Ind. Geol. Rept. Vol. 21:122-212:1897.

The Birds of Indiana by Amos W. Butler in the Ind. Geol. Rept. Vol. 22: 515-1187:1898. This is one of the most complete works ever done on the fauna of the State, yet some additional information has been added.

The Mollusca of Indiana by R. E. Call in the Ind. Geol. Rept. Vol. 24: 235-531:1899. Many additions to the preceding paper have been made by Daniels and Blatchley.

The Dragonflies of Indiana by E. B. Williamson in the Ind. Geol. Rept. Vol. 24: 229-333: 1899. A list of the species now known to occur in the State, numbering 125, is presented by Mr. Williamson at this meeting.

A catalogue of the Butterflies known to occur in Indiana by W. S. Blatchley in the Ind. Geol. Rept. Vol. 17:365-408:1892. He lists 108 species and says Edwards credits 23 more species whose range includes Indiana.

The Orthoptera of Indiana by W. S. Blatchley in the Ind. Geol. Rept. Vol. 27:123-471:1903. This is an exhaustive and creditable work, characteristic of Mr. Blatchley.

The Insect Galls of Indiana by M. T. Cook in the Ind. Geol. Rept. Vol. 29:801-867:1905. Several additional papers have been published by the same author, and Prof. Cook promised to present a paper at this meeting which would bring the knowledge of the gall insects of Indiana up to date.

A preliminary list of the Arachnida of Indiana by Nathan Banks in the Ind. Geol. Rept. Vol. 31:715-747:1907.

On the Coleoptera known to occur in Indiana by W. S. Blatchley, published as Bulletin No. 1 of the Ind. Geological Survey, consisting of 1,386 pages, in 1910. This is one of the most scientific and comprehensive works done by any author in the U. S. on this subject, and does great honor both to the author and to the State. This Bulletin did not include the snout-beetles which have been separately treated by Mr. Blatchley and Mr. Lang.

The Mammals of Indiana by Walter L. Hahn in the Ind. Geol. Rept. Vol. 33: 417-654:1909. This is an accurate and painstaking piece of work.

The Coccidae or Scale insects of Indiana by Dietz and Morrison. Published in the Rept. State Entomologist No. 8:195-321:1916. This is a late and accurate piece of work.

It will be noted that the greater part of the survey work done has been on the Vertebrata, the larger and conspicuous forms; and that much yet remains to be done on the invertebrata.

Of the survey of the insect life of the State, the greater part remains yet to be done. Of the Hemiptera, only the Coccidae have been studied. Of the Lepidoptera, the Moths, the larger and more difficult group and the one of the greatest economic importance are yet to be studied. Nothing has been published on the Diptera or Hymenoptera, both large and important groups of insects.

On the flora of Indiana, papers are few that treat of all of the species of a group that occur throughout the State. The latest and most complete papers follow in chronological sequence.

The Flowering Plants and Ferns of Indiana by Stanley Coulter in the Ind. Geol. Rept. Vol. 24:553:1002:1899. This was a most excellent work; and we are promised that this work will be brought up to date by the same author at this meeting.

Revised list of Indiana plant Rusts by J. C. Arthur in Proc. Ind. Acad. Sci. 1903. This group of so much economic importance has been much studied, and, yet, much remains to be done. We are promised that the knowledge of this group will be brought up to date at this meeting.

Preliminary list of the Hymenomyces or Mushrooms of Indiana by Donald Reddick in the Ind. Geol. Rept. Vol. 32:1193-1252:1908.

Indiana Fungi by J. M. Van Hook in the Proc. Ind. Acad. Sci. 1910 and 1911.

The Trees of Indiana by C. C. Deam in Ind. Forestry Rept. 1911.

It will be noted that there is yet much to be done on the plant life of the State. On the lowest forms only fragmentary papers have appeared. The work on the fungi is far from complete. Practically nothing has been published on the lichens of the State; little on the Characeae; nothing on the Hepaticae; only local lists on the mosses; and much yet remains to be done on the higher forms of plant life.

A review of the work done on the flora and fauna of the State shows that it is chiefly of a systematic nature. Life histories; life zones; and the ecological and economic features of the biological survey have been treated in a fragmentary way in isolated papers, and in only a few instances have attempts been made to bring together the systematic, ecological and economic knowledge of a group in one paper. Then, too, if I mistake not, there is little work in progress to accomplish the ends desired.

Admitting that there is much to be done, who is to do it? Any one familiar with the work knows that it should be done by some one with more than a rudimentary knowledge of the subject, if reliable results are to be obtained. Then too, much time and money are necessary.

There are several ways by which results may be obtained; and some of them will be briefly stated, because your committee believes that some action should be taken at this meeting to further the work on the biological survey.

*First:* The work might be done by some philanthropic individual. Instances of this kind, however, are rare exceptions. The advance of science has been in specialization and today a subject of any magnitude means collaboration; consequently one person is not able to do it all.

*Second:* The professors in charge of the departments of biology in our colleges and universities might so arrange the work of their departments as to accomplish more than they have. They might encourage more students to specialize on local or state problems. The assignments to students need

not be difficult, and problems of local interest might be worked up, or those in which the time required is beyond the reach of the professor himself.

*Third:* Our legislature might be prevailed upon to have the work done under a special grant by the legislature. The possibility of aid from this source is very remote.

*Fourth:* The work to be done by some State department. Today Indiana has a State department of Geology and Natural History. This department has already published the greater part of the biological work done in Indiana. We have a State department of Entomology. We have a State department of Forestry; and a State department of Fish and Game. If you will investigate what other states are doing, you will find these same state departments doing the biological work. What are our state departments doing along the line of biological survey? You know that in order to get the maximum service from these offices, that they must be filled by scientific men. Scientific men, too, can be obtained as cheaply as politicians. Not one of the State Entomologists has been a member of the Ind. Acad. Sci. Only one of the three State Foresters has been a member; and not a single one of the Fish and Game wardens since Phillip Kirsch, who let it be known, was a scientific man. We do not contend that one could not be a worthy scientific man and be the head of one of the state departments named and not be a member of the Ind. Acad. Sci. but it surely would be extremely poor business for such a head to stand aloof from the body of men in Indiana with whom he would and should co-operate.

Mr. President: It is not necessary to go into detail. To us it appears clear that the most feasible plan for the greater works of the biological survey is to have the work done by our various state departments. To accomplish this it will be necessary for the members of the Academy to see to it that the State departments referred to are filled with men of scientific ability and with men who are willing to do something along this line. At present these State departments do not have the financial means to do much, and we must lend our aid in securing special appropriations for these departments to undertake special work. It should be borne in mind that our State Geologist at the last session of the legislature asked an additional appropriation to extend his work and his request was denied. There should be concerted action between the Academy and the State departments, and the several members must accept it as a duty to explain the situation to his representative and senator. Our case is a most worthy one, and positive results will follow active endeavor. Our committee recommends that a resolution be passed at this meeting, which will set forth the great need of further work on the biological survey, and show why it should be done by the State departments, and that this resolution include the appointment of a committee which shall at an appropriate time present the matter to the Governor elect.

PROGRAM OF THE THIRTY-SECOND ANNUAL  
MEETING OF THE  
INDIANA ACADEMY OF SCIENCE  
CLAYPOOL HOTEL—INDIANAPOLIS  
FRIDAY AND SATURDAY  
DECEMBER 8 AND 9, 1916.

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OFFICERS

ANDREW J. BIGNEY, President.	E. B. WILLIAMSON, Assistant Secretary.
AMOS W. BUTLER, Vice-President.	WILLIAM M. BLANCHARD, Treasurer.
HOWARD E. ENDERS, Secretary.	FRANK B. WADE, Press Secretary.
HARRY E. BARNARD, Editor.	

PROGRAM COMMITTEE.

STANLEY COULTER	L. F. BENNETT	SEVERANCE BURRAGE
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GENERAL PROGRAM

Thursday.

Meeting of the Executive Committee.....	7:30 p. m.
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Friday.

Business Session.....	9:15 a. m.
General Session.....	10:00 a. m.
Sectional Meetings.....	1:30 p. m.
Informal Dinner. (Claypool).....	6:00 p. m.
General Session.....	8:00 p. m.

Saturday.

General Session.....	9:00 a. m.
Sectional Meetings.....	10:00 a. m.

THE PRESIDENTIAL ADDRESS.

The address of the retiring President, Andrew J. Bigney, will be delivered at the informal dinner.

## A CENTURY OF SCIENCE IN INDIANA.

As this is the Centennial year of Indiana, the Program Committee selected the above theme for the general session and the papers are presented by the writers at the invitation of the committee.

## GENERAL MEETINGS.

Friday, 10:00 a. m.

David Worth Dennis—An Appreciation.....	Allen D. Hole
John Price Durbin John—An Appreciation.....	Wm. M. Blanchard
Francis Marion Webster—An Appreciation.....	James Troop
Mental Hygiene in Indiana—Retrospect and Prospect.....	E. H. Lindley
A Century of Geology in Indiana.....	W. S. Blatchley

Friday, 8:00 p. m.

The Early History of Chemistry in Indiana.....	H. W. Wiley
Indiana's Feeble-Minded—What is Being Done and What Should be done (Illustr.).....	George S. Bliss
A Century of Zoology in Indiana.....	B. W. Evermann

Saturday, 9:00 a. m.

A History of Public Health Work in Indiana.....	John N. Hurty
A Century of Botany in Indiana.....	John M. Coulter
The Sand-Dunes of Indiana as a National Park (Illustr.).....	L. F. Bennett

## SECTIONAL MEETINGS.

Friday, 1:30 p. m., and Saturday, 10:00 a. m.

## BACTERIOLOGY.

1. An Improved Medium for the Cultivation of *Trypanosoma Brucei*,  
20 min.....C. A. Behrens
2. Technic for Bacteriological Examination of Soils, 12 min.  
.....H. A. Noyes and Edwin Voight
3. Acute Poliomyelitis, 20 min.....C. A. Behrens
4. Cultivation of Trypanosomes in Vivo, 10 min.....H. C. Travelbee

## BOTANY.

5. Plants New to Indiana VII, 7 min.....C. C. Dean
6. The Effect of Centrifugal Force in Plants, 10 min.....F. M. Andrews
7. The Trees of White County with some Relation to those of the  
State, 15 min.....L. H. Heimlich
8. Supplementary List of the Rusts of Indiana, 10 min.....H. S. Jackson
9. An Accium on Red Clover—*Trifolium pratense*, 5 min....G. N. Hoffer



10. Parasitic Fungi Attacking Forest Trees and Shrubs (By Title)  
.....G. N. Hoffer
11. Additions to the List of Plant Diseases of Economic Importance in Indiana, 5 min.....Geo. A. Osner
12. An Elementary Discussion of Economic Growth of White Oak (By Title).....B. N. Prentice
13. Relation Between Nitrogen Compounds and Plant Growth in Winona Lake, 20 min.....Thurman B. Rice
14. A Variation in *Plantago lanceolata*, 5 min.....Paul Weatherwax
15. Fascination in *Oenothera biennis*, 5 min.....Paul Weatherwax
16. Weed Seeds in the Soil, 10 min.....F. J. Pipal
17. Experiments with Hydrogen Peroxide in Preventing Grain Smut, 5 min.....F. J. Pipal
18. Rusts of Hamilton and Marion Counties, Indiana H.....Guy W. Wilson
19. Deterioration in Asparagus, 10 min.....Katherine G. Bitting
20. Our Present Knowledge of the Indiana Flora, 10 min.  
.....Stanley Coulter.
- 20A. Peculiarity of Branching in *Cladophora*, 5 min. (Lantern)  
.....Mildred Nothnagel

## CHEMISTRY.

21. The Ethyl-sulphuric Acid Reaction, 10 min.....P. N. Evans
22. E. M. F. Measurements of the System  $H_2 - Pt - 0.1 N (HCl + KCl) - Hg_2 Cl_2 - Hg$ , 10 min.....N. A. Loomis
23. Chemistry in Indiana. (By title), 20 min.....J. H. Ransom
24. Determination of Sulphur in Iron Pyrites, 5 min.....Wm. M. Blanchard
35. Rate of Humification of Green Manures, 10 min.....R. H. Carr
26. Indiana Soils Containing Excess Soluble Salts, 10 min.....S. D. Conner
- 26A. The Effect of Certain Dissolved Salts upon the Cohesion of Water, 10 min. (Lantern).....Edwin Morrison
- 26B. The Preparation of  $CO_2$ -free Volumetric Solution of Acids and Alkalies, 10 min.....Wm. F. Epple

## ENGINEERING.

27. Pressure on Objects in a Moving Current of Air (Illustr.), 15 min.  
.....Albert Smith

## GEOLOGY AND GEOGRAPHY.

28. Some Topographic Features of the Wabash Valley in Carroll County, 10 min.....F. J. Breeze
29. Diversion of Drainage from Indian Creek to Burnett Creek, Tippecanoe County, 5 min.....F. J. Breeze
30. Notes on the Hardness of Kunzite stellite, 10 min.....F. B. Wade

31. The Tornado of Northern Washington Co., Ind., Jan. 19, 1916  
(Illustr.), 10 min. . . . . Clyde A. Malott
32. Some Peculiarities of Blue River, Indiana. . . . . Clyde A. Malott
33. The Wabash Valley and the Maumee Outlet, 15 min.  
. . . . . C. H. Dryer and B. K. Shoekel
- 33A. The Fossil Plants of the Lower Coal Measures of Indiana  
. . . . . Thomas F. Jackson

#### MATHEMATICS.

34. A Direct Proof of Poincaré's Last Theorem, 20 min  
. . . . . Tobias Dautzig
- 34A. The Use of Mathematics in the Sciences, 10 min . . . . . Geo. Spitzer
- 34B. What Might Have Been. . . . . C. A. Waldo

#### PHYSICS.

35. An Investigation of the Nature of the Electric Spark in Air,  
10 min. (Lantern) . . . . . Arthur L. Foley
36. A Photographic Study of the Velocity of Sound Waves in Tubes  
and between Walls, 10 min. (Lantern) . . . . . Arthur L. Foley
37. New Methods of Constructing Condensers, 5 min. . . . . Arthur L. Foley
38. A Kinetic Model of an Electron Atom, 10 min. . . . . Rolla R. Ramey
39. A Preliminary Account of an Experiment on X-Ray Diffraction  
Fringes, 10 min . . . . . Mason E. Hufford
40. A Photographic Investigation of the Vibratory Character of  
Explosion Waves, 10 min. . . . . John B. Dutcher
41. An Investigation to Determine the Best Conditions for the Pro-  
jection of the Brownian Monument, 10 min. . . . . Charles Hire
42. Some Peculiar Effect Produced on Photographic Plates When  
Placed in the Neighborhood of High Potential Discharges  
5 min. . . . . Arthur L. Foley
43. A Photographic Investigation of the Effect of Inductance and  
Capacity on the Electric Spark. . . . . Arthur L. Foley
- 43a. A New Form of Telescope Mounting. . . . . W. A. Cogshall

#### ZOOLOGY.

44. A List of Indiana Dragonflies, 5 min . . . . . E. B. Williamson
45. Field Notes on Distribution and Life Habits of the Tiger  
Beetles of Indiana, 10 min. . . . . Wm. M. Goldsmith
46. The Respiratory Mechanism of Two Rare Amphibians (Typh-  
lomolge and Ichthyophis), 10 min. . . . . H. L. Bruner.
47. The Smooth Nasal Muscles of Reptiles, 10 min. . . . . H. L. Bruner
48. Further Notes on Indiana Birds, 10 min. . . . . Amos W. Butler
49. Another South American Expedition, 10 min. . . . . C. H. Eigenmann

50. The Ants of Indiana (By Title).....M. W. Wheeler  
 51. Bird Censuses, 5 min.....M. L. Fisher  
 52. The Time Birds Get Up in the Morning, 5 min.....M. L. Fisher  
 53. Multiple Allelomorphs and Multiple Factors in Heredity,  
     10 min.....R. R. Hyde  
 53A. The Turtles and Batrachians of the Lake Maxinkuekee Region,  
     20 min.....Barton Warren Evermann and H. Walton Clark  
 53B. Chief Moses Day—Day-by-way-waindung.....Albert B. Reagan

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On account of the many centennial papers which have taken much of the space in the present publication, a few papers have been left unpublished. Should the authors desire these papers may be re-entered in the next year's program and printed in the next year's Proceedings.

The paper "Our Present Knowledge of the Indiana Flora" by Stanley Coulter has been withheld by the request of the author. This paper considers some 500 species not included in the present state catalogue. It will be published in the next year's Proceedings.

EDITOR