or practice. After Davisson and Germer's experiment, the wave nature of other corpuscular particles, such as the neutron, was automatically an established fact long before the advent of modern nuclear chain reactors which have since provided collimated thermal neutron beams of "high" intensities. The study of such well-known optical phenomena as diffraction, refraction, reflection and polarization followed naturally. It is to be noted that because the wave lengths of thermal neutrons are of the order of 1 Å., all optical properties dealt with here are related primarily to atomic spacings rather than nuclear spacings. The latter are not fully developed and perhaps can be better studied by using high energy protons rather than neutrons.

The analogy of neutron optics to electromagnetic wave optics makes the subject simple to treat and to understand. In many respects, the optics of neutrons supplements that of X-rays. On the other hand, because of the unique features of neutrons, other phenomena are manifested which result in many significant applications.

After reviewing the basic principles involved and pointing out the similarities and differences between neutron and electron optics, the author proceeds with a detailed treatment of experimental methods. As in the theory, much of the technique used in X-rays and standard optics has been transferred to this field. For example, the experimental method of neutron diffraction for powders is practically identical with that of X-rays. New techniques have also been developed, of which a notable example is the mirror reflection method. At present, this art is unavailable to many potential users because experimental neutron optics still suffers from relatively low intensity of neutron beams and unusually high cost of a reactor.

Following the treatment of the experimental methods, the author discusses the three most important fields of application. The first is in the field of nuclear physics and is related to nuclear interactions. Coherent cross sections of various nuclei may be determined by diffraction and mirror reflection methods. The coherent amplitudes for neutrons and protons when combined with other nuclear constants yields information on the triplet and singlet ranges. The agreement of the singlet range with the proton–proton range gives support to the idea of charge independence of nuclear forces. The mirror reflection method also allows accurate study of scattering of neutrons by electrons, thus revealing information on their interaction.

The second application of neutron optics is in the determination of the structure of matter. This may overshadow the nuclear applications. The costly installation and low intensity of neutron beams immediately suggest that neutron diffraction should be used only for problems not amenable to X-ray methods. One such problem is the location of hydrogen in the structure of various materials such as H_2O, NH_4Cl, KHF_2, hydrides of alkali metals, and of Zr, Th, and others. Other than the location of very light and heavy elements, neutron diffraction methods facilitate the study of compounds or alloys of similar atomic weights or of materials of different isotopic proportions. Thus, the superlattice structure of FeCO is easily determined. Other unique features relate to the study of gases, liquids, and cold worked alloys. Because of the similarity of neutron mass and atomic mass, the energy exchange with the lattice vibrations in a solid (absorption or emission of phonons) results in appreciable change in neutron energy. Thus, the study of inelastic scattering of cold neutrons should reveal information on the spectrum of lattice vibration.

The third and really unique application of neutron optics is concerned with the phenomena resulting from the magnetic scattering of neutrons. This is a field in which X-rays are completely useless. The book outlines the basic principles involved as well as various methods of probing magnetic structure. A typical example is the determination of the antiferromagnetic structure of MnO and similar materials. The structure of magnetic domain may be advantageously studied by using polarized neutrons.

In the case of optical-, microwave-, mass- and β-spectroscopies, X-ray and electron diffraction, and magnetic resonance, the capabilities of these new phenomena and techniques initiated by physicists have been utilized greatly by chemists in their ever-vigorous efforts of understanding and improving the living as well as the material world. It is very probable that neutron optics soon will be added to this notable list of analytical tools.

The author's own pioneering researches and contributions in neutron optics have assisted his natural talent for lucid exposition in making this book easy to understand and pleasant to read.

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Vitamins and Hormones: Advances in Research and Applications. Edited by ROBERT S. HARRIS, Professor of Biochemistry of Nutrition, Massachusetts Institute of Technology, Cambridge, Massachusetts, G. F. MARRIAN, Professor of Medical Chemistry, University of Edinburgh, Edinburgh, Scotland, and KENNETH V. THIMANN, Professor of Plant Physiology, Harvard University, Cambridge, Massachusetts. Academic Press, Inc., Publishers, 125 East 23rd Street, New York, N. Y., 1953. ix + 356 pp. 16 × 23.5 cm. Price, $8.50.

The general character of this series is too well known to require special description. This year's volume (XI) contains the cumulative index of volumes VI through X as well as eight essays or reviews, some of which are of more than ordinary importance. Mapson's review on the function of ascorbic acid in plants points out that while there are several enzymatic systems for both the reduction and oxidation of ascorbic acid, it is still not known whether any of these carry a quantitatively significant part of the respiration of the living plant. Meiklejohn has presented a colorful essay on ascorbic acid, particularly in the animal with especial reference to its relation to the adrenal. This is by no means the usual review but is an almost step by step indictment of present foolishness in physiological and biochemical research. While not always exactly fair and well balanced, and certainly not free from prejudice, it is on the whole salutary and serves as an efficient method of presenting particular and selected types of information. Something of the same flavor of doubt and question of the validity, if not the good sense, of current experiment and viewpoint is to be found in the review by Nicolaysen and Eeg-Larsen on vitamin D who conclude that with respect to the mode of action of this substance all that is known for sure is that it promotes the absorption of calcium and even this may be dependent upon the species studied. The condensed and valuable review of Gross and Pitt-Rivers on the biochemistry of the thyroid, covering the rapid and important developments represented by triiodothyronine, points to somewhat the same situation. These essays are not either petty fault-finding or dull recital of mistakes, but are a stock-taking of progress in complex and difficultly approachable areas.

Zubirán and Gómez-Mont point out that the symptoms of undernourishment are not attributable to any single dietary deficiency and that a generally deficient diet affects every function of the organism, endocrines included. This report is more directly experimental than the others in this volume and presents clinical and laboratory evidence that malnutrition leads to decreased function in the gonads, the adrenals and the pituitary, and possibly in the thyroid. The laboratory counterpart is found in the review by Ralli and Dumm on the relation of pantothenic acid to adrenal function.

With respect to the adrenal steroids themselves, this volume contains a comprehensive review by Djerassi on the synthesis of cortisone and related steroids which especially notes the variety of starting materials now available for such syntheses. This volume contains a stimulating essay by Deane and Seligman on the cytology of the adrenal steroids under a restrictive title called "Evaluation of Procedures." The essay itself is much more important than its title implies. After interesting descriptions of the development, the methodology and the criticisms, a great deal of information is presented on the results of such methods, and it is clear that if it should be demonstrated that what the histochemists now call steroids are not such in fact, the remarkable correlation of the histochemistry with the physiological activity of the organs is, of itself, a valuable contribution.

The papers contained in this volume comprise quite significant contributions to the area covered and make volume XI one of the best in the series.

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