fibers in the tracheal end-cells.[2] The normal flash of the insect is undoubtedly under nervous control. The innervation of the luminous organs has been described by a number of observers, notably Bongardt and Geipel, who found nerve fibers penetrating the tracheal end-cells. Within these cells are muscle fibers radially arranged around the tracheole in such a manner that their contraction increases the size of its lumen. The tracheole is surrounded by a small band which has been thought to be composed of circular muscle fibers.[3] Evidence from experiments with gases shows that the tracheoles are never completely closed in the normal insect. It seems more likely that the band is an elastic, chitinous ring which keeps the tracheoles partially contracted and serves as a point of attachment for the radial muscle fibers.

In general, adrenalin causes the contraction of smooth muscle, its point of action being the "receptive substance" in the myo-neural junction of non-medullated nerves. Very little is known in regard to its effect on invertebrates, but if we assume that adrenalin causes the contraction of the muscle fibers of the tracheal end-cells, and through this the enlargement of the lumen of the tracheole, the explanation for the prolonged glow is obvious, since an abnormally large amount of air is admitted to the luminous tissue as long as the tracheoles are dilated.

A 1:1000 solution of adrenalin chloride was injected into the insect just posterior to the last pair of legs. The movements of the legs and abdomen, at first violent, gradually cease and with their cessation appears the steady glow. That this is not due to mechanical stimulation through pressure of the injected fluid may be shown by injecting physiological salt solution. In this case no glow occurs. Injected insects recover and show a normal behavior after about six hours.

The extent to which the adrenalin affects muscles other than those of the tracheal end-cells has not yet been thoroughly studied. It is certain that some of the other muscles are not contracted by the injection. The muscles of the occluding apparatus, structures which surround the base of each tracheal trunk just inside the stigma, compress the trachea by their contraction, thus preventing the entry of air into the tracheal system. Conversely, their relaxation permits free ingress of air. That these muscles are not contracted is shown by the reaction of an injected insect to an alternating atmosphere of oxygen and nitrogen. Under such conditions the glow of the luminous organ follows the alternation of the gases with beautiful precision, becoming brilliant in oxygen and being extinguished in nitrogen. This could not occur if the muscles of the occluding apparatus were contracted by the adrenalin, but it may be questioned whether they are relaxed or whether normal breathing movements continue after injection.

In order to see, if possible, the actual effect of the adrenalin on the tracheoles of the luminous organ a histological investigation of the tissue was made. The abdomens were cut from injected insects and normal controls and fixed at once in hot Bouin's fluid. An injected and normal abdomen were together embedded in celloidon and paraffin, cut at six microns and stained with iron-haemotoxylin. In the normal tissue the tracheoles could, in a few cases, be followed a short distance into the surrounding tissue. For the most part they could not be seen at all. In the adrenalin injected tissue the tracheoles were very prominent and could readily be followed through the tissue from one cylinder to another.

The results of this initial study of the action of drugs upon the luminescence of the firefly point to the following interpretation of the process:

The normal flash of the insect is directly due to nervous control, but it is also indirectly dependent upon breathing processes. During the respiratory cycle of an insect there is a phase when air is forced into the finest tracheoles by the coordinated contraction of the abdominal muscles and those of the occluding apparatus. Except when the insect is flashing, the air permitted to enter the tracheoles of the luminous tissue is regulated by the size of the elastic ring to an amount just sufficient for the respiratory needs of the luminous cells. By the contraction of the muscle fibers of the tracheal end-cells and the consequent distention of the elastic ring at the instant when the air in the tracheal system is under pressure a much greater amount of air is admitted to the tracheoles of the luminous organ, thus causing luminescence.

WM. S. CREIGHTON

PRINCETON UNIVERSITY

[2] For a general discussion of the gross structure and the histology of the luminous organs of fireflies see Dahlgren, "The Production of Light by Animals," *Jour. Franklin Ins.*, March and May, 1917.

[3] Dahlgren, *loc. cit.*

THE OHIO ACADEMY OF SCIENCE

THE thirty-sixth annual meeting of the Ohio Academy of Science was held at the Ohio State University, Columbus, Ohio, April 9 and 10, under the presidency of President Paul M. Rea, of the Cleveland Museum of Natural History, Cleveland, Ohio. The attendance was unusually large and enthusiastic, and the program was well received. Sixty-nine new members were elected and five members were elevated to the rank of fellows in the academy, namely, J. H.

Gourley, Nellie F. Henderson, Ondess L. Inman, Harry M. Johnson and H. C. Young.

Dr. A. E. Waller, treasurer, was unanimously elected to represent the academy at the International Botanical Congress to assemble at Ithaca, N. Y., next August.

At the suggestion of Dr. Landacre the academy authorized the president to appoint a committee to work toward and secure if possible a closer and more cordial cooperation between the biological and the medical schools of the state.

The following officers were elected for the ensuing year: *President,* William McPherson, Ohio State University; *vice-presidents—zoology,* J. A. Nelson, Mt. Vernon; *botany,* H. M. Benedict, Cincinnati; *geology,* Wilbur E. Stout, Columbus; *medical sciences,* Dr. E. R. Hayhurst, Columbus; *psychology,* Garry C. Myers, Cleveland; *physical sciences,* Charles R. Skinner, Delaware; *secretary,* William H. Alexander, Columbus; *treasurer,* A. E. Waller, Columbus.

Public lectures were given as follows: Invitation address on "The Evolution of the Grand Canyon Region," by Dr. Douglas Johnson, Columbia University, New York. Presidential address on "The Social Significance of Science," by President Paul M. Rea, Cleveland, Ohio.

At the general sessions seventeen papers were presented, including two symposia—the first on animal parasites and the second on biological training for medicine and dentistry. In the section of zoology eleven papers were read, in the section of botany sixteen, geology thirteen, medical sciences sixteen, psychology eight and in the physical sciences eight, giving a total of about ninety papers.

WILLIAM H. ALEXANDER,
Secretary

THE UTAH ACADEMY OF SCIENCES

THE nineteenth annual convention of the Utah Academy of Sciences was held at the University of Utah on April 2 and 3, 1926.

Mr. Edward E. Watson, consulting geologist for the Utah Oil Refining Company, delivered the principal address on Friday evening on oil possibilities in Utah. He pointed out in detail the reasons why the attempts to locate oil in the state have not been successful up to the past few months and why it has been located in apparently paying quantities recently at Moab. His address was timely and was listened to with keen interest.

The program on Saturday consisted of papers dealing with subjects of agriculture, mining and engineering, which were mainly of a practical nature. The pure sciences, physics, geology, mathematics and zoology were also well represented.

The convention closed with a business session at which the following officers were elected:

President, Dr. Thomas L. Martin, B. Y. U., Provo.
First Vice-president, Mr. R. A. Hart, Salt Lake City.
Second Vice-president, Dr. Jos. F. Merrill, U. of U., Salt Lake City.
Secretary, C. Arthur Smith, East High School, Salt Lake City.
Council, Dr. Willard Gardner, U. A. C., Logan.
Council, Dr. B. L. Richards, U. A. C., Logan.
Council, Mr. J. Cecil Alter, Salt Lake City.

It was voted to continue the academy's affiliation with the Pacific Division of the American Association for the Advancement of Science rather than transfer to the proposed Rocky Mountain Division.

The academy also voted to publish abstracts of the papers presented at the meeting allowing the authors to retain the ownership of the complete paper.

C. ARTHUR SMITH,
Permanent Secretary.

SALT LAKE CITY, UTAH

THE NORTH CAROLINA ACADEMY OF SCIENCE

THE twenty-fifth annual meeting of the North Carolina Academy of Science was held at Wake Forest College, April 30 and and May 1. The membership at present is approximately 250. The following officers were elected for the ensuing year:

President, Dr. Bert Cunningham, Duke University.
Vice-president, Dr. F. E. Rice, State College.
Secretary-treasurer, Dr. H. R. Totten, University of North Carolina.
Executive Committee, Dr. J. W. Nowell, Wake Forest; Dr. A. Henderson, University of North Carolina; Professor C. M. Heck, State College.

In addition to the usual business, the following resolutions were unanimously adopted:

The North Carolina Academy of Science desires to reiterate that if the present rate of progress and enlightenment in the State of North Carolina is to be maintained and advanced, it is absolutely and unqualifiedly necessary that all those hypotheses, theories, laws and facts which constitute the legitimate content of any field of study may be dealt with at any time by any teachers.

The academy goes on record as endorsing most emphatically the stand of Dr. H. W. Chase and Dr. W. L. Poteat on the freedom of thought and teaching.

During the scientific sessions over sixty-five papers were read.

BERT CUNNINGHAM,
Secretary

DURHAM, N. C.