this sense, then, two of the presently active frontiers of general microbiology—cytology and genetics—are given scantier treatment than seems desirable; on the other hand, while the current frenetic activity in microbial physiology is accurately mirrored, one could wish for fewer details. In a similar vein, a medically oriented colleague has expressed his own dissatisfaction with the somewhat less than a once-over-lightly approach in his special field of infection and immunity. However, there is no point in dismembering a functioning organism because it does not fit a preconceived picture; instead, let us look at the actual presentation.

Thimann's book is "an attempt not only to see bacteriology as a whole—that is, as a branch of biology—but also to see it in its perspective as a development from the past and as an active area of modern investigation." It is a successful attempt, organized in four parts: "Morphology and general physiology"; "Nitrogen cycle"; "Carbohydrate metabolism"; "Growth and synthesis." The text begins with a fascinating history of microbiology. Chapter II outlines the relationship of bacteria to other microorganisms. Internal structure is then considered, followed by a summary of physiology. "Using the term soil in its most general sense, to include also natural waters," Thimann then introduces the roles of microbes in their natural habitat.

Nitrogen metabolism is treated competently in a series of chapters on proteolysis, amino acid catabolism, nitrogen fixation, and nitrification and denitrification.

The section on carbon metabolism includes separate chapters on alcoholic, lactic, propionic, formic, and butyric fermentation, "oxidative fermentations," disaccharide and polysaccharide breakdown, and fermentations involving inorganic hydrogen acceptors. In each case, digressions to related subjects are skillfully made; thus, for example, rumen microbiology is covered in the chapter on polysaccharide breakdown; vinegar manufacture and aromatic catabolism, in the chapter on "oxidative fermentations"; and the significance of Enterobacteriaceae, in the chapter on formic fermentation.

The fourth division begins with growth and protoplasm formation, followed by chapters on assimilation, autotrophy, photosynthesis, and growth inhibition. The final chapter, on evolution, closes the presentation with the significant comment that bacteria "offer an outstanding example of the evolutionary success which attends upon versatility. Perhaps it is because of this versatility that, though they have been so intensively studied, they remain so profoundly unknown."

The text is unstintingly illustrated by photographs, graphs, charts, and drawings and by tables and formulas, both mathematical and chemical. It is admirably indexed, not only by author and subject, but (*mirabile dictu*!) also by microorganisms. Relevant literature is copiously cited, with particular attention given to original papers, which the author (and I concur) feels give "more insight into a subject than the coverage of twenty times as much literature through reviews."

Thimann's work is obviously a labor of love; it illustrates beautifully the beneficial effects of this motivation and the full maturity which is its invariable companion.

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**Changes of State.** A mathematical-physical assessment. H. N. V. Temperley. Cleaver-Hume, London; Interscience, New York, 1956. 324 pp. Illus. $7.50.

The subject "changes of state," or phase transitions, is amenable to treatment by two of the exact mathematical branches of physics—thermodynamics and statistical mechanics.

The treatment by thermodynamics is rigorous and leads to a natural classification of the various transition types. It also leads to equations which are numerically applicable to experimental data. The results, however, are meager, and a book dealing only with the thermodynamic equations, unless burdened with many numerical examples, would be but of pamphlet length. This treatment occupies Temperley's first chapter.

Statistical mechanical treatments of phase change have not as yet met simultaneously all three criteria of being realistic, rigorous, and numerically applicable. Some treatments manage to satisfy two of these requirements: at least one is rigorous and treats a realistic model but does not lead to numerically applicable equations; one is rigorous and numerically applicable but deals with a model divorced from that of any real material; others treat a reasonably realistic model nonrigorously and arrive at approximate numerical results; most of the rather voluminous literature cannot even be said to do as well as meet even a pair of these three desiderata. A book presenting these mathematical treatments fully could be faultless but would probably be boring.

However, whereas thermodynamics is noncausal in character, statistical mechanical treatments do give some insight into the causes of transitions. An imaginative scientist studying the literature cannot help but arrive at intuitively based conceptual schemes which correlate, in his mind at least, the causes and effects. Such schemes are difficult to convey adequately. Intuitive concepts demand semantic adjectival phrases which tend to escape rigorous definition. A too pedantic caution in definition of terms robs the description of vigor, but an undefined term can be misunderstood, and the description conveyed to the reader may then be merely false.

Temperley's book is outstanding in its wealth of intuitive descriptions. Most chapters start with a verbal explanation, lacking equations, of the subject matter treated. This frequently occupies as much as, or more than, half of the page space. The more important mathematical methods are then given, or at least outlined, and with continuous reference to the original articles. The references, in general, are adequate and well chosen, although in a few instances I felt that more recent references, which often give treatments superior to the original ones, should not have been omitted.

Most readers will probably like or dislike this book, depending on their reaction to the more verbal and intuitively derived concepts. For the value of these it is difficult to give a just and unbiased appraisal. I found some for which I presumably failed to grasp the intent of the author, and for which the arguments appeared therefore to be *non sequiturs*. In a few cases, even, a reasonable interpretation of the terms used seems to lead to a demonstrably false statement. However, many, or most, of the discussions were stimulating and enlightening. A purely critical reader will probably object to the book. One who also has some tolerance of understanding and imagination can find much of value in it.

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**The Neurohypophysis.** Proceedings of the eighth symposium of the Colston Research Society, held in the University of Bristol, 1956. H. Heller, Ed. Academic Press, New York; Butterworths, London, 1957. 275 pp. Illus. $9.50.

An increasing appreciation of the true physiological role of the neurohypophysis, together with the fact that two of its active principles have been analyzed chemically and even synthesized, has resulted in renewed interest in this structure—an interest that is reflected by the fact that the eighth symposium of the Colston Research Society (9–12 Apr. 1956) was devoted to it and that the proceedings were published in book form.

Previously, there has been more interest in the adenohypophysis, whose principles produce a variety of dramatic effects and whose deficiency syndrome leads to disability and even death. By contrast, the principles of the neurohypophysis have been considered of more pharmacological than physiological interest, with their deficiency resulting in little more than an inconvenient polyuria. It is becoming more and more apparent, however, that the neurohypophysis, by itself, plays a vital role in fluid and electrolyte balance and in certain aspects of reproductive physiology, and that, by exerting important controls over the adenohypophysis, it is intimately concerned with many of the latter's functions as well. In the introduction to this symposium, by Henry Dale, we are reminded that, recent as much of the interest in the neurohypophysis may seem, historically it was one of the first structures that was ever demonstrated to contain a potent hormone, and that among the very first successful applications of hormone replacement therapy was the use of posterior pituitary powder in the treatment of diabetes insipidus.

The participants in the symposium constitute a distinguished group of investigators—anatomists, biochemists, physiologists, and pharmacologists—gathered together from widespread portions of the globe. The subjects covered at the meetings included the phenomenon of neurosecretion (Bargmann, Hanström); chemistry of the hormones and related substances (Acher and Fromageot, Croxatto); the problems of hormone storage, liberation, destruction, and urinary excretion (van Dyke, Adamsons, and Engel; Heller; Noble); physiological control over hormone release (Ginsburg and Brown, Andersson); pharmacological stimulation (Walker); and, finally, the action of the hormones on such target organs as the kidney (Brooks and Pickford; Sawyer; Wirz), mammary gland (Cowie and Folley), uterus (Fitzpatrick), and adrenals (Gaunt, Lloyd, and Chart; Jones). Every paper is followed by a transcript of the discussion, and many of the participants in the symposium who did not actually deliver papers are heard from in this manner.

As can be seen, these contributions are no miscellaneous collection but comprise an orderly and thorough coverage of the subject, ranging from the most recent theories on the site of formation of the posterior pituitary hormones to observations concerning their ultimate action on various target organs. Each paper includes a pertinent review of the subject, followed by the more recent work of the investigator, so that, in its entirety, this book offers a complete view of research on the neurohypophysis at a rather advanced level. References are well documented, both in papers and discussion. The material has been carefully edited by H. Heller, and the resulting volume has been attractively published and bound. It furnishes a great deal of useful information, much of it new, and at the same time leaves the reader with a keen appreciation of the considerable gaps in present knowledge and the formidable difficulties still to be overcome in this field.

Although the book is quite comprehensive, one might have wished for some coverage of the histochemistry and electron microscopy of the neurohypophysis and for more attention to its possible hormones other than vasopressin and oxytocin, such as that which induces the anterior pituitary to release adrenocorticotropic hormone. In general, this book can be strongly recommended to research workers in physiology or endocrinology, where it will serve as an important reference work for some time to come.

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**Technique of Organic Chemistry.** vol. X, *Fundamentals of Chromatography.* Harold G. Cassidy. Interscience, New York, 1957. xvii + 447 pp. Illus. $9.75.

The staggering amount of published literature in the field of chromatography makes it unlikely that a single author could do justice to all the various aspects of the subject in a 447-page volume. Cassidy has therefore wisely restricted himself to the principles of the method. This book is not a revision of the author's earlier work, *Adsorption and Chromatography* (volume V in the same series), but a new book.

Starting with a definition of chromatography, the author gives a few examples of chromatographic methods and then discusses the molecular interactions on which the separations are based. This discussion is very brief and should be supplemented by readings from chapters I to V of *Adsorption and Chromatography*. The general theory is then very lucidly explained by the author, who uses the approach from cascade-type distribution, which in my experience is most readily understood by beginning students. This is followed by some details of gas-liquid and liquid-liquid (column and paper) partition chromatography, adsorption and ion-exchange chromatography, and some technical suggestions. The book contains a number of valuable tables of adsorbents, filter papers, and ion exchangers and 1042 references. There is also an appendix of (almost exclusively) American and British supply houses.

The author will undoubtedly succeed in giving the novice an introduction to the principles of chromatography. However, compared with other available books on this subject, the book will be of little value to either the uninitiated who is looking for a definite solution to a separation problem or to the specialist who needs a good bibliography. The illustrations of apparatus are outmoded and inadequate, and the choice of sample techniques and references is inept. Thus, no mention is made, for example, of the English translation of Cramer's book on *Paper Chromatography* or of Trapnell's treatise on *Chemisorption,* and we find only five references to general quantitative methods, one of which is to the *Manual of Paper Chromatography and Paper Electrophoresis* by Block, Durrum, and Zweig, and two to unpublished work of Shapiro and Dowmont. The author devotes a whole chapter to his own work on redox resins, although they have not yet been shown to be applicable to chromatographic separations, but chelating resins are omitted from the text.

Cassidy defines chromatography as "a separation process applicable to essentially molecular mixtures, which relies on distribution of the mixture between an essentially two-dimensional, or thin, phase and one or more bulk phases, which are brought into contact in a differential countercurrent manner." This definition, contrary to that of Strain, includes the relatively uninteresting foam and emulsion fractionation, to which he devotes an entire chapter, but excludes electrochromatography, which is of great importance to biological chemists. The author apparently realizes the dilemma created by his definition when he puts quotation marks on the "surface" of ion exchangers (page 15). The adsorption chromatography of gases is not discussed at all. Chromatostrip and chromatobar are classed with column or paper partition, although they depend on adsorption.

In spite of the limitations of this book, I feel that it will be a valuable aid in the orientation of newcomers to chromatographic methods.

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**Man into Space.** New projects for rocket and space travel. Hermann Oberth. Translated from the German by G. P. H. De Freville. Harper, New York, 1957. xiv + 232 pp. Illus. $4.50.

Hermann Oberth may be considered the Charles Darwin of rocketry. His first book, in 1923, clearly forecast many of our modern developments, and *Man into Space* starts from today and goes into