responsible for the destruction of the photogen as the dried powder will withstand this temperature for 24 hrs. without any appreciable diminution in its power to phosphoresce. McDermott finds that liquid sulfur dioxide and liquid ammonia also destroy the photogenic power.

The powder obtained by drying cultures of luminous bacteria behaves similarly to the firefly material.

These results indicate that it will be a vastly more difficult problem to isolate and identify the photogenic substance than might at first be supposed.

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EXPERIMENTS ON THE NATURE OF THE PHOTOGENIC PROCESSES IN THE LAMPYRIDAE.

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During the summer of 1914, the writer made some tests along the same line as described in the preceding paper by Harvey (p. 396), and he also attempted to obtain evidence of the breaking down of nucleic acids during the photogenic process, as suggested by Lund.[1] While the results are mainly negative, they are of interest as confirming Harvey's experiences. The obvious limitations to such work, owing to the restricted amount of material available at one time, is a serious handicap to very extensive results. Most of the present writer's experiments were made on material prepared from *Photinus pyralis* and *P. castus;* some of the material from the former species had been collected at Washington, D. C., in the summer of 1911, and, after drying *in vacuo* over sulfuric acid, had been sealed *in vacuo* in small flasks. This latter material was very kindly supplied to me by Professor J. H. Kastle, Director of the Kentucky Agricultural Experiment Station. It was apparently as active as when first prepared.

Extractions were made in oxygen-free natural gas. After grinding, the tissue to be tested was placed in a small separatory funnel which had been filled with gas which had been passed through pyrogallol solution; the washed gas was allowed to pass through the funnel for some time to sweep out any air which may have entered when the tissue was placed in the funnel. For the filtering, a vacuum desiccator was fitted up with a small beaker, a wire funnel support and a small funnel with a folded filter. The desiccator was connected to the gas supply for some time in order to remove all the air. The solvent to be used was placed in a small Erlenmeyer flask provided with a tightly fitting stopper bearing two small bore stopcocks. The washed gas was passed through this flask for some time after the solvent had been run in, and the solvent was then heated

[1] Lund, *J. Exper. Zoöl.*, 11, 415 (1911).

slowly to the boiling point, and kept boiling quietly for about a minute, when it was allowed to cool slowly in a current of the gas (except in those cases in which it was used hot). When cool, both stopcocks were closed and the outgoing tube connected to the inlet of the separatory containing the material to be tested; both tubes were well blown out with the gas before connection, and kept surrounded by a current of gas while being connected; the outgoing stopcock on the flask and the ingoing on the separatory were then opened, then the ingoing stopcock on the solvent flask, and finally the outgoing on the separatory, the solvent being run into the separatory by the pressure of the gas, when the small flask was inverted. The stopcocks on the separatory were then closed and the solvent flask disconnected. The separatory was shaken thoroughly, so that the tissue would be fully exposed to the action of the solvent; in some experiments filtration was done immediately, while in other cases the tissue was allowed to stand in the solvent for some time, usually with occasional shaking.

Fifteen to twenty of the dried luminous segments, weighing about 0.05 to 0.07 g., were usually used in a test. The filtrate and residue were usually tested by first exposing to the air and then by adding hydrogen peroxide (3% solution) always in a dark room, the eyes being allowed to become accustomed to the darkness for at least ten minutes before applying the test. In no case was the emission of light from the filtrate observed, though in short, cold extractions with alkali some activity of the residual material was noticed—due to larger fragments of the material which had not been thoroughly penetrated by the solvent.

The following are some of the combinations which were used:

1. 15 organs; 25 cc. 0.15 *N* H_2SO_4; solvent used cold, and allowed to stand fifteen minutes after shaking before filtration: No light at any stage.

2. 15 organs; 20 cc. 0.03 *N* NaOH; solvent used cold, and allowed to stand fifteen minutes after shaking before filtration. No light on adding solvent to tissue; faint light on running liquid on filter: Filtration very slow; no light on testing residue and filtrate four hours later.

3. 15 organs; 20 cc. 0.05 *N* NaOH; solvent used cold and filtered immediately after shaking: No light at any stage.

4. 15 organs; 25 cc. 0.001 *N* NaOH; organs crushed rather than ground; solvent applied hot and filtered immediately after shaking: No light at any stage.

5. 4 repeated, using cold alkali; larger pieces of tissue glowed on treatment of residue with 3% H_2O_2 on filter; no light from fine material on the filter, nor from the filtrate. A very active catalase went into solution in the alkali in this experiment.

All the extracts had the characteristic odor of the insect, which was intensified by the alkali.

A considerable number of experiments were run using alkaline solutions as solvents, with the view that if nucleic acids were present, as suggested by Lund and were active in light production, they might be thus gotten into solution; in no case was an active extract obtained. To examine this

point further, determinations of the total nitrogen in the insects and in the luminous organs, and of the nitrogen, phosphoric acid and carbohydrates in the extracts were attempted. For the determination of the total nitrogen in the insects and in the luminous apparatus, dried specimens of *Photinus castus* collected in Pittsburgh, Pa., were used; this species is quite closely related to *P. pyralis* and it is unlikely that there would be any wide difference in the proportion or distribution of the nitrogen in them.

The mean of two determinations of the total nitrogen in the luminous tissue showed 13.6%, while the mean of two determinations on the remainder of the insect showed 10.3%; this would indicate about 11% N for the whole insect, calculated on the relative weights of the luminous segments and the remainder of the insect. All weights refer to the tissue dried *in vacuo* over sulfuric acid. The low figure for the total nitrogen of the insect is probably accounted for by the relatively large amount of chitin, while the high figure for the luminous tissue is undoubtedly due to the deposits of uric acid or closely related compounds which form the so-called reflecting layer, constituting the larger part of the bulk of the dry material from the luminous segments.

To test the possible effect of the photogenic processes on the amount of soluble nitrogen, phosphoric acid and carbohydrate, two experiments were run in parallel, using the tissue of *Photinus pyralis*. In the first test, (A), 0.146 g. of the ground dry tissue was treated with 20 cc. of hot 0.075 *N* H_2SO_4, in natural gas; 1 cc. of 3% hydrogen peroxide and 20 cc. of water were then added, the mixture boiled and filtered and the filtrate and washings made up to 50 cc. In the second (B), 0.179 g. of the ground dry tissue was treated with 1 cc. of 3% hydrogen peroxide and 20 cc. of water in the air, and allowed to stand till the action and light-emission had ceased; 20 cc. of 0.075 *N* H_2SO_4 were then added and the solution boiled, filtered, and made up to 50 cc. By this means the material in the first test, (A), was kept from light production, while in the second test (B) the light-producing power was expended. The nitrogen was determined in 25 cc. portions of each of these filtrates, while a portion of the remainder was used for the titration of P_2O_5 with uranium acetate. Tests for optical activity were negative on both filtrates, which is taken to indicate the absence of significant quantities of carbohydrates. The results of the N and P_2O_5 determinations are given below:

	Per cent. of weight of dry tissue taken.	
Test.	N in solution, by Kjeldahl.	P_2O_5 in solution, by uranium acetate.
A	4.81	0.515
B	4.14	0.420

These figures do not show as great a difference as might be expected were the photogenic process accompanied by any extensive breaking down

of nucleic acids, and the differences, indeed, are in the opposite direction to what would be expected under such circumstances.

From the evidence at hand, therefore, it seems that the deposits of purine substances which form the so-called reflecting layer of the photogenic organs of the Lampyridae cannot be traced satisfactorily to the breaking down of nucleic acids. In agreement with the work of Harvey, reported in the preceding paper, dilute acid and alkaline solutions, hot or cold, fail to extract a light-producing substance from the dry tissues of these insects, even when used in the entire absence of oxygen, and such solutions rapidly destroy the photogenic activity of the dry tissue.

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NEW BOOKS.

Qualitative Chemical Analysis. By CHALFANT E. BIVINS. New York: John Wiley and Sons. Price, $1.00.

This manual is one of a series of loose-leaf laboratory manuals, edited by J. M. Jameson. The author has made no attempt to depart from conventional tests and separations. The book has, however, many excellent features. The directions are clear and easily followed; the discussion of procedures, explanatory notes, practice equations, and questions on the groups are excellent, and should be helpful to both teacher and student. The treatment of the analysis of alloys and metals is particularly good.

Comparatively little in the way of discussion of the principles of qualitative analysis has been attempted. The little that is given is so brief as to be of inconsiderable value. The statement that "*All the reactions of precipitation are ionic*, that is, are made by ions," would hardly be accepted even by many of the most ardent supporters of the theory of Electrolytic Dissociation. Likewise, the statement that "Oxidation is an increase in valence, and reduction a decrease in valence," leaves the student with an incorrect idea of these processes. No mention is made of the law of Mass Action and its applications.

For teachers who prefer to develop these subjects in the class room and wish a good laboratory guide, this laboratory manual can be used profitably. JAMES H. WALTON, JR.

Food Products. By HENRY C. SHERMAN, PH.D. ix + 594 pp.; illustrated. New York: The Macmillan Company, 1914. Price, $2.75.

During the last ten or fifteen years people have heard much about the origin and composition of foods and of laws to protect the purity of foods. Much of this discussion has been timely and it has acquainted the lay citizen with a class of facts which at one time appeared to be of interest to the food expert only. The lengthy papers and treatises on the somewhat