# SCIENTIFIC BOOKS

## OPTICAL ACTIVITY

*Optical Activity and Living Matter.* By G. F. GAUSE. No. 2 of a series of monographs on general physiology edited by B. J. Lujet. 162 pp. Normandy, Missouri: *Biodynamica.* $2.75.

THE author presents this monograph as a review of the widely scattered literature pertaining to the structure and the activity of living systems as related to the asymmetric configuration of their constituents. Thus, Dr. Gause's monograph covers a general ground in part identical with the subject of F. M. Jaeger's well-known treatise, "The Principle of Symmetry," and the same author's George Fisher Baker Lecture, "The Spatial Arrangements of Atomic Systems and Optical Activity." However, the two authors approach their subject from different angles. While Jaeger considers the symmetry relationships of static systems, Gause gives greater emphasis to the dynamic effects and in particular, to the dynamic biological effects of asymmetric systems.

The five chapters of Dr. Gause's monograph are preceded by a short introduction, in which the general principles and definitions are given. Here, Dr. Gause distinguishes between dissymmetry and asymmetry. In an attempt to overcome "some confusion in the terminology," he defines dissymmetry as the property of molecules possessing non-superimposable mirror-images, while he regards asymmetry as the property of molecular aggregates presenting a predominance of the right or the left form of dissymmetric molecules. Obviously, Dr. Gause's terminology will not remain unchallenged.

The first chapter deals with the optical activity of biological material. Asymmetry of molecular aggregates is regarded as a specific property of protoplasm and of living systems. The author forwards the thesis that the primary constituents of protoplasm such as the amino acids, the lecithins and the majority of the important sugars, occur in protoplasm in the form of only one of the optical isomers. They are obligatorily asymmetric and the author speaks of the exclusiveness of the asymmetry-sign in primary substances. Secondary substances, *i.e.,* substances possessing non-obligatory asymmetry, are said by Dr. Gause to be found in nature in the dextrorotatory as well as in the levorotatory form or as inactive racemates. It appears to the reviewer that it is not an easy task to agree upon an unambiguous definition by which primary and secondary biological substances can be distinguished. Amino acids, for example, are listed as primary substances. After the recent discovery of d-glutamic acid, d-proline, d-leucine, d-valine and d-phenylalanine as building stones of biological substances, do we now have to degrade amino acids to the rank of secondary substances? On the other hand, one may ask whether the distinction between primary and secondary protoplasmic constituents is concerned with optically active substances only and does not cover substances such as acetylcholine, pyruvic acid and certain optically inactive vitamins.

The second chapter is devoted to a discussion of origin and maintenance of optical activity. Here, the author illustrates the thermodynamic, kinetic and enzymologic aspects of one of the most attractive problems of biology. He does not fail to point out the gaps and inconsistencies, which, at the present state of our knowledge, still obstruct the clarity of our understanding. As to the origin of the initial optical activity of the components of protoplasm, Dr. Gause briefly presents the two principal theories: the asymmetric photochemical influence of terrestrial circularly polarized light upon racemates, on the one hand, and asymmetry as originating through fluctuations around the statistical mean value of equality of left and right isomers, on the other. Considerably more space is given to the mechanisms by which asymmetric syntheses are performed and optical activity is maintained in living matter at the present stage of evolution. Of the subjects and theories discussed by Dr. Gause in this connection, a few may be mentioned in this review. The interaction of two optically impure substances may, according to Langenbeck and Triem, lead to the synthesis of an optically active material of higher optical purity, when the reaction is interrupted before completion. Werner Kuhn's theory, ascribing the ageing of organisms to the progressive racemization of their optically active constituents, is also related. Another point is the production of an optically active substance from symmetric material, such as the formation of glucose and starch during the assimilation of carbon dioxide by green plants or the enzymatic synthesis of mandelic acid from benzaldehyde and hydrocyanic acid. However, all such asymmetric syntheses known to be performed by living matter depend upon the presence of optically active enzymes and the reviewer can not help but feel that these asymmetric enzymatic syntheses do not elucidate the mechanism by which the first optically active substance, after it had first been formed at the dawn of evolution and before any optically active enzyme existed, could have survived and transmitted its optical activity to other substances. Was the first optically active substance an enzyme and was it, at still an earlier period of evolution, preceded by optically inactive enzymes? Very recently, many proteolytic enzymes have been discovered which are adapted to substrates containing not *l*-amino acids but the "unnatural" *d*-amino acids. Are these *d*-enzymes remnants of such a hypothetical early period at which

each enzyme may have existed in equal quantities of its *d*- and *l*-forms?

Chapter III deals with heredity and the influence of environmental factors on the optical activity of biological material. First, several experiments are reported which the author presents as "proving the impossibility of inverting the optical properties of the primary constituents of protoplasm or of modifying protoplasm so as to cause it to invert the optical properties of the products of its metabolism." This is followed by a discussion of various mechanisms controlling the biological production of a given optical isomer.

Chapter IV deals with the relation between the inversion of spirally twisted organisms and the molecular inversion of their protoplasmatic constituents. The optical activities of protoplasmatic constituents in dextral and sinistral specimens of an organism have been found to be identical, *e.g.*, the same optically active forms of the various amino acids have been isolated from both the sinistral and the dextral forms of a snail.

In Chapter V, Dr. Gause discusses the asymmetric analysis of the mechanism of biological processes by the study of the differential influence of optical isomers. The author has applied this asymmetric analysis to the study of the mechanism of toxic action, to the evolution of the nervous system and to various physiological functions in protozoa.

In the last three chapters, the author moves in his own experimental field and, therefore, can draw from his own many experimental findings.

In a short appendix, the author discusses the structure of the cancer cell. He mentions the claim of Kögl and Erxleben to have isolated *d*-glutamic acid from malignant cells. The contradictory findings of Chibnall, of Graff and of Lipmann are also reported together with some other recent literature pertaining to this aspect of the cancer problem.

Dr. Gause's monograph presents in a rather limited space a great number of experimental results and theoretical data. It can be recommended as very stimulating reading.

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## PLASTICS AND SYNTHETIC RESINS

*A Laboratory Manual of Plastics and Synthetic Resins.* By G. F. D'ALILIO. 134 pp. New York: John Wiley and Sons, Inc. 1943. $2.00.

DURING the past decade the literature covering all phases of the plastics industry has grown to such proportions that any one wishing to acquaint himself with the industry as a whole is likely to become lost in the details and references pertaining to the subject. Even those engaged in the industry are for the most part specialists in one or two branches of this highly diversified industry. Those engaged in the development of synthetic molding powder often know little of the field of surface coatings and the research worker who is thoroughly acquainted with the literature of phenolic resins may, for example, have but a nodding acquaintance with the theory of styrene polymerization.

As a quick ready reference for introductory methods for preparing the various synthetic resins of industrial importance, Dr. D'Alilio's "Laboratory Manual" will be an invaluable aid. Fortunately, the author has seen fit to limit the scope of this manual to experiments covering only those resins of recognized industrial importance and thereby avoiding the possibility of thoroughly confusing the student. Even so, the manual includes 40 synthetic resin preparations with accompanying experiments covering reaction variables and methods of product evaluation as surface coatings, adhesives, molding powders, plywood, synthetic rubber and others. On this basis the resins prepared from the original raw materials are used in successive evaluation experiments and for comparative tests with other resins to give the student a first-hand knowledge of the relative merits of the basic resin types covered.

A series of questions and added exercises follows each of the experiments. The questions are based on the assumption by the author that the student has had a course in organic chemistry, and while many of the answers to the questions lie within the experiment performed, the student will find it necessary to refer to the literature on the subject to check his conclusions. The suggested extensions of the various experiments are very comprehensive and explain why the field of plastics is one of specialization.

In addition to the series of 88 experiments, the author lists a series of 26 test methods. Some of these methods are straightforward organic test methods, such as the determination of formaldehyde by the hydroxylamine hydrochloride or sodium bisulfite methods, but many of the methods listed are empirical ones developed by the industry to fulfil a definite need. The determination of the softening point and the rate of cure of resin are examples of such methods.

The author has also thoughtfully included in the appendix a list of the raw materials required for performing the various experiments and several sources for obtaining them. This is indicative of the thoroughness with which the "Laboratory Manual" has been compiled and thus it will not only admirably fulfil its intended function as a student laboratory manual but also aid those workers of the plastics in-