the strictly mathematical concept of web. For the benefit of the noninitiated: The simplest type consists of three one-parameter families of curves in the plane (or a part of it) such that through every point there is exactly one curve of each family. If each of the families consists of parallel lines, hexagons may be constructed as follows: consider a triangle ca_1a_2 whose sides belong to the three families, construct a_3 as the intersection of the parallels to a_1a_2 through c and to ca_1 through a_2. Proceed in the same way with the triangle ca_2a_3 obtaining a_4, and so forth. Then $a_7 = a_1$. This construction is possible in other webs, but in general $a_7 \neq a_1$. If always $a_7 = a_1$ the web is called hexagonal. A typical problem is the characterization of the hexagonal webs and the definition of a measure (called curvature) for the local deviation of an arbitrary web from a hexagonal one.

This book is no mere excerpt from the older work; the methods are thoroughly different, based on Pfaffian forms and exterior differentiation. This permits the author to cover a large territory in few pages. The four chapters deal with webs in the plane, webs of surfaces in space (consisting of four one-parameter families of surfaces), plane webs consisting of four one-parameter families of curves, and webs of curves in space. The connections with algebraic geometry are particularly intriguing—for instance, rectilinear hexagonal webs consist of the tangents of a curve of class three.

Calculations, as opposed to synthetic reasonings, play a greater part in this book than in its predecessor; at times the author himself seems to regret this tendency, for instance (p. 64) where he speaks of creating a little geometric light in a wild forest of formulas. Nevertheless, the book is very readable and transparent and can be recommended as an excellent introduction to the subject. Because in his other works the author often disturbs the reader by extraneous—that is, nonmathematical—prejudices, I emphasize that this little book is not open to such objections.

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Physiology of Digestion. I. P. Pavlov. Academy of Medical Sciences of the U.S.S.R., Moscow, 1952. 508 pp. (In Russian).

This is an elegant and complete collection of all of Pavlov's publications in the field of the physiology of digestion. It includes the famous lecture series, all of Pavlov's papers on his ingenious surgical and experimental techniques, as well as a great number of articles previously scattered in various journals. The surgical papers contain numerous neat and clear-cut drawings, which every physiologist and surgeon would greatly appreciate. This volume also includes six of Pavlov's erudite essays on the broad general principles of the physiology of digestion, with particular reference to clinical problems and applications. One of these papers represents the presentation made by Pavlov at Stockholm in 1904 on the occasion of his acceptance of the Nobel prize.

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Lectures on Theoretical Physics. vol. V, *Thermodynamics and Statistical Mechanics.* Arnold Sommerfeld. F. Bopp and J. Meixner, Eds. Translated by J. Kestin, Academic Press, New York, 1956. 401 pp. $7.

Sommerfeld has compiled the lectures that he gave to his students into six volumes. The present volume completes the series on theoretical physics and deals with thermodynamics, kinetic theory, and statistical mechanics. Unfortunately Sommerfeld died before he had finished the manuscript of this volume, and it has been completed and edited by J. Bopp and J. Meixner.

The first three chapters and part of the fourth had been virtually completed by the author. The subject matter of the latter part of Chapter IV had been discussed with the editors, but the presentation and method are theirs. Sommerfeld had not decided on the contents of Chapter V, which is entirely the work of the editors, although the sections on the electron theory of metals are based on the well-known article by Sommerfeld and Bethe in the *Handbuch der Physik.*

Chapter I develops the general considerations of thermodynamics. Thermodynamics had a very practical origin, and the author stresses the technical aspect of the subject. Sommerfeld avoids any notation, such as dx, for nonperfect differentials, preferring to think in terms of *properties* of systems and their associated perfect differentials. In this light, the main importance of the second law of thermodynamics (which is discussed here by the methods of both Clausius and Caratheodory) is that it shows the existence of a property (the entropy) of a system and shows that under certain well-defined conditions the entropy never decreases. The chapter concludes with a section on the origin and consequences of the Nernst heat theorem.

Chapter II applies the results of Chapter I to special systems, such as dilute solutions and galvanic cells. The section on black-body radiation follows the original train of thought by which Planck arrived at his radiation law. It is a feature of this book that, without ever disturbing the logical development of the subject, the historical approach is discussed whenever possible and the presentation is extremely clear and readable.

Chapter III, on elementary kinetic theory, gives an introduction to statistical mechanics. The statistical significance of the van der Waals constants and the classical derivation of the Langevin function amplify the earlier sections on these subjects. Statistical fluctuations are exemplified in the very elegant section on Brownian motion.

In Chapter IV classical statistical mechanics is developed by Boltzmann's enumeration method, and the ensemble theory of Gibbs is only mentioned. Quantum statistics are introduced by the Darwin-Fowler method, whereas the combinatorial method would have been more in keeping with the general tone of the book as an undergraduate textbook.

Chapter V, which deals with the Maxwell-Boltzmann transport equation and its solution by the method of moments, is at a much higher level of difficulty, and the editors are forced to refer the reader more often to specialized papers.

At the end of the book there is an excellent collection of questions appropriate to the subject matter of the various chapters and some 40 pages of comment and hints for solution.

The translator has succeeded in preserving the clarity and elegance of presentation of the original, and this volume is to be highly recommended to teachers and students of classical thermodynamics and statistical mechanics.

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Protoplasmatologia. Handbuch der Protoplasmaforschung. vol. XI. *Protoplasmatische Pflanzenanatomie.* Lotte Reuter. Springer, Vienna, 1955. 131 pp. Illus. $8.10.

Workers in the fields of experimental plant anatomy and developmental physiology will appreciate Lotte Reuter's monograph, which correlates the extensive studies in "protoplasmic anatomy" by Friedl Weber and his school with parallel or related trends in dynamic anatomy elsewhere. Although not all the aspects and reports dealing with structure, development, physiological state and function, and differentiation are covered completely, a satisfactory synthesis of main results in the chosen fields has been obtained.

The first part of the book deals with

methodology; there are three headings: cell-physiological trends; cytomorphological trends, and correlative effects. The cell-physiological methods comprise the determination of conditions and changes at the level of chemical and colloidal events, such as viscosity, osmotic value, permeability, vital staining, isoelectric point, and differences in resistance to chemical or physical attack between cells and tissues. Methods designed for the study of cytomorphological data deal with observations at the level of microscopic order in cytoplasm, nucleus, plastids, chondriosomes, vacuole, and other cell constituents. Correlative effects are chiefly defined as gradients, polarity phenomena, and intercellular patterns.

The results and the present state of protoplasmic anatomy are outlined in the second part of the book, which includes (i) discussions on metabolism, development, and polarity in the living cell, (ii) many histological data arranged under the headings of the Haberlandtian tissue systems, and (iii) a section dealing with organs such as algal thalli, mycelia, and prothalli and with the general body of mosses, ferns, and flowering plants. A brief discussion of some aspects of normal and abnormal development and of regeneration concludes the volume, the usefulness of which is increased by illustrations, bibliographies after each subject, and author and plant name indexes.

One certainly cannot lay aside this small monograph without being reminded of the fact that experiment and physiological criteria are now extensively used in anatomical research. Often the difference between protoplasmic anatomy and cellular physiology appears to be one of definition rather than of methodology. The overlapping of research fields and methods, a characteristic of present-day science, is now very evident in plant anatomical work.

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Principles of Renal Physiology. Homer W. Smith. Oxford University Press, New York, 1956. 237 pp. Illus. $5.

This book is to some extent an abridgment of Homer Smith's more extensive monograph entitled *The Kidney, Structure and Function in Health and Disease,* published in 1951. Thus, the first third of the book treats classical renal morphology, theories of renal function, and principles of measurement of glomerular filtration rate, renal blood flow, tubular reabsorption, and tubular secretion. In the chapters devoted to these latter topics, specific mechanisms are described for reabsorption of glucose, amino acids, urea, protein, and so forth, and for secretion of para-amino hippuric acid, diodrast, and phenol red. Such problems as competitive interference and self-depression of tubular transport are briefly, though lucidly, discussed.

The second third of the book is devoted to the regulation of the water and salt composition of the body. The treatment of excretion and tubular reabsorption of water and strong electrolytes is classically "Smithian." Osmolar clearance and free water clearance, concepts that trouble even renal physiologists, are simply explained. The treatment of acid-base regulation, including acid excretion and bicarbonate reabsorption, is typically "Pittsian."

The last third of the book, made up of a series of appendixes, is an extension of scope rather than an abridgment of the longer treatise. Appendix I is a moderately detailed, rather one-sided discussion of electron microscopy of the kidney. Appendix II deals with, but will scarcely serve to popularize, the Henderson-Hasselbalch equation. Other sections describe chemical and mechanical procedures involved in clearance determinations. The bibliography is selective.

A number of the chapters of the book are closed by problems and questions. I frequently found it necessary to look up the answers in the "pony"; hence, I would not recommend lifting these questions *in toto* for the examination of other than first-quality students. Medical students, practitioners, graduate students, and investigators, in fact anyone with a passing interest in the kidney, will find something of value in this book. For those of us in the bifocal age, the typography is not all that might be desired. However, a reasonable price and jacket-pocket size excuse this transgression.

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New Books

The Genus Achlya: Morphology and Taxonomy. University of Michigan Studies, Scientific Series vol. XX. Terry W. Johnson, Jr. University of Michigan Press, Ann Arbor; Geoffrey Cumberlege, Oxford University Press, London, 1956. 180 pp. $4.50.

Synthetic Ion-Exchangers. Recent developments in theory and application. G. H. Osborn. Macmillan, New York, 1956. 194 pp. $6.

Organic Chemistry. Louis F. Fieser and Mary Fieser. Reinhold, New York, ed. 3, 1956. 1112 pp. $10.

Solid State Physics. vol. II, *Advances in Research and Applications.* Frederick Seitz and David Turnbull, Eds. Academic Press, New York, 1956. 468 pp. $10.

Animal Nutrition. Leonard A. Maynard and John K. Loosli. McGraw-Hill, New York, 1956. 484 pp. $7.50.

Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, *but to the publisher or agency sponsoring the publication.)*

Report of an International Conference on Operator Theory and Group Representations. 20–23 Oct. 1953, Arden House, Harriman, N.Y. Publ. 387. National Academy of Sciences–National Research Council, Washington, D.C., 1955. 37 pp.

Inventory and Price List of Electromagnetically Enriched and Other Stable Isotopes. Stable Isotopes Research and Production Div., Oak Ridge National Laboratory, Oak Ridge, Tenn., 1956. 17 pp.

Ohio State University, Health Physics Conference. 13–15 June 1955. Columbus, Ohio. Office of Radiation Safety, Ohio State University, Columbus; U.S. Atomic Energy Commission, Washington, D.C., 1956. 223 pp.

The Baccalaureate Origins of the Science Doctorates Awarded in the United States from 1936 to 1950 Inclusive. National Academy of Science–National Research Council, Washington, 1955. 158 pp. $2.

Composting. Sanitary disposal and reclamation of organic wastes. Harold B. Gotaas. WHO Monogr. Ser. No. 31. World Health Organization, Geneva, 1956. 205 pp. $5.

A Decade of Research: 1946–1956. Cornell Aeronautical Laboratory, Inc. of Cornell University, Buffalo 21, N.Y., 1956. 66 pp.

Joint Establishment for Nuclear Energy Research, 4th Annual Report. July 1954–June 1955. JENER, Kjeller, Norway, 1956. 34 pp.

Protein Malnutrition in Brazil. FAO Nutritional Studies No. 14. J. Waterlow and A. Vergara. Food and Agriculture Organization of the United Nations, Rome, Italy, 1956. 40 pp. $0.50.

Annotated Bibliography of Articles on Light Weight Ceramics. Bull. of the V.P.I. Engineering Expt. Sta. Ser. No. 110. A. J. Metzger, Ed. Virginia Polytechnic Institute, Blacksburg, 1956. 42 pp. $0.25.

Comptes rendus des travaux du Laboratoire Carlsberg. Serie Physiologique. vol. 26, No. 1–25, *Volume Jubilaire en l'honneur du Professeur Ojvind Winge pour son 70th Anniversaire.* Luno, Copenhagen, Denmark, 1956. 443 pp. Kr. 40.

Nuclear Science and Engineering Training in the United States. A summary listing of facilities at selected colleges and universities and at the National Laboratories of the United States Atomic Energy Commission. Fund for Peaceful Atomic Development, Detroit 26, Mich., 1956. 57 pp.

Regional Comparison of Radiosondes. Brussels, 4–19 Nov. 1954. vol. 1, *Data relative to the Standard and Significant Levels of the P.T.U. Soundings.* L. M. Malet. Institut Royal Météorologique de Belgique, Uccle, 1955. 95 pp.

Current Expenditures per Pupil in Public School Systems: Small and Medium-Sized Cities, 1954–55. Circ. No. 473. Lester B. Herlihy and Emery M. Foster. U.S. Office of Education, Washington, 1956 (order from Supt. of Documents, GPO, Washington 25). $0.30.