The name statistical physics chosen by Gregory Wannier for the title of his first-year graduate textbook felicitously describes a field which in spite of its venerable age is growing and is solving new and significant problems and whose concepts and methods enter into almost every active branch of the physical sciences.

The tone of the book is pragmatic. It neither ignores nor is bogged down in the question of the provenance of the fundamental distribution in phase space. It combines without apology ideas that have their source in phenomenological thermodynamics with ideas arising from the atomic-molecular picture of matter. It is mathematically sophisticated but the ratio of formulas to text is low. The reader encounters physical concepts such as "doped semiconductors," "Brownian motion," or "Joule-Thompson effect," at least as often as mathematical ones such as "Mayer diagrams," "Wiener-Khinchine theorem," or "Fermion operator."

Part 1 of the book, Principles of Statistical Thermodynamics, is a kind of fugue on the themes of phenomenological thermodynamics in its classical axiomatic form, on the one hand, and statistical and dynamical concepts on the other. The topics covered constitute the foundation material for both a classical course in thermodynamics and one in statistical mechanics. As the author points out in the preface, this combination permits a mutual illumination of concepts as well as an economy of presentation. Part 2 presents what must be considered to be the meat of any course in statistical physics, the application of principles to the explanation of specific physical phenomena. The choice of examples is eclectic, reference being made to such topics as law of mass action, the theory of the imperfect gas, osmotic pressure, and phase rule, which belong to the discipline of chemistry, as well as ferromagnetism, electrons, metals, and normal mode frequency spectra of crystals, well within the bailiwick of physics. A noteworthy pedagogical tour de force is the presentation of the Onsager solution of the two-dimensional Ising model of ferromagnetism (in the form given by Schultz, Mattis, and Lieb) in the space of nine pages. Part 3 of the book presents a very good introduction to the statistical theory of time-dependent phenomena in the same spirit as the previous sections. Such fundamental matters as the paradoxes of irreversibility and correlation formulas for transport properties are discussed, as well as such practical topics as the Wiedemann-Franz law, solution of the Boltzmann equation, Hall effect, and mean free path.

This is an important new textbook in the field of statistical physics, first because of the pedagogical skill with which it is written, but more significantly because it breaks down the traditional but now irrelevant barriers between the phenomenological and the particulate view of matter, between the disciplines of physics and chemistry, and between equilibrium theory and kinetic theory.

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Primate Study

Lemur Behavior. A Madagascar Field Study. ALISON JOLLY. University of Chicago Press, Chicago, 1967. 201 pp., illus. $6.95.

It is unusual in Madagascar to find an environment that is still in its natural state. Almost everywhere the ecologist arrives late, after the destroyers of forests, the hunters, and the scientific collectors. There are, however, a few places where it is still possible to make an interesting study of normal animal populations. Among them is the reserve of Monsieur de Heaulme at Fort-Dauphin, in the south of the island. It was under the good conditions there that Alison Jolly did the essential part of the excellent work that is reported in *Lemur Behavior.*

It is sometimes difficult for a foreigner to be completely accepted in a strange country in a short time. It is rather a tour de force that Jolly accomplished this during her stay in Madagascar. Her natural charm conquered the Malagasy and the French who knew her, and I am glad to report that her sojourn in Madagascar left a very good memory everywhere and that it is cited as an example to be imitated.

Her work itself is also, in my opinion, exemplary, for her study is of the most intelligent, and the least easy, kind that can be made in Madagascar. She did not collect specimens for museums, nor did she destroy the animals she studied. Instead, she patiently observed their life and attempted to understand it.

The results of this work are set forth in a well-arranged book that includes numerous photographs, maps, and convenient tables. In an introductory chapter Jolly summarizes the different kinds of lemuroids and gives a sketch of the literature that has been devoted to them, from the early descriptions by the Sieur de Flacourt through the most recent studies. This introduction will be particularly useful to American readers who are not proficient in French. Jolly then gives more detailed information about the main subjects of her study, *Propithecus verreauxi* and *Lemur catta,* their habitat, and the manner in which the study was carried out.

Chapter 2 is devoted to *Propithecus verreauxi verreauxi,* its description, ecology, and behavior and its relations with other species, particularly *Lemur catta,* and with other *P. v. verreauxi,* adults and juveniles. The characteristics of this propithecine are generally similar to those of western subspecies, but they deserve this thorough study. Chapter 3, similarly arranged, deals with *Lemur catta.* It gives a fairly complete account of this species, which, although very common in zoological gardens, has not previously been observed in detail in nature and which seems in many respects original and different from other species of lemurs. In chapter 4 *Lemur catta* is compared with another *Lemur, L. macaco collaris,* which lives at the edge of the area inhabited by *L. catta.*

In chapter 5 all types of communication—olfactory, tactile, visual, and auditory—are summarized and their motivation and function interpreted. Chapter 6 is devoted to territory and its importance for the species. All social lemuroids have well-defined territories. Comparisons with what is known of other primates from the most recent field studies of Haddow, Jay, Schaller, Southwick, and others are very instructive and lead to some interesting reflections on the evolution of the lemuroids.

The last chapter, on the evolution of social behavior in the primates, also permits enlightening comparisons between the social behavior (aggression, encounters between the sexes, relations between the young) of lemuroids and that of other primates.

The interest of Jolly's work lies in its giving a more complete knowledge of the life under natural conditions of two types of primates that are as yet very little known. Departing from her very specialized study of two species, Jolly enlarges her conclusions to the lemuroids as a whole, drawing on personal observations made in different parts of Madagascar and on the litera-

ture. Her work does not close the study of Malagasy lemurs. It can serve as a model for equally detailed studies of other species, and it should encourage the safeguarding, with the combined help of all scientists, of the exceptional, but unfortunately threatened, territory for study that the natural reserves of Madagascar provide.

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Copper Proteins

The Biochemistry of Copper. Proceedings of the Symposium on Copper in Biological Systems (Harriman, N.Y.), September 1965. JACK PEISACH, PHILIP AISEN, and WILLIAM E. BLUMBERG, Eds. Academic Press, New York, 1966. 606 pp., illus. $23.50.

Symposium volumes rarely make good books. That this collection of papers and discussion succeeds, at least in part, is the result of two facts. First, the study of copper proteins has reached a point at which review is needed and new ideas are beginning to emerge. Second, profitable contact can now be made between biochemists and those physical chemists concerned with the nature of transition metal complexes. The lively interchange between these groups is evident in the discussions following many of these papers.

The book begins with a series of excellent papers on the bonding and structure of low-molecular-weight copper complexes. I particularly enjoyed H. Freeman's concise and detailed elucidation of structures determined by x-ray diffraction, which is appropriately followed by the work of Gurd and Bryce on interactions of cupric ions with myoglobin and model peptides. This approach, in which analogies between small complexes and protein complexes are stressed, is neatly complemented by papers by W. E. Blumberg and R. J. P. Williams, in which possible unique behavior of copper-protein complexes is emphasized. Unfortunately, this good introduction is immediately followed by a series of generally unrelated papers on physiological problems. While essential to a broad view, this material would have been much more appropriate near the end of the book, following the discussion of particular copper proteins.

The remainder of the volume is devoted largely to papers on individual copper proteins. Fortunately, there was an apparent effort to treat a few proteins in depth, rather than to survey the field uniformly. As a result, there are very successful sections on ceruloplasmin, cytochrome oxidase, and tyrosinase. Each of these series of papers is prefaced by an introductory review, and in the first two instances, the discussion of each group of papers is combined. It is unfortunate that two papers on Wilson's disease, which might reasonably follow the series on ceruloplasmin, are placed before.

The book will, of course, be of particular value to those working with copper proteins. But a broader audience will find, particularly in the first section and in the sequences of papers on ceruloplasmin, cytochrome oxidase, and tyrosinase, a good picture of the current interaction between the chemistry of metal complexes and the biochemistry of metalloproteins.

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Photochemistry

Mechanistic Organic Photochemistry. DOUGLAS C. NECKERS. Reinhold, New York, 1967. 334 pp., illus. $14.75.

The current activity in organic photochemistry has resulted recently in the publication of several books on the subject written from different points of view. This newest addition "is intended primarily for organic chemists and biochemists whose major interest is something other than photochemistry. Students at the senior or first year graduate level should find it useful." The book is therefore an introduction to organic photochemistry, not primarily a critical discussion of the subject for researchers in the field.

After a much-too-brief discussion of the nature of the absorption process and excited states, the author discusses photochemical reactions, grouping them into artificial categories based on the overall transformations involved (decomposition reactions, addition reactions, rearrangements, and so on). Numerous examples are given in useful tables, and each section is extensively referenced, particularly with respect to the recent literature through early 1966. The coverage is broad, including all standard reactions and several quite obscure reactions. Numerous applications for synthetic purposes are noted.

The author has chosen in most instances to present mechanistic conclusions without the data and observations that led to the conclusions. It seems to me that it would have been preferable to give the reader, particularly one unfamiliar with photochemistry, a better idea of the kind of experiments that have been carried out and the nature of the observations. For example, the extremely important area of energy transfer is treated superficially (barely six pages), and there is very little direct reference to experimental data to indicate the basis for the theory. It does not seem to me desirable to minimize the physical aspects of organic photochemistry, especially in a book whose title indicates a mechanistic orientation. Much current work involves kinetic studies, often no more complex than competitive kinetics based on a steady-state analysis, but there is not a single rate expression in the book, although values for rate constants (which will have little meaning for the reader) are occasionally cited. There seems to have been little need for this omission, for most of the prospective readers will have had at least an introductory physical chemistry course, including basic kinetics.

There are a number of topics in which more detail would be desirable, among them the role of twisted ("phantom") triplet states, photosensitized *cis-trans* isomerization and dimerization of olefins, photochemical formation of *trans*-fused bicyclo-[4.2.0]hexane ring systems, and the intriguing complexities of dienone and enone photochemistry (particularly with reference to the work of Jeger and Kropp). The author also overemphasizes his premise of the relationship of photochemistry and ground-state free-radical chemistry.

In general, the writing is clear, and there are relatively few typographical errors. Structural formulas are used extensively, but a number of figures are confusing. The book can be especially recommended to people with little interest or background in the more physical aspects of the subject who want to learn about the scope of organic photochemistry and its synthetic utility.

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