of *Drosophila* known as *white* and *vestigial* show variations from the reactions of wild flies to light. He decided that the *vestigial* flies are not oriented by light, a conclusion apparently verified by experiments in which wild flies, whose wings had been removed, were used. The *white* race oriented positively to light, but with less regularity and precision. In my experiments it was also found that *white* flies are less precise in their photic orientation, it being many times impossible to secure satisfactory readings on 50 per cent. of the individuals, since after reaching the top of the cylinder some would crawl back to the bottom, even under an intensity of 1,500 c.m. No results, therefore, are presented for the *whites*. In the case of *vestigial* flies it was found that a mechanical factor retarded orientation. When the glass cylinder was used for these flies it was discovered that the reason they did not reach the top was because they continually lost their foothold, when part way up, and fell back to the bottom. This also happens with wild flies whose wings are normal, but immediately the wings are spread and the animal secures a new foothold very near where he was before. The upward movement is then continued, very little time having been lost. This difficulty with *vestigials* was removed by lining the cylinder with very thin Japanese rice paper. This may easily be done by moistening the paper, pressing it against the glass and allowing it to dry. With paper-lined cylinders the *vestigial* flies are strongly phototropic and reach the top in almost the same time as wild ones. The results are as follows: with illumination of 1,500 candle meters the time was 6.81 seconds; with 750 c.m., 7.92 seconds; and with 75 c.m., 11.1 seconds. In darkness the time for *vestigials* was 12.2 seconds. From this data it is evident that *vestigial Drosophila* is positively phototropic, the degree being only slightly less than in wild flies, as measured by the rate of locomotion. Some of this difference is undoubtedly due to the aid rendered by the flying of the wild individuals, although, as far as possible, all cases of extended flight were omitted from the averages.

It may be stated, therefore, that the effect of light on the locomotion of *Drosophila melanogaster* is related to the intensity of the photic stimulus according to the Weber-Fechner law, and secondly that the race of flies known as *vestigial* is positively phototropic, and may be demonstrated as such if the animals are given a rough surface on which to crawl.

WILLIAM H. COLE

BIOLOGY LABORATORY,
LAKE FOREST COLLEGE,
LAKE FOREST, ILL.

THE STRUCTURE OF BENZENE

THE writer has shown, in his thesis for the master's degree[1] and in an article soon to be published, that the benzene model first proposed by Körner,[2] and later advocated by Marsh,[3] Vaubel,[4] and others, interpreted in the light of the Lewis theory of the atom,[5] has a sound theoretical basis. By applying a theory of conjugation resembling in many respects that presented by Erlenmeyer, Jr., in 1901,[6] all objections to this benzene structure but one—that ortho and meta di-substitution products should, according to the theory, give stereoisomers which have not yet been resolved—have been removed.

In this model the six carbon tetrahedra have their bases all in the same plane, the hydrogen atoms and the points of the tetrahedra to which they are bonded being alternately above and below this plane. There are six electrons grouped around the center of each hexagon, and two at each of the hexagon corners and on the centerlines between each hydrogen and the carbon to which it is bonded.

In a paper written in October, 1920,[7] the

[1] Written in April, 1920; on file in the Library of the University of California.

[2] *Gaz. chim.*, 4: 444 (1874).

[3] *Phil. Mag.*, 26: 426 (1888).

[4] *J. prakt. Chem.*, [2] 44: 137 (1891); 49: 308 (1894); 50: 58 (1894. "Lehrbuch der theoretischen Chemie [J. Springer, Berlin, 1903],I, 468.

[5] *J. Am. Chem. Soc.*, 38: 762 (1916).

[6] *Ann.*, 316: 43, 71, 75 (1901).

[7] This paper was revised and submitted for publication in April, 1921. It is expected that it will soon be published.

author has shown that the structure of graphite, as determined by X-ray analysis,[8] is exactly what would be obtained if it were built of layers of benzene hexagons of the type just described, the carbon-hydrogen bonds of the benzene molecules being replaced by carbon-carbon bonds between the layers. Such an arrangement not only accounts for the symmetry of the substance and for the observed spectra, but also for its known chemical and physical properties.

There are quite a number of aromatic compounds, including benzene itself, in crystals of which, according to the author's conjugation theory, we might expect the molecules to be in layers of much the same type as the layers in graphite. Assuming this to be the case, if the densities, axial ratios and axial angles are known, the dimensions of the hexagon in these crystals can be calculated. This has been done for a considerable number of substances, and in every case in which large distortions would not be expected, due to substituted groups, *the dimensions of the hexagon are very close to the corresponding dimensions in graphite.* If this result were obtained for one or two crystals, it might be considered merely a coincidence, but it is found to be general; the dimensions are found to correspond best where least distortion would be expected; and the axial ratios and angles, and the crystal form, symmetry and cleavage, as well as the actual distances, are found to conform to the structures assumed. Hence *this structure for the benzene nucleus must be considered proved.*

This method of proof was reported on by the author in a paper presented at the twenty-fourth special meeting of the California Section of the American Chemical Society, held in conjunction with the annual meeting of the Pacific Division of the American Association for the Advancement of Science, at Berkeley, California, on August 5, 1921, at which time the structures of quinol, pyrocatechin and triphenyl carbinol were used as examples. The density of solid benzene was not then to be found in the literature. This is now obtainable, and from it and the axial ratios, by assuming close packing of the molecules in each layer, the hexagon dimensions can be computed. They again check with those in graphite.

A paper is now being prepared in which the method of proof and its application to a large number of aromatic compounds will be given in detail.

MAURICE L. HUGGINS
UNIVERSITY OF CALIFORNIA,
BERKELEY, CALIF.,

[8] Debye and Scherrer, *Phys. Zeit.*, 17: 277 (1916); 18: 291 (1917); Hull, *Phys. Rev.*, 10: 661 (1917).

The author's interpretation of the experimental results is a compromise between that of Hull and that of Debye and Scherrer.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

MEETING OF THE EXECUTIVE COMMITTEE OF THE COUNCIL

THE spring meeting of the executive committee was held in the board room of the Cosmos Club, Washington, D. C., on April 23. It was called to order at 4:10, with Dr. Simon Flexner in the chair and with all members present, and it adjourned at 11:30, a recess of an hour and a half having been taken for dinner. The main items considered are shown below.

(1) Minutes of the last meeting (December 31, 1922), and of two actions taken by mail ballot in the interim were approved. These interim actions were (1) the formal vote to authorize the summer meeting with the Pacific Division, which is to occur on June 22-24, at Salt Lake City, and (2) the election of Dr. J. McK. Cattell to succeed himself as a member of the Board of Science Service.

(2) The permanent secretary presented a report on the affairs of the association for the half-year ending March 31. A summary of that report is appended to the report of this meeting.

(3) It was voted that all members of the American Medical Association who are not already members of the American Association for the Advancement of Science may become members of this association without the payment of the usual entrance fee ($5). The A. A. A. S. is unable each year to invite all

THE STRUCTURE OF BENZENE

Maurice L. Huggins

Science **55** (1434), 679-680.
DOI: 10.1126/science.55.1434.679