Other toxic symptoms of dinitrophenol poisoning such as the typical neuritis also responded promptly to the ascorbic acid therapy. This raises the question as to whether the toxic effects of dinitrophenol may not be due to the destruction of the auto-oxidative system elements of the cells as a result of the hyperoxidation which it induces, or whether it be due to direct chemical interaction with them.

The prophylactic treatment of all persons who have been the victims of dinitrophenol for reducing with the therapy in question is indicated; for a number of them who have been examined with the slit-lamp, in spite of the fact that there are no subjective symptoms, show early cataract formation.

An additional noteworthy finding in connection with the ascorbic acid therapy is the regeneration of lens fibers in an eye that had been aphakic following cataract extraction for many years. In this case, after two weeks of therapy, the lens capsule became filled out and the scarred anterior capsule of the lens, as well as the posterior, resumed its normal shagreen, and some of the fibers assumed normal transparency.

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THE DEVELOPMENT OF LIVER THERAPY IN ANEMIA[1]

PRIOR to 1922, no published records or reports are available of the use of liver in "sprue-anemia" by Sir Patrick Manson (1844–1922), although later editions of Manson's works revised by Manson-Bahr, of London, do contain mention of *liver soup* in the treatment of sprue. Sprue was first accurately described by Sir Patrick Manson[2] in 1880.

C. S. Engel, of Berlin (1898), used *"sanguinoform"* (made by a Berlin druggist and containing hog liver, stomach and other organs) in the treatment of anemia. He also noted an increase in eosinophiles from the use of this hog-organ preparation!

Professor Adalbert Czerny, pediatrician, did *not* mention liver therapy in the treatment of anemia of children before the First International Congress on Pediatrics, at Paris, in his paper on "Rapport sur l'Anèmie d'Origine alimentaire,"[3] as Oxenius, of Chemnitz, and George Roeder, of Rahway, N. J., claim.[4]

Hans Günther,[5] of Leipzig, refers to Engel's (1898) use of hog liver and stomach, but does not mention the work of Pirera and Castellino (1912) with liver in anemia nor the use of red bone marrow by Fraser (1894).

R. L. Fenlon[6] included liver in the diet for pernicious anemia patients.

R. B. Gibson and C. P. Howard, of Iowa City, gave liver daily, together with egg yolk and green vegetables, to anemia patients.[7]

Finally, Professor Alfonso Pirera, of Naples, in his article[8] on "Intorno ad alcuni problemi recenti di patologia epatica,"—Studio Sperimentale—mentions the research work (1912) with liver juice by Germano and Pizzini and Cafiero—using 12 injections of a concentrated liver preparation.

Pirera, of Naples, reviews the subject in his article "Epatoterapia ed emopoiesi epatica. Anemie da disepatismo."[9]

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[2] *Customs Gazette*, 1880.

[3] *Comptes Rendus de l'Ass'n. int. de Pédiatrie Premier Congrès* (7–9 Octobre, 1912), pages 91–101, 1913, G. Steinheil, Editeur, Paris.

[4] *Deutsche Med. Wochenschr.*, 60: 51, 1977, December 21, 1934; 61: 23, 929, June 7, 1935.

[5] "Uber Fortschritte in der Diättherapie," *Med. Klin.*, 27: 2, 48–50, January 6, 1931.

[6] *Jour. of Iowa State Med. Soc.*, XI: 2, 50, February, 1921.

[7] *Arch. Int. Med.*, 32: 1, 1–16, July, 1923.

[8] *Il Tommasi*, September 20 and 30, 1912, pages 601–617 and 625–636, Naples.

[9] *Rinascenze Medica* (Napoli), Anno XI, 13: 22, 683–685, November 30, 1934; 13: 23, 715–717, December 15, 1934.

SCIENTIFIC BOOKS

ATOMIC SPECTRA

Introduction to Atomic Spectra. By HARVEY E. WHITE. McGraw-Hill Book Company, N. Y. (1934). $5.00.

ONE of the most interesting chapters in some future history of contemporary physics will amaze the reader with an account of the rapidity with which physicists of the last two decades have brought order out of the apparent chaos of empirical information on the wave-lengths and intensities of spectrum lines. In 1924, one of the major problems of spectroscopy, namely, the cause of the fine structure of the alkali terms, was apparently in a hopeless snarl. There was no generally accepted notation for the cataloguing of spectral terms, and the confusion of the various schemes in use was an almost insuperable obstacle to the student of the subject. The notation has now become standardized, and I think that most physicists would agree with me in the statement that at the present time there are no major outstanding problems in the field. Some spectra, for instance, those of some of the rare earths, have not been unraveled, but the difficulty lies only in their complexity, and is not due to the lack of basic principles on which to attack the analysis.

It is in this stage of the subject, that is, just after the sudden collapse of the main problems, and the almost instantaneous marshalling of the remaining facts under a few categories, that Professor White's book appears. His object, as stated in the preface, is to supply a treatise for the student approaching the subject for the first time. One ideal in such an undertaking would be to present the subject-matter in perfectly logical form, beginning with the smallest possible number of assumptions and explaining the phenomena encountered by deduction from these assumptions. Professor White has not attempted to write his book in this rigid Euclidean form, and I am quite certain that his choice is by far the wiser one. The subject of spectroscopy extends from the physical optics of gratings and prisms to the wave-mechanical treatments of radiating atoms and molecules. It seems to me that there is a well-defined intermediate region, in which one studies the interpretation of experimentally observed spectra by the use of the results of quantum mechanics, without going deeply into the technique of experimental spectroscopy or the mathematical manipulations which characterize the present stage of atomic theory. The book under consideration lies in this province. It contains excellent photographs of atomic spectra; quotes the results of wave-mechanics and shows how to link these together.

The book reflects what I consider to be a most commendably pragmatic attitude toward the theory. In spite of the advent of wave mechanics I think there are few who would discard completely Bohr's 1913 interpretation of the hydrogen atom, and I am pleased to see that Professor White has accorded it due prominence. Education in the subject consists largely in learning how far the successive models and vector diagrams may be trusted. These limits are extensively and adequately discussed in the book.

An especially good feature is the comparison of electron distributions according to the elliptic orbits of the classical quantum theory with those deduced from wave-mechanics. This is supplemented by a series of "pictures" of the hydrogen atom in various quantized states, with and without spin, which were ingeniously made by the author. The excellent diagrams of the Zeeman and Paschen-Back effects of terms arising from various electron configurations are also praiseworthy.

The first ten chapters of the book deal with single electron systems, appropriately beginning with hydrogen, and showing the relation between hydrogen terms and those of the alkalis and of alkali-like structures. In connection with the discussion of the periodic system, it seems to me that a statement of the *Aufbauprinzip,* or construction principle, is given which is open to criticism. On page 79 we read, "With quantum numbers assigned to each electron each atom Z in the periodic table is, so far as the extranuclear electrons are concerned, formed by adding one more electron to the atom Z-1." Either this statement has the entirely trivial meaning that an atom of atomic number Z has one more electron than the preceding atom in the periodic table, or it means that the electron configuration of the atom of atomic number Z is obtained by adding one electron to the electron configuration of atom Z-1. In this second sense the statement is not always true, for instance, in the case of 29Cu and 28Ni, where we have

28Ni	$1s^2$	$2s^22p^6$	$3s^23p^63d^8$	$4s^2$
29Cu	$1s^2$	$2s^22p^6$	$3s^23p^63d^{10}$	$4s$,

and the copper configuration is not that of nickel plus one electron. An idealized construction principle can be stated for the configuration of a small number of electrons about a nucleus of much larger charge. If to a hypothetical nucleus of charge 100e, 28 external electrons are added, the electron arrangement would not be that of nickel, but the addition of the 29th would not disturb the quantum numbers of the 28 previously present.

On page 86 we are rather abruptly introduced to element number 87 as "cornellium," which was my first aquaintance with this latest ebullition of college spirit. On page 170 we are given a quotation from a composite personage called Mullikan, who by slight vowel changes can be resolved into either of two well-known physicists.

The second part of the book deals with the spectra of atoms with more than one valence electron. The various coupling possibilities are adequately discussed, and in general, interval calculations, g-factor computations, etc., are carried out in full for both Russell-Saunders and jj coupling. The alternation law of multiplicities is strikingly illustrated by actual photographs of the spectra of the elements from 19K to 30Zn, taken by the author. I note by comparing pages 165 and 225 that Professor White has used the symbol Γ to represent the increase in the energy value of a term due to the interaction between the spin and orbital angular momenta of a single electron. Would it not be better to use γ for this purpose and reserve

Γ for the summation of the γ values which is important in complex spectra? The Γ sum rule and the Γ permanence rule are stated separately in sections 13.14 and 13.15. In this connection it is noteworthy that on pages 704–5 of the fifth edition of Sommerfeld's "Atombau" is found a treatment of these rules which shows that the sum rule can be developed as a consequence or corollary of the more general permanence rule.

In the chapter on x-ray spectra, the x-ray and optical terms of cadmium are shown on the same scale in Fig. 16.11, page 310. If we compare this figure with the optical terms of cadmium, shown in Fig. 11.6, page 179, we find that the configuration to which the wave-number zero is assigned is different in the two representations. In the optical case the wave-number zero is assigned to the configuration in which one of the outermost s-electrons is removed to infinity; on the optical-x-ray diagram the normal state of the cadmium atom is given wave-number zero. The former convention is undoubtedly the most commonly used one in optical spectra, and appears in Bacher and Goudsmit's "Atomic Energy States" for all spectra in which series limits are known. Whether a new convention should be adopted for diagrams showing the relation between x-ray and optical spectra I am not ready to state. If we retain the conventional optical assignment, all the x-ray terms have negative wave-numbers like the upper members of the displaced sequences in calcium, which are shown in an excellent diagram on page 182 of the book.

The application of the Γ permanence and Γ sum rules to x-ray spectra is not brought out, and Russell-Saunders term symbols are used for x-ray terms, which I believe assumes more about their coupling than is warranted by the information at hand.

An excellent feature of the book is the chapter on series perturbations and auto-ionization, which is the best treatment of the subject I have seen in book form. The book closes with an up-to-date account of the breadth of spectrum lines.

This book can be given unqualified approval as a text for graduate courses in atomic spectra. For the labor of its compilation the author deserves the thanks of every teacher and student of the subject.

SAMUEL K. ALLISON

GYMNOSPERMS

Gymnosperms, Structure and Evolution. By C. J. CHAMBERLAIN. Pp. xi + 484, 396 figures. University of Chicago Press, Chicago, Illinois. $4.50.

THIS book by Chamberlain describes the morphology and evolution of the gymnosperms, seed plants whose history extends back into the Paleozoic. The work is not only an excellent morphological treatise, but also includes many other phases of the subject. In it we find first-hand accounts of their geographic distribution and excellent photographs of the growth habit and habitats of these plants. Many restorations of the fossil forms add materially to the clearness with which the author describes the origin, history and evolution of the gymnosperms from the Carboniferous to the present.

In nearly every chapter, we find some of the author's own contributions to the subject, and throughout the book there is evidence that the findings of other investigators have been carefully checked and verified. Moreover, he has filled in many gaps in our knowledge of the morphology. Thus the book has the merit of being written by one who is thoroughly familiar with the material itself as well as the literature of the subject and who has devoted a lifetime to teaching and research in this particular field. A great majority of the excellent illustrations have been prepared by the author himself and about one third of them are entirely new.

The earliest records in the Paleozoic, reaching back at least 300 million years, show us that, included in this group, there are already two distinct lines which the author calls the Cycadophytes and Coniferophytes. The Cycadophytes are traced back to the Cycadofilicales; the Coniferophytes to the Cordaitales. These two lines appear to be distinct as far back as they can be traced in Paleozoic history. The two orders Bennettitales (or so-called "fossil cycads" of our texts on Historical Geology) and the Cycadales were both derived independently from the Cycadofilicales, not the cycads from the "fossil cycads." This last phase of their evolution occurred at the beginning of the Mesozoic. Likewise, the two orders of Coniferophytes, Ginkgoales and Coniferales, both lead back more or less independently to the Cordaitales, which became extinct at the close of the Permian. There is no connection between the Coniferophytes and any of the cone-bearing lycopods which flourished during the Devonian and Carboniferous. The Gnetales are much more recent and their origin is more obscure, though it seems evident that some of them show a definite affinity to the Coniferales, especially when we consider their embryogeny.

In his chapter on Cycadofilicales (often called the Pteridosperms), the author presents a very clear account of the structural features of this fossil material. Many excellent restorations are shown among the figures. Chamberlain also includes a series of hypothetical reconstructions of the essential steps in the evolution of the seed, based on a study of the seeds of Cycadofilicales. He defines a seed as a megasporangium which retains its megaspore and emphasizes the fact that the steps in the evolution of this structure