of visual cells, including a discussion of the difficulties encountered in assigning certain aberrant types to the rod or cone category, and the criteria (advanced by Kolmer through the use of differential staining) to be employed in the proper identification of these elements. A final morphological chapter covers the development of the retinal elements, in which the differentiation of the visual cells receives major attention. The rod and cone are considered to be the products of divergent specialization from a common prototype; consequently, arguments are marshalled against the claim that cones are specialized rods or that cones are rods arrested in development.

From this point on, the treatment shifts from straight morphology to functional correlations and interpretations. Three chapters discuss some of the more general adaptations that are seemingly useful. One of these chapters cites the correlations that exist between the kinds and ratios of visual cells found in any retina and the habits (diurnal, nocturnal or both) of that animal. Somewhat disappointing is the failure to come to grips unequivocally with the issue raised by Walls's provocative claim that cones have transmuted into rods in many nocturnal animals. A second chapter gives a résumé of the capacities of rods, cones and retinal pigment to undergo positional changes in light and darkness. Some other influences, such as temperature, are included as well. The final chapter in this group reviews the possible usefulness of positional shifts in the visual receptors and retinal pigment in the furthering of efficient vision. No one theory is deemed sufficiently inclusive to explain all the responses to light, temperature, etc., on an adaptive basis. The author fails to present what, in the opinion of the reviewer, is the most conclusive evidence showing how the several photomechanical responses to bright and dim light in fishes correlate with the duplicity theory of vision.

The remaining four chapters are devoted to more specialized topics. Two consider the arrangements by which visual acuity is attained, particular attention being paid to the significance of the fovea. The correlation between foveal development and the ability to perform extensive ocular movements is accepted, but the author concludes that conjugate movements, binocular vision and partial decussation of the optic tracts are not necessarily implied. He also demurs against Elliott-Smith's view that the presence of a macula has led to marked evolutionary advances in the portions of the brain concerned with vision. Walls's recent interpretation of the fovea as a mechanism for enhancing the resolving power of the retina, not for mere optical thinness and homogeneity, is given the sympathetic consideration that this important concept deserves.

The two final chapters center about the retinal photopigments. The fundamentals emerge through an exposition of the properties of rhodopsin and the less familiar porphyropsin of the rod and of iodopsin of the cone. The relations of these carotenoid derivatives to the vitamins A (as both precursor substances and decomposition products) are reviewed on the basis of Wald's recent, important disclosures. The author attempts to make tangible the spectrophotometric analyses concerning these substances by identifying the Kolmer droplets, seen abundantly alongside dark-adapted rods, as retinene —the decomposition product intermediate between vitamin A and visual purple. In conclusion there is a timely digest of the dependence of vision on vitamin A, of the effect of its deficiency on physiological thresholds (night blindness), of the breakdown of rods following prolonged avitaminosis A and of the capacity of rod repair after a return to an adequate diet.

This monograph carries 110 excellent illustrations, several extensive tables, a recapitulation, a valuable bibliography against which textual statements may be checked, and both an adequate author and subject index. It contains some original data, of use as source material to the specialist. The scientific world is placed in debt to Professor Detwiler for having produced so readable, stimulating and authoritative a book in a field that has been both enlarged and quickened through his own investigative activities.

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RADIOLOGY

Physical Foundations of Radiology. By OTTO GLASSER, EDITH H. QUIMBY, LAURISTON S. TAYLOR and J. L. WEATHERWAX. x + 426 pp. 95 figures. 55 tables. New York and London: Paul B. Hoeber, Inc., Medical Book Department of Harper and Brothers. 1944. $5.00.

THE applications of physics to the field of radiology have grown rapidly within the last decade. The subject is assuming a place of increasing importance in the field of radiology.

The student in radiology, as well as the established radiologist who wishes to study this phase of the subject, will find this book relatively easy and profitable reading. The four eminent research workers and well-known teachers have pooled their experiences to produce this fundamental and non-mathematical work. The text is not a source book of theoretical radiologic physics, for it contains very little mathematics. A

bibliography is included at the end of each chapter for those wishing more detailed information.

Chapter I presents the historical milestones in radiology from the discovery of roentgen rays to the construction of the 100 million volt betatron. In the 14 pages of Chapter II a very brief but fundamental outline is given of the concepts of the structure of matter. The nature of radiations is covered in Chapter III (7 pages) and in Chapter IV the fundamentals of electricity and magnetism are given in the simplest terms. High voltage generators in Chapter V (26 pages) starts with rectification, including all the general types. It continues with short descriptions of electromagnetic and electrostatic supervoltage generators and ends with the Kerst betatron. Chapter VI (8 pages) dealing with roentgen ray tubes is perhaps too short. The next two chapters deal with the production and nature of x-rays and the interaction of radiation and matter. These chapters contain fundamental information which greatly helps in the understanding of the action of x-rays, both in their biologic action and in diagnostic procedures, the latter being considered in Chapter IX. The measurement of x-ray quantity and quality is excellently taken up in the next two chapters (64 pages). The principle of ionization chambers of various kinds and their use are well described. Diagrams, charts, curves and tables help to clarify this material. Of great interest is the chapter on tissue dosage (33 pages). Next comes radioactivity, and measurement of gamma ray quantity. Neutrons and artificial radioactivity are coming subjects of inevitable importance to the radiologist. Some of the fundamentals are presented in Chapter XV (20 pages). Dosage in gamma-ray therapy is discussed in Chapter XVI, with charts and tables; and biologic reaction to radiation in Chapter XVII. The next chapter, dealing with roentgen ray and radium therapy records, is extremely worth while as it teaches the therapist to think accurately and it is a step toward uniformity of all therapy records. The last chapter (XIX) deals with roentgen ray and radium protection and is a subject that all radiologists should constantly keep in mind.

In the Appendix, 12 depth dose tables are given covering radiation from 100 kv inherent filter only, to 200 kv, 2.00 mm cu. The volume ends with a name index and a suject index.

The book is practical in nature, covering material needed by the practicing radiologist.

GEORGE C. HENNY

SPECIAL ARTICLES

INHIBITION OF GROWTH OF MYCOBACTERIUM TUBERCULOSIS BY A MOLD[1]

A CULTURE of tubercle bacilli which had been stored in the ice box was found to be overgrown by a green mold. Subcultures of this mold on other cultures of tubercle bacilli showed rapid and luxuriant growth at room temperature but no growth at 37° C. On cultures of tubercle bacilli the mold grew faster and sporulated earlier than it did on similar sterile media.[2] Growth of the mold occurred on suspensions of tubercle bacilli in saline solution, although no growth of it occurred in the saline solution alone. The mold is as yet unidentified but probably belongs to the Penicillium group.

Experiments were carried out to determine the effect, if any, of this mold or substances produced by it, on tubercle bacilli. Several of these experiments are presented in this preliminary report.

Effect of the mold on Mycobacterium tuberculosis: Suspensions of tubercle bacilli were made in saline solution in concentrations of 3 mgm tubercle bacilli per ml. Recently isolated, rapidly growing strains of human type tubercle bacilli were used. Suspensions of the mold were made by grinding it in a mortar with saline solution. The pH of the mold suspension varied from 6.5 to 7.8. 5 ml of tubercle bacilli suspension (15 mgm of organisms) were added to 5 ml of the mold suspension and to 5 ml of saline solution as a control. The mixed suspensions were allowed to stand from 24 to 48 hours at room temperature. At the end of this period smears and cultures were made on three culture tubes and 1 ml of the mold suspension was injected into the left groin of a guinea pig.

Thirteen experiments of this type have been carried out with but one culture tube showing any growth of tubercle bacilli. In that instance only one colony was observed, whereas the control cultures grew luxuriantly. The other twelve experiments gave entirely negative results. Although no growth was observed on these tubes, acid-fast bacilli were still present in smears even after several months' incubation of the tubes. Likewise, acid-fast bacilli were seen in smears of the mixed suspensions.

Seven of the thirteen experimental guinea pigs are alive and have negative tuberculin tests, whereas all the control animals except one have died of tuberculosis. Six of the experimental animals died of tuberculosis. The results of two experiments of this type are shown in Table 1.

[1] From the Edward J. Meyer Memorial Hospital and the Department of Medicine, University of Buffalo School of Medicine, Buffalo, N. Y.

[2] F. G. Petrik, *Am. Jour. Clin. Path. (Tech. Supl.)*, 8: 134, 1938.