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.

MAX BERGMANN

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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-

dustry who wish to become better acquainted with plastics other than those with which they are thoroughly familiar.

L. M. DEBING

MANOMETRIC MEASURES

Manometric Methods. By MALCOLM DIXON. xiv + 155 pp., 20 figures. New York: The Macmillan Company. Cambridge: The University Press. Second edition. 1943. Price, $1.75.

THE manometric method, as embodied in the familiar Warburg apparatus, has become increasingly valuable to the physiologist, biochemist and more recently to other classes of investigators, particularly food technologists who have been impressed with the versatility of the technique.

Manometric manipulations, though exacting, are regarded by many with undue awe. On the other hand, there are some who have used them without sufficient regard for the pitfalls which necessarily exist in a method so delicate. This excellent little book, now in its second edition, should be most helpful to both types of investigators. The author's object—to provide a handbook for the laboratory, supplying in convenient form just that information which is likely to be required by research workers using the methods—has been fully realized.

Part I of the book comprises a discussion of principles and includes a satisfactory account of the theory involved in each of the methods described.

Part II contains a detailed description of the main methods now available: the direct and indirect method of Warburg, the first and second methods of Dickens and Simer and the method of Dixon and Keilin. A brief outline of the micro-technique is also given.

The book might have been improved by a presentation of the recent work on new applications and a description of the excellent new equipment now commercially available.

CHARLES N. FREY

SPECIAL ARTICLES

ESSENTIAL FATTY ACIDS AND LIPOTROPIC ACTION OF INOSITOL

OVER a year ago the author became interested in the possible effect of essential fatty acids on the lipotropic action of choline. If choline lowers fat in the liver by virtue of its incorporation into the lecithin molecule, then essential fatty acids, which also constitute integral parts of this phospholipid, might similarly be required before choline can exert this effect. A preliminary experiment of three weeks' duration, using rats 100 to 125 grams in weight, suggested that the essential fatty acids were not required for the action of choline, although the results obtained did suggest that choline decreases liver fat to a greater extent when these metabolites are present. However, the difference found was of questionable statistical significance. It was realized that the three-week period would not have permitted a marked depletion of the animals' stores of essential fatty acids, and an experiment of longer duration was contemplated.

In the meantime Engel's paper[1] on the relation of the essential fatty acids to the lipotropic action of choline was published. In an experiment of eight weeks' duration performed on weanling rats, Engel found that pyridoxine was required for the full lipotropic action of choline. Because of the relationship of pyridoxine and essential fatty acids in the cure of rat acrodynia, Engel determined under similar conditions the effect of essential fatty acids on the lipotropic action of choline. He found that they also augmented the lipotropic action of this substance.

[1] R. W. Engel, *Jour. Nutrition*, 24: 175, 1942.

An experiment of eight weeks' duration was devised to test the effect of essential fatty acids upon the lipotropic action of choline and also of inositol since it, too, is a constituent of certain phospholipids and its influence might be similarly affected by essential fatty acids in the diet. The basal diet chosen for this experiment consisted of 8 per cent. casein, 12 per cent. casein, 12 per cent. gelatin (both extracted with 1:1 alcohol-ether), 73 per cent. sucrose, 5 per cent. salt mixture, 2 per cent. agar, 0.015 per cent. vitamins A and D concentrate (Ayerst, McKenna and Harrison, containing 500,000 I.U. of A per gram and 50,000 I.U. of D per gram). A mixture of the B vitamins in the following amounts was injected daily in 0.5 ml physiological saline: thiamine chloride, 50 α, riboflavin, 25 α, pyridoxine, 20 α, calcium pantothenate, 100 α, nicotinic acid, 100 α. Twenty weanling rats of the Wistar strain (23 to 35 days old) were used for each group and litters were divided as evenly as possible amongst the different groups.[2] The groups were also balanced with respect to weight and sex. After eight weeks on the diet, the rats were killed by a blow on the head. Individual liver fats were determined in the usual way by saponification, acidification and extraction of the fatty acids with petroleum ether. Table 1 shows the results obtained.

This result supports Engel's statement that the lipotropic action of choline is increased in the presence of Mazola oil presumably through the action of essential fatty acids[1]. The lipotropic action of inositol on

[2] The mortality of the rats on the choline-free diets was quite high because of the development of hemorrhagic kidneys.