

PROCEEDINGS

OF THE

Indiana Academy of Science

1915

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H. E. BARNARD, Editor

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INDIANA ACADEMY OF SCIENCE  
BLOOMINGTON, INDIANA

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1916



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# CONSTITUTION.

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## 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. 5. 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.

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## 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 1915-1916.

The appropriation for the publication of the proceedings of the Academy during the years 1915 and 1916 was increased by the Legislature in the General Appropriation bill, approved March 9, 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 1915 shall be available for 1916, and that any unexpended balance in 1916 shall be available in 1917.

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

SEC. 602. Whoever kills, traps or has in his possession any wild bird, or whoever sells or offers the same for sale, or whoever destroys the nest or eggs of any wild bird, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined not less than ten dollars nor more than twenty-five dollars: *Provided*, That the provisions of this section shall not apply to the following named birds: The Anatidae, commonly called swans, geese, brant, river and sea duck; the Rallidae, commonly called rails, coots, mud-hens gallinules; the limicolae, commonly called shore birds, surf birds, plover, snipe, woodcock, sandpipers, tattlers and curlew; the Gallinae, commonly called wild turkeys, grouse, prairie chickens, quails and pheasants;

nor to English or European house sparrows, crows, hawks or other birds of prey. Nor shall this section apply to persons taking birds, their nests or eggs, for scientific purposes, under permit, as provided in the next section.

SEC. 603. Permits may be granted by the Commissioner of Fisheries and Game 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 such Commissioner written testimonials from two well-known scientific men certifying to the good character and fitness of such applicant to be entrusted with such privilege, and pay to such Commissioner one dollar therefor and file with him a properly executed bond in the sum of two hundred dollars, payable to the State of Indiana, conditioned that he will obey the terms of such permit, and signed by at least two responsible citizens of the State as sureties. The bond may be forfeited, and the permit revoked upon proof to the satisfaction of such Commissioner that the holder of such permit has killed any bird or taken the nest or eggs of any bird for any other purpose than that named in this section.

#### 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.

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## OFFICERS, 1915-1916.

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PRESIDENT,

ANDREW J. BIGNEY.

VICE-PRESIDENT,

AMOS W. BUTLER.

SECRETARY,

HOWARD E. ENDERS.

ASSISTANT SECRETARY,

E. B. WILLIAMSON.

PRESS SECRETARY,

FRANK B. WADE.

TREASURER,

WILLIAM M. BLANCHARD.

EDITOR,

H. E. BARNARD.

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### EXECUTIVE COMMITTEE:

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

## CURATORS:

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

## COMMITTEES ACADEMY OF SCIENCE, 1915-1916.

*Program.**Membership.*

STANLEY COULTER, Lafayette	E. R. CUMMINGS, Bloomington
L. F. BENNETT, Valparaiso	EDWIN MORRISON, Richmond
SEVERANCE BURRAGE, Indianapolis	H. L. BRUNER, Indianapolis

*Nominations.**Auditing.*

WILBUR A. COGSHALL, Bloomington	J. P. NAYLOR, Greencastle
W. A. McBETH, Terre Haute	GLENN CULBERTSON, Hanover
A. S. HATHAWAY, Terre Haute	

*State Library.**Restriction of Weeds and Diseases.*

W. S. BLATCHLEY, Indianapolis	ROBERT HESSLER, Logansport
A. W. BUTLER, Indianapolis	F. M. ANDREWS, Bloomington
JAMES BROWN, Indianapolis	J. N. HURTY, State House, Indianapolis
	STANLEY COULTER, Lafayette
	D. M. MOTTIER, Bloomington

*Biological Survey.**Academy to State.*

C. C. DEAM, Bluffton	R. W. McBRIDE, Indianapolis
H. W. ANDERSON, Crawfordsville	GLENN CULBERTSON, Hanover
GEORGE N. HOFFER, West Lafayette	H. E. BARNARD, Indianapolis
U. O. COX, Terre Haute	A. W. BUTLER, Indianapolis
J. N. NIEUWLAND, Notre Dame	W. W. WOOLLEN, Indianapolis

*Distribution of Proceedings.*

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

*Publication of Proceedings.*

H. E. BARNARD, Editor, Indianapolis  
C. R. DRYER, Fort Wayne  
M. E. HAGGERTY, Bloomington  
R. R. HYDE, Terre Haute  
J. S. WRIGHT, Indianapolis

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.....	.....	.....	A. C. 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. McBeth.
1903-1904	C. L. Mees.....	John S. Wright.....	J. H. Ransom.....	G. A. Abbott.....	W. A. McBeth.
1904-1905	John S. Wright.....	Lynn B. McMullen.....	J. H. Ransom.....	G. A. Abbott.....	W. A. McBeth.
1905-1906	Robert Hessler.....	Lynn B. McMullen.....	J. H. Ransom.....	Charles R. Clark.....	W. A. McBeth.
1906-1907	D. M. Mottier.....	Lynn B. McMullen.....	J. H. Ransom.....	G. A. Abbott.....	W. A. McBeth.
1907-1908	Glenn Culbertson.....	J. H. Ransom.....	A. J. Bigney.....	G. A. Abbott.....	W. A. McBeth.
1908-1909	A. L. Foley.....	J. H. Ransom.....	A. J. Bigney.....	G. A. Abbott.....	W. A. McBeth.
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.....	H. E. Enders.....	F. B. Wade.....	W. A. Cogshall.
1914-1915	Wilbur A. Cogshall.....	A. J. Bigney.....	H. E. Enders.....	F. B. Wade.....	W. M. Blanchard.
1915-1916	A. J. Bigney.....	Howard E. Enders.....	E. B. Williamson.....	F. B. Wade.....	W. M. Blanchard.

\*Deceased.

## MEMBERS.\*

## FELLOWS.

- ††Abbott, G. A., Grand Forks, N. Dak. . . . . †1908  
 Professor of Chemistry, University of North Dakota.  
 Chemistry.
- Aley, Robert J., Orono, Me. . . . . 1898  
 President of University of Maine.  
 Mathematics and General Science.
- Anderson, H. W., 1 Mills Place, Crawfordsville, Ind. . . . . 1912  
 Professor of Botany, Wabash College.  
 Botany.
- Andrews, F. M., 744 E. Third St., Bloomington, Ind. . . . . 1911  
 Assistant Professor of Botany, Indiana University.  
 Botany.
- Arthur, Joseph C., 915 Columbia St., Lafayette, Ind. . . . . 1894  
 Professor of Vegetable Physiology and Pathology, Purdue University.  
 Botany.
- Barnard, H. E., Room 20 State House, Indianapolis, Ind. . . . . 1910  
 Chemist to Indiana State Board of Health.  
 Chemistry, Sanitary Science, Pure Foods.
- Blanchard, William M., 1008 S. College Ave., Greencastle, Ind. . . . .  
 Professor of Chemistry, DePauw University, Greencastle, Ind.  
 Organic Chemistry.
- Beede, Joshua W., cor. Wall and Atwater Sts., Bloomington, Ind. . . . . 1896  
 Associate Professor of Geology, Indiana University.  
 Stratigraphic Geology, Physiography.

\*Every effort has been made to obtain the correct address and occupation of each member, and to learn what line of science he is interested in. 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.

††Non-resident.

- Benton, George W., 100 Washington Square, New York, N. Y. . . . . 1896  
 Editor in Chief, American Book Company.
- Bigney, Andrew J., Moores Hill, Ind. . . . . 1897  
 President and Professor of Biology and Geology, Moores Hill  
 College.  
 Biology and Geology.
- Bitting, Catharine Golden, Washington, D. C. . . . . 1895  
 Microscopic Expert, Pure Food, National Canners Laboratory.  
 Botany.
- Blatchley, W. S., 1558 Park Ave., Indianapolis, Ind. . . . . 1893  
 Naturalist.  
 Botany, Entomology and Geology.
- Bodine, Donaldson, Four Mills Place, Crawfordsville, Ind. . . . . 1899  
 Professor of Geology and Zoology, Wabash College.  
 Entomology and Geology.
- Breeze, Fred J., care American Book Company, New York, N. Y. . . . . 1910  
 With the American Book Company.  
 Geography.
- Bruner, Henry Lane, 324 S. Ritter Ave., Indianapolis, Ind. . . . . 1899  
 Professor of Biology, Butler College.  
 Comparative Anatomy, Zoology.
- Bryan, William Lowe, Bloomington, Ind. . . . .  
 President Indiana University.  
 Psychology.
- Burrage, Severance, care Eli Lilly Co., Indianapolis, Ind. . . . . 1898  
 Charge of Biological Laboratory, Eli Lilly Co.  
 Bacteriology, Sanitary Science.
- Butler, Amos W., 52 Downey Ave., Irvington, Ind. . . . . 1893  
 Secretary, Indiana Board of State Charities.  
 Vertebrate Zoology, Anthropology, Sociology.
- Cogshall, Wilbur A., 423 S. Fess Ave., Bloomington, Ind. . . . . 1906  
 Associate Professor of Astronomy, Indiana University.  
 Astronomy and Physics.
- Cook, Mel T., New Brunswick, N. J. . . . . 1902  
 Professor of Plant Pathology, Rutgers College.  
 Botany, Plant Pathology, Entomology.

- Coulter, John M., care University of Chicago, Chicago, Ill. . . . . 1893  
 Head Department of Botany, Chicago, University.  
 Botany.
- Coulter, Stanley, 213 S. Ninth St., Lafayette, Ind. . . . . 1893  
 Dean School of Science, Purdue University.  
 Botany, Forestry.
- Cox, Ulysses O., P. O. Box 81, Terre Haute, Ind. . . . . 1908  
 Head Department Zoology and Botany, Indiana State Normal.  
 Botany, Zoology.
- Culbertson, Glenn, Hanover, Ind. . . . . 1899  
 Chair Geology, Physics and Astronomy, Hanover College.  
 Geology.
- Cumings, Edgar Roscoe, 327 E. Second St., Bloomington, Ind. . . . . 1906  
 Professor of Geology, Indiana University.  
 Geology, Paleontology.
- Davisson, Schuyler Colfax, Bloomington, Ind. . . . . 1908  
 Professor of Mathematics, Indiana University.  
 Mathematics.
- Deam, Charles C., Bluffton, Ind. . . . . 1910  
 Druggist.  
 Botany.
- Dennis, David Worth, Richmond, Ind. . . . . 1895  
 Professor of Biology, Earlham College.  
 Biology.
- Dryer, Charles R., Oak Knoll, Fort Wayne, Ind. . . . . 1897  
 Geographer.
- Dutcher, J. B., Bloomington, Ind. . . . .  
 Assistant Professor of Physics, Indiana University.  
 Physics.
- Eigenmann, Carl H., 630 Atwater St., Bloomington, Ind. . . . . 1893  
 Professor Zoology, Dean of Graduate School, Indiana University.  
 Embryology, Degeneration, Heredity, Evolution and Distribution  
 of American Fish.
- Enders, Howard Edwin, 105 Quiney St., Lafayette, Ind. . . . . 1912  
 Associate Professor of Zoology, Purdue University.  
 Zoology.

- Evans, Percy Norton, Lafayette, Ind. . . . . 1901  
 Director of Chemical Laboratory, Purdue University.  
 Chemistry.
- Foley, Arthur L., Bloomington, Ind. . . . . 1897  
 Head of Department of Physics, Indiana University.  
 Physics.
- Golden, M. J., Lafayette, Ind. . . . . 1899  
 Director of Laboratories of Practical Mechanics, Purdue University.  
 Mechanics.
- ††Goss, William Freeman M., Urbana, Ill. . . . . 1893  
 Dean of College of Engineering, University of Illinois.
- Haggerty, M. E., Bloomington, Ind. . . . . 1913
- Hathaway, Arthur S., 2206 N. Tenth St., Terre Haute, Ind. . . . . 1895  
 Professor of Mathematics, Rose Polytechnic Institute.  
 Mathematics, Physics.
- Hessler, Robert, Logansport, Ind. . . . . 1899  
 Physician.  
 Biology.
- Hilliard, C. M., Simmons College, Boston, Mass. . . . . 1913
- Hoffer, Geo. N., West Lafayette, Ind. . . . . 1913
- Hurty, J. N., Indianapolis, Ind. . . . . 1910  
 Secretary, Indiana State Board of Health.  
 Sanitary Science, Vital Statistics, Eugenics.
- †Huston, H. A., New York City. . . . . 1893
- Hyde, Roseoc Raymond, Terre Haute. . . . .  
 Assistant Professor, Physiology and Zoology, Indiana State Normal.  
 Zoology, Physiology, Bacteriology.
- Kenyon, Alfred Monroe, 315 University St., West Lafayette, Ind. . . . .  
 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, Ind. . . . . 1896  
 Head of Department of Chemistry, Indiana University.  
 Organic and Biological Chemistry.

- McBeth, William A., 1905 N. Eighth St., Terre Haute, Ind. . . . . 1904  
 Assistant Professor Geography, Indiana State Normal.  
 Geography, Geology, Scientific Agriculture.
- †Marsters, V. F., Santiago, Chile. . . . . 1893
- Mees, C. L., Terre Haute, Ind. . . . . 1894  
 President of Rose Polytechnic Institute.
- Middleton, A. R., West Lafayette, Ind. . . . .  
 Professor of Chemistry, Purdue University.  
 Chemistry.
- †Miller, John Anthony, Swarthmore, Pa. . . . . 1904  
 Professor of Mathematics and Astronomy, Swarthmore College.  
 Astronomy, Mathematics.
- Moenkhaus, William J., 501 Fess Ave., Bloomington, Ind. . . . . 1901  
 Professor of Physiology, Indiana University.  
 Physiology.
- Moore, Richard B., Denver, Colo. . . . . 1893  
 With U. S. Bureau of Mines.  
 Chemistry, Radio-activity.
- Morrison, Edwin, 80 S. W. Seventh St., Richmond. . . . .  
 Professor of Physics, Earlham College.  
 Physics and Chemistry.
- Mottier, David M., 215 Forest Place, Bloomington, Ind. . . . . 1893  
 Professor of Botany, Indiana University.  
 Morphology, Cytology.
- Naylor, J. P., Greencastle, Ind. . . . . 1903  
 Professor of Physics, Depauw University.  
 Physics, Mathematics.
- Nieuwland, J. N., The University, Notre Dame, Ind. . . . .  
 Professor of Botany, Editor Midland, Naturalist.  
 Systematic Botany, Plant Histology, Organic Chemistry.
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 Professor of Botany.  
 Botany and Human Physiology.
- Weir, Daniel T., Indianapolis.  
 Supervising Principal, care School office.  
 School Work.
- Weyant, James E., Indianapolis.  
 Teacher of Physics, Shortridge High School.  
 Physics.
- Wheeler, Virges, Montmorenci.
- Whiting, Rex Anthony, 118 Marsteller St., West Lafayette.  
 Veterinary.
- Wiancko, Alfred T., Lafayette.  
 Chief in Soils and Crops, Purdue University.  
 Agronomy.
- Wicks, Frank Scott Corey, Indianapolis.  
 Sociology.
- Wiley, Ralph Benjamin, West Lafayette.  
 Hydraulic Engineering, Purdue University.
- Williams, Kenneth P., Bloomington.  
 Instructor in Mathematics, Indiana University.  
 Mathematics, Astronomy.
- Williamson, E. B. Bluffton.  
 Cashier, The Wells County Bank.  
 Dragonflies.
- Wilson, Charles E., Bloomington.  
 Graduate Student, Zoology, Indiana University.  
 Zoology.
- Wilson, Mrs. Etta, 1044 Congress Ave., Indianapolis, Ind.  
 Botany and Zoology.
- Wilson, Guy West, Assistant Professor Mycology and Plant Pathology,  
 State University, Iowa City, Ia.
- Wissler, W. A., Bloomington.  
 Chemistry.

Wood, Harry W., 84 North Ritter Ave., Indianapolis. Teacher, Manual Training High School.	
Wood, Harvey Geer, West Lafayette, Ind. Physics.	
Woodburn, Wm. L., 902 Asbury Ave., Evanston, Ill. Instructor in Botany, Northwestern University. Botany and Bacteriology.	
Woodhams, John H., care Houghton Mifflin Co., Chicago, Ill. Traveling Salesman. Mathematics.	
Wootery, Ruth, Bloomington, Ind.	
Yocum, H. B., Crawfordsville.	
Young, Gilbert A., 725 Highland Ave., Lafayette. Head of Department of Mechanical Engineering, Purdue University.	
Zehring, William Arthur, 303 Russell St., West Lafayette. Assistant Professor of Mathematics, Purdue University. Mathematics.	
Zeleny, Charles, University of Illinois, Urbana, Ill. Associate Professor of Zoology. Zoology.	
Zufall, C. J., Indianapolis, Ind.	
Fellows.....	80
Members, Active.....	277
Members, Non-resident.....	29
Total.....	386

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

BLOOMINGTON, INDIANA, THURSDAY—SATURDAY, MAY 20-22, 1915.

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The Spring meeting of the Indiana Academy of Science was held at Bloomington, Thursday to Saturday, May 20-22, 1915.

The first session was held in the Physics Lecture room in Science Hall at 8 o'clock P. M. May 20th to listen to a lecture on Electrical Discharges by Dr. A. L. Foley, Head of the Department of Physics in Indiana University. It was fully illustrated. It was very interesting and instructive and greatly appreciated by the crowded house. After this lecture, the Faculty Club of the University entertained the Academy with a "Get-Acquainted Hour" which was very pleasant.

The annual tramp had been planned for eight o'clock the next morning, but on account of a heavy rain we could not start until ten o'clock. The remainder of the day was beautiful. The route was up Rocky Branch to Griffey Creek, then up that creek and one of its branches to the University Reservoir. Examining the reservoir and pumping station was full of interest.

A special committee of the University Faculty arrived in advance with a picnic lunch. The meat was roasted over the blazing fires. The fifty-one persons present testified to the superior quality of this picnic dinner.

After lunch, the Academy was met by automobiles which took them to the stone district south of Bloomington. Visiting some of the quarries and mills was particularly instructive.

At seven o'clock the members had a complimentary dinner at the Commons. The members lingered till a late hour telling stories and making speeches.

On Saturday morning a number of the members took the train at 6:20 for Cave farm near Mitchell. On arriving at Mitchell, they encountered a severe rain-storm which continued until noon. This prevented them from going to the farm.

ANDREW J. BIGNEY,  
Secretary.



MINUTES OF THE THIRTY-FIRST ANNUAL MEETING  
INDIANA ACADEMY OF SCIENCE,

CLAYPOOL HOTEL, INDIANAPOLIS, IND.,

December 3, 1915

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The executive committee of the Indiana Academy of Science met in the Moorish Room of the Claypool Hotel and was called to order by the President, W. A. Cogshall. The following members were present: W. A. Cogshall, W. A. McBeth, A. W. Butler, Glenn Culbertson, Stanley Coulter, A. L. Foley, Severance Burrage, R. W. McBride, Will Scott, F. B. Wade, W. M. Blanchard, C. R. Dryer, J. S. Wright and A. J. Bigney. The minutes of the executive committee meeting of 1914 were read and approved.

The President called for reports from the standing committees:

*Program*—Will Scott, chairman, reported work performed as indicated by printed program.

On motion, \$100 was appropriated for the services and traveling expenses of Dr. C. B. Davenport of Cold Spring Harbor, New York, the principal speaker at the evening session.

*Treasurer*—W. M. Blanchard reported as follows:

Received from Treasurer of 1914.....	\$241.02
Collected—1915.....	225.00
	<hr/>
Total.....	\$466.02
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Expenditures—1915.....	139.02
Balance.....	327.00
	<hr/>
	\$466.02

*State Library*—A. W. Butler reporting—Some progress had been made toward binding exchanges. Two hundred fifty copies of the Proceedings go to Libraries. Many copies had to be returned. On motion, the committee was ordered to go over the list of applications for Proceedings so as to ascer-

tain those who are in good standing, and such could receive copies. F. B. Wade reported a set of Chemical Journals at City Library.

After much discussion, on motion, the committee decided that as far as possible the Proceedings should be sent only to those who pay their dues.

*Biological Survey*—No report.

*Distribution of Proceedings*—A. J. Bigney reporting. The copies were in the hands of the State Librarian and would be mailed in a few days. Copies would be sent to the meeting so the members present could receive them.

*Membership*—Report to be made at general session.

*Auditing*—No report.

*Restriction of Weeds and Diseases*—No report.

*Relation of the Academy to the State*—R. W. McBride reporting. The appropriation of \$1,200 had been made by the State.

*Publication of Proceedings*—Editor was not present. Dr. C. R. Dryer reported that the work had been done and that they were ready for distribution. On motion, it was decided that no paper should be received for publication after February 1st.

Attention was called to the Pan-American Scientific Congress that would be held by the U. S. Government in Washington beginning December 29, 1915.

The incoming president, later, appointed C. H. Eigenmann of Bloomington as delegate, and A. W. Butler of Indianapolis as alternate.

#### GENERAL SESSION—1:30.

ASSEMBLY HALL, CLAYPOOL HOTEL,

December 3, 1915.

The Indiana Academy of Science met for its regular program, W. A. Cogshall, President, in the chair.

The minutes of the Executive Committee were read and approved. Dr. H. E. Barnard, Editor, reported that the Proceedings for 1914 had been published. He stated the great difficulty of securing the papers from the members.

On motion of A. W. Butler, the following resolution was adopted:

WHEREAS, the Scientific investigations and accurate records kept by representatives of the United States Fish Commission, concerning Lake Maxinkuekee, Ind., in our opinion make the report that has been made by

Dr. B. W. Evermann one of the most valuable compilations that has been prepared, and

WHEREAS, we learn that the Commission is unable to publish it out of its funds, therefore

BE IT RESOLVED, By the Indiana Academy of Science, in regular session, that we express our belief in the great value of this work, in its importance to scientific students, not only in America, but throughout the world, and in the desirability of having it published at an early date so as to be accessible, and

BE IT FURTHER RESOLVED, That a committee of five (5) members be appointed to represent the Academy in an endeavor to secure the early publication of this report.

On motion, the Academy appointed the following Committee: Amos W. Butler, Dr. Charles B. Stoltz, C. C. Deam, D. M. Mottier, and Glenn Culbertson.

The General Papers were then called for; "1" to "6" responded, after which the Academy went into Sectional Meetings as follows:

Section A.—Chemistry, Geology, Mathematics, Physics. W. A. Cogshall, Chairman, A. J. Bigney, Secretary.

Section B.—Anatomy, Bacteriology, Botany, Zoology. Stanley Coulter, Chairman, H. E. Enders, Secretary.

Adjourned at 5:30 for dinner at the Claypool at 6:15 at which the President's address was read on the "Origin of the Universe."

9:00 A. M. December 4.

#### GENERAL SESSION.

Business—

On motion of W. M. Blanchard the following resolutions was adopted:

RESOLVED, as the sense of the Indiana Academy of Science that the Commission having in charge the matter of adequate and proper celebration of the State's Centennial, could do no more fitting and practical thing in the way of a permanent memorial of the one hundredth anniversary of the State's admission to the Union, than to inaugurate at this time and carry to consummation a plan to purchase, through action by the General Assembly several tracts of land in Indiana for public park purposes for the people.

On motion the following committee was appointed to carry out the pro-

visions of the resolution: Stanley Coulter, W. W. Woolen, and R. W. McBride.

As the Historical Commission was in session in the State House, the Committee at once presented the resolution to the Commission, also to the County Chairmen of the Commission, which was also in session. It was heartily endorsed by both bodies and the Academy thanked for its interest in the proposed Centennial celebration.

A copy of this resolution to be mailed to Mr. Harlow Lindley, Department of Archives and History, Indiana State Library.

Prof. L. F. Bennett, of Valparaiso College, extended an invitation to the Academy to hold the Spring meeting of 1916 at Valparaiso. On motion, the invitation was unanimously accepted.

On motion of A. W. Butler the Academy urged that all members and all organizations with which they are connected, use their influence to prevent any legislation for changing our present Fish and Game Laws.

The Membership Committee reported the following new members:

Dr. John Merton Aldrich, S. Grant St., W. Lafayette, Ind., Zoology and Entomology.

Russell Baldwin, Richmond, Ind., Physics.

Colonzo C. Balls, Russiaville, Ind., Botany.

Guy Richard Bisby, Lafayette, Ind., Botany.

Joseph Blose, Culerville, Ind., Physics.

Eugene Butler, Richmond, Ind., Physics and Mathematics.

Charles Crampton, Bloomington, Ind., Psychology.

A. B. Davis, Eli Lilly & Co., Indianapolis, Ind., Chemistry.

Elizabeth Downhour, 2307 Talbott Ave., Indianapolis, Ind., Geology and Botany.

Jesse Lyle Essex, 523 Russell St., W. Lafayette, Ind., Chemistry.

Leonard L. Huber, Hanover, Ind., Zoology.

Cloyd C. Hurd, Crawfordsville, Ind., Zoology.

H. Kremers, Wabash College, Crawfordsville, Ind., Chemistry.

John F. McBride, 340 S. Ritter Ave., Indianapolis, Ind., Chemistry.

Burr N. Prentice, 216 Sheetz, W. Lafayette, Forestry.

Charles C. Rees, 225 Sylvia St., W. Lafayette, Ind., Botany.

Robert G. Schaeffer, 508 E. Third St., Bloomington, Ind., Chemistry and Botany.

Ralph W. Showalter, Eli Lilly & Co., Indianapolis, Ind., Biology.

Rex Anthony Whiting, 118 Marsteller St., W. Lafayette, Ind., Veterinary.

Mrs. Etta Wilson, 1044 Congress Ave., Indianapolis, Ind., Botany and Zoology.

Herbert Spencer Jackson, 127 Waldron St., Lafayette, Ind., Botany.

Emory Hutchison, Atwater St., Bloomington, Ind., Zoology.

Harvey Geer Wood, West Lafayette, Ind., Physics.

Floyd R. Carter, Frankfort, Ind., Botany.

Irene Graybook, New Albany, Ind., Botany.

Paul Harmon, Bloomington, Ind., Physiology.

Mildred Hoge, Kirkwood, Bloomington, Ind., Zoology.

On motion they were elected.

The Committee on the nomination of officers, Severance Burrage, Chairman, reported as follows:

President—Andrew J. Bigney, Moores Hill College, Moores Hill.

Vice-President—Amos W. Butler, Indianapolis, Ind.

Secretary—Howard E. Enders, Purdue University, West Lafayette.

Assistant Secretary—E. B. Williamson, Bluffton.

Treasurer—W. M. Blanchard, Greencastle.

Press Secretary—F. B. Wade, Indianapolis, Ind.

Editor—H. E. Barnard.

On motion the report was adopted and the officers elected.

On motion of Prof. John M. Aldrich the following resolution was adopted:

WHEREAS, Thomas Say was one of the great entomologists of the world in his time, prominent among the men who made New Harmony, Ind., the scientific center of the United States about 1825, his grave at that place is one of the shrines of Indiana history, the Indiana Academy of Science therefore feels an especial interest in the project to establish a memorial to Say's name in the form of a publishing foundation for works in entomology. It is an ideal memorial to an unselfish and deserving scientific man, and at the same time promises great value in the cause of entomology for the present and future.

THEREFORE BE IT RESOLVED, That we commend the plan of the Say Foundation to the consideration of the people of Indiana as especially worthy of consummation in the Centennial year of our state.

Sections A and B then continued their programs until they were completed.

Adjourned.

W. A. COGSHALL,

President.

A. J. BIGNEY,

Secretary.



PROGRAM OF THE THIRTY-FIRST ANNUAL MEETING  
INDIANA ACADEMY OF SCIENCE,

CLAYPOOL HOTEL—INDIANAPOLIS

FRIDAY AND SATURDAY

DECEMBER 3 AND 4, 1915

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GENERAL PROGRAM.

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FRIDAY

MEETING OF THE EXECUTIVE COMMITTEE.....	10:30 A. M.
GENERAL SESSION.....	1:30 P. M.
SECTIONAL MEETINGS.....	3:45 P. M.
INFORMAL DINNER.....	6:00 P. M.
SYMPOSIUM ON HEREDITY.....	8:00 P. M.

SATURDAY

GENERAL SESSION.....	9:00 A. M.
SECTIONAL MEETINGS.....	9:45 A. M.

THE PRESIDENTIAL ADDRESS

The address of the retiring president, WILBUR A. COGSHALL, will be delivered at the informal dinner.

THE SYMPOSIUM ON HEREDITY

A Resumé of the Work on Heredity. DR. C. H. EIGENMANN, Dean of the Graduate School, Indiana University.

Fifteen years of Mendelism; Mendelism, the Key to the Architecture of The Germ-plasm. DR. ROSCOE R. HYDE, Professor of Zoology, Indiana State Normal School.

Heredity in Man. DR. CHARLES B. DAVENPORT, Director of the Station for Experimental Evolution, Cold Spring Harbor, New York.

## PAPERS TO BE READ

## GENERAL

1. A Memoir of Donaldson Bodine . . . . . H. W. ANDERSON
2. Memoir of Josiah T. Scovel, 20 min. . . . . CHARLES R. DRYER
3. Twelve of Nature's Beauty Spots in Indiana, 45 min., lantern,  
EDWARD BARRETT
4. Concerning the Report of the Survey of Lake Maxinkuckee,  
10 min. . . . . AMOS W. BUTLER
5. A Field Trip in General Science, 15 min. . . . . B. H. SCHOCKEL
6. The Tobacco Problem (abstract) 20 min. . . . . ROBERT HESSLER

## ANATOMY

7. Histological Changes in Testes of Vasectomized Animals,  
10 min. . . . . BURTON D. MYERS

## BACTERIOLOGY

8. The Minimum Lethal Infecting Dose of Trypanosomes,  
25 min. . . . . C. A. BEHRENS
9. Tolerance of Soil Bacteria to Media Variations, 20 min. . . . . H. A. NOYES

## BOTANY

10. Some Methods for the Study of Plastids in Higher Plants,  
10 min. . . . . D. M. MOTTIER
11. The Morphology of *Riccia fluitans*, 5 min. . . . . FRED DONAGHY
12. Plants not Hitherto Reported from Indiana. VI.  
3 min. . . . . CHAS. C. DEAM
13. Indiana Fungi. III. 5 min. . . . . J. M. VAN HOOK
14. The Second Blooming of *Magnolia soulangiana*, 5 min. . . . . D. M. MOTTIER
15. Additional Notes on Rate of Tree Growth, 10 min. . . . . STANLEY COULTER
16. The Effect of Centrifugal Force on Plants, 15 min. . . . . F. M. ANDREWS
17. Some Preliminary Notes on the Stem Analyses of White Oak,  
10 min. . . . . BURR N. PRENTICE
18. Botanic vs. Biologic Gardens. Illustrated by Specimens,  
10 min. . . . . ROBERT HESSLER

## CHEMISTRY

19. Soluble Salts of Aluminum in Water from an Indiana Coal  
Mine, 5 min. . . . . S. D. CONNER

20. Detection of Nickel in Cobalt Salts, 8 min.,  
A. R. MIDDLETON and H. L. MILLER
21. The Use of the Spectrophotometer in Chemical Analysis,  
10 min. . . . .GEORGE SPITZER and D. C. DUNCAN
22. The Different Methods of Estimating Protein in Milk. .GEORGE SPITZER

## GEOLOGY

23. A New Cave Near Versailles, 5 min. . . . .A. J. BIGNEY
24. Loess Deposits in Vigo County, Indiana, 10 min. . . . .WM. A. McBETH
25. Volume of the Glacial Wabash River, 10 min. . . . .WM. A. McBETH
26. A Geologic Map of the Terre Haute Region, 5 min. . . . .B. H. SCHOCKEL
27. A Bibliography of Geographical Material, 10 min. . . . .B. H. SCHOCKEL
28. Settlement and Development of the Lead and Zinc Mining Region  
of the Upper Mississippi, 20 min. . . . .B. H. SCHOCKEL
29. A Few Science Wonders of the Cement Age, 15 min.,  
lantern . . . . .F. W. GOTTLIEB
30. The Fauna of the Trenton and Black River Series of New  
York . . . . .H. N. CORYELL

## MATHEMATICS

31. Gamma Coefficients with Applications to the Solution of Dif-  
ference Equations and Determination of Symmetric Func-  
tions of the Roots of an Equation in the Terms of the  
Coefficients. 25 min. . . . .ARTHUR S. HATHAWAY
32. Some Determinants Connected with the Bernoulli Numbers,  
K. P. WILLIAMS
33. Some Relations of Plane to Spheric Geometry,  
10 min. . . . .DAVID A. ROTHROCK

## PHYSICS

34. Some Notes on the Mechanism of Light and Heat Radiations,  
15 min. . . . .JAMES E. WYANT
35. A Standard for the Measurement of High Voltages,  
10 min. . . . .C. FRANCIS HARDING
36. Ionization Produced by Different Thicknesses of Uranium  
Oxide, 5 min. . . . .EDWIN MORRISON
37. Radioactivity of Richmond Water, 5 min. . . . .EDWIN MORRISON

38. A Student Photographic Spectometer, 5 min.,  
lantern ..... EDWIN MORRISON
39. An Experimental Determination of the Velocity of Sound  
Waves of Different Intensities, 10 min., lantern.....ARTHUR L. FOLEY
40. A Simple Method of Harmonizing Leyden Jar Discharges,  
5 min., lantern.....ARTHUR L. FOLEY
41. An Electroscop for Measuring the Radioactivity of Soils,  
10 min., lantern.....R. R. RAMSEY
42. Some Photographs of Explosions in a Gas, 10 min.,  
lantern ..... JOHN B. DUTCHER
43. The Cause of the Variation in the Emanation Content of Spring  
Water, 10 min., lantern.....R. R. RAMSEY
44. A Standard Condenser of Small Capacity, 10 min.,  
lantern .....R. R. RAMSEY
45. A Comparison of Calculated and Experimental Radii of the  
Ring System by Diffraction and an Extension of Lommel's  
Work in Diffraction, 10 min., lantern.....MASON E. HUFFORD

## SOILS

46. Rate of Humification of Manures, 15 min.....R. H. CARR

## ZOOLOGY

47. An Instance of Division by Constriction in the Sea-Anemone,  
*Sagartia luciae*, 5 min.....DONALD W. DAVIS
48. Data on the Food of Nestling Birds, 15 min.  
WILL SCOTT and H. E. ENDERS
49. Two New Mutations and Their Bearing on the Question of  
Multiple Allelomorphs, 5 min.....ROSCOE R. HYDE
50. A Study of the Oxygenless Region of Center Lake, 10 min  
WILL SCOTT and H. G. IMEL
51. The Lakes of the Tippecanoe Basin.....WILL SCOTT