when the optical thickness of the system is not small in some frequencies. Hence, in general, the determination of the local state of the gas at some point z requires knowledge of $I_\nu(z, \theta)$, the intensity of radiation with frequency ν making an angle θ with the z-axis, which in turn depends on the state of the gas in a large region surrounding the point z. The author calls this situation "nonlocally controlled." Determination of the state of the system now requires self consistent global solutions of the microscopic kinetic equations for the interconnected state of the gas and the radiation field. How to attempt to do this using the experimental information obtained from observing I_ν at the surface of the atmosphere is the main content of the book.

The book consists of seven lectures: "Aim and structure of spectroscopic diagnostics"; "Empirical methodology for specifying the observational state"; "Theoretical approach to the intermediate parameters"; "The small-perturbation vs. the general rate-process approach to the non-LTE configuration for a diffuse radiating gas"; "The radiative transfer problem for atmospheric self-emission"; "Relation of the local energy content of the gas to its spectroscopic state"; and "The new spectroscopy."

I found the book very instructive and, on this score, would recommend it highly to physicists interested in doing research in this field. (Warning: as a physicist working in nonequilibrium statistical mechanics, I found the constant use of the word "nonlocal" somewhat confusing. After all, even in LTE the temperature is nonlocally controlled.) I heartily wish I could say that I found the book easy or pleasant reading. Unfortunately, I did not. The style, which might have been clear in oral presentation, is generally very complex, so complex in fact that I frequently found it impossible to decide just what the author had in mind. Fortunately, there are exceptions to this rule. The bibliographical notes give a concise historical review, with acid comments, of the development of the subject. There is no general index.

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Chemistry of Natural Products Series

The Chemistry of the Vitamins. S. F. Dyke. Interscience (Wiley), New York, 1965. x + 363 pp. Illus. $10.

This book covers in a relatively comprehensive and satisfactory manner what its title indicates. Included are the borderline substances, lipoic acid, the essential fatty acids, and myoinositol as well as eight individual vitamins and five vitamin groups (vitamins B_6, vitamins A, vitamins D, vitamins E, and vitamins K). A short introductory chapter is concerned mostly with nomenclature. A total of about 950 references are cited at the ends of the individual chapters.

Unfortunately, from my viewpoint, real advances in the area of vitamins will not depend on more and more refined knowledge of their chemistry. Rather we need to know much more about their biological functioning and their interrelationships and to have quantitative information about vitamin requirements. The author has unavoidably introduced some of this biochemical material, and unfortunately, it is not of the highest order. He says, for example, "It is unlikely that all the vitamins have been discovered and much effort is being devoted to nutritional research at the present time." Although a categorical denial would not be justified, the statement suggests a misconception about the present status of the situation. He also states that "The normal adult requires about 3250 units per day of Vitamin A." The presentation of this figure does not take into account the fact that, for 13 years, Mead, Johnson, and Company offered a $15,000 prize to anyone who would determine the Vitamin A need of humans; there were no takers. Mead, Johnson would have been satisfied with a value expressed with *one* significant figure. In a number of places the author speaks of the production of vitamins by intestinal bacteria, but he does not mention this in connection with the requirements of humans for vitamins K. (Healthy adult mammals are generally considered to have all their vitamin K needs supplied by this means.)

These matters lie outside the subject of this book—that is, the *chemistry* of the vitamins. On the strictly chemical phases, I have no sound basis for challenging the author's competence. I did not attempt to detect typographical errors, but they appear to be few.

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Atomic Physics

The Theory of Electron-Atom Collisions. G. F. Drukarev. Translated from the Russian edition (1962) by S. Chomet. J. B. Hasted, Translation Ed. Academic Press, New York, 1965. xii + 161 pp. Illus. $6.50.

In recent years there has been an almost explosive development in the experimental and theoretical study of atomic collision phenomena at relatively low energies of impact. This has arisen partly because of the requirements for knowledge of the rates of a wide variety of collision processes in high temperature plasma physics, atmospheric physics and astrophysics, direct conversion of heat to electricity, and the study of lasers. Among the various phenomena are many that are concerned with the collisions of electrons with atoms, a subject which is still attractive in that it offers greater scope for detailed theoretical analysis than most others.

The appearance in a good translation, of a book such as that written by Drukarev, devoted to describing the present state of this analysis, is therefore very welcome. The author is at pains to apologize for not presenting a fully comprehensive account and for the fact that by the time the book has appeared it is already a little out of date. Neither apology is necessary. It remains important to present interim surveys even of rapidly expanding fields—there is always a strong tendency for those involved to miss seeing their own work in a larger context. Equally well, the book gains by not attempting to be too comprehensive. On the other hand it contains a great deal of general collision theory and a large part of the major theoretical applications to electron impact with atoms.

The first two chapters give rather concentrated but still thorough accounts of scattering theory, including variational methods and dispersion relations among other topics normally dealt with. Although these chapters are not easy

reading, the treatment is systematic and the approach often possesses a touch of novelty.

Chapter 3 gives a good account of the further theory involved in discussing collisions of electrons with hydrogen atoms, the basic problem. This account precedes a discussion of applications to elastic scattering and to excitation (chapters 4 and 5). Ionization is specifically excluded. Chapter 6 extends the analysis to collisions with helium ions.

After a further specialized chapter that deals with collisions with helium atoms, an important case because of the wide range of experimental tests available, the analysis is generalized in chapter 8 to apply to collisions with any atom or ion. This is exemplified in chapter 9 for sodium atoms, which are of special interest because of the very large contribution to the polarizability which comes from the 3p orbitals. Finally, in chapter 9 a short account is given of excitation of multiply charged ions, a subject of much interest in high temperature plasmas, whether in terrestrial laboratories or in the solar corona.

There is much of interest in this book for anyone who is concerned with theoretical atomic physics, but the fact that rather forbidding analysis is carried through in detail makes the volume of special use to workers in the specialized field covered. There is little attempt made to bring out the physics involved, but this is neither expected nor required of all review monographs. The translation reads well, and the format is pleasing.

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University Reviews in Biology

Reproduction in the Insects. K. G. Davey. Oliver and Boyd, London; Freeman, San Francisco, Calif., 1965. x + 96 pp. Illus. Paper, $2.50.

Recently man has shown concern about the population explosion and is beginning to make a concerted effort to control human reproduction. For a somewhat longer period he has tried to control insect populations, but only within the past few years has he attempted to do this in certain pest species by controlling their reproduction. A thorough knowledge of the fundamental aspects of reproduction is necessary before reproduction—insect or human—can be controlled. This book briefly summarizes various aspects of insect reproduction and by pointing out unsolved problems emphasizes the gaps in our knowledge of this important subject.

Despite its briefness, this volume covers the following subjects: the male reproductive system and spermatozoa; the female system and eggs; transfer of semen; ovulation; fertilization and oviposition; parthenogenesis; viviparity; polyembryony; alternation of generations; and hormones and reproduction. There are few errors. The ootheca of ovoviviparous cockroaches is first extruded and then retracted into a uterus or brood sac; it is not ". . . withdrawn into the ducts once more, . . ." (p. 60) or retained ". . . in the genital ducts" (p. 81).

Davey probably completed the book in 1963 (the preface is dated January 1964), yet approximately 34 percent of the 136 references were written in the 1960's and almost 40 percent in the 1950's. There is considerable interest in, and research being conducted on, hormones and reproduction—so much so that, despite the up-to-date nature of this review, some of the conclusions mentioned here have since had to be modified.

"This little book" is lucid and does what Davey hoped it would—acquaint the undergraduate and the graduate with the physiology of reproduction in insects.

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Rabbit Populations and Myxoma Virus

Myxomatosis. Frank Fenner and F. N. Ratcliffe. Cambridge University Press, New York, 1965. xliv + 348 pp. Illus. $15.

Evolution is the greatest unifying theory in biology, but in only a few situations has man been able to study the process taking place with sufficient speed, and with sufficiently large animals, to observe its course. From this point of view the interactions of rabbit populations and myxoma virus have provided a grand experiment "in nature." The stage for this experiment was beautifully set at its outset in 1950. On the one hand was an ancient population of cottontail rabbits (*Sylvilagus* sp.) in North and South America, in which host-parasite relations had reached a well-adapted equilibrium, a climax association, and on the other, populations of European rabbits (*Oryctolagus*) running into billions, without prior experience with myxoma, a virus not only new to them and to the continent of Australia, but also almost 100 percent lethal. The opportunity provided for study was fortunately recognized by Fenner and his associates from the start. Their book, therefore, gives a comprehensive and relatively complete picture of the way in which the rabbit has become genetically more resistant and the virus less virulent, with the mosquito vector acting as a principal agent of natural selection.

It is apparent from their book, *Myxomatosis*, that Fenner and Ratcliffe had a well-conceived strategy for studying their continental problem and ways of measuring the step-by-step changes that took place. If one is interested in details of virology as well as in field studies, the book may be read *in toto*. A general reader, however, may find that a few chapters, especially those dealing with the pox viruses, are not too germane to the central theme. But the book can be read selectively, for each chapter is followed by a clear, readable summary that is sufficient to maintain the thread of the account between the chapters of more general and often absorbing biological interest.

Myxomatosis should appeal to at least three classes of readers. It will certainly appeal to biologists who are interested in evolution, for they will discover that this is one of the few published accounts that shows how powerful a selective factor an infectious disease can be; another class is those who are interested in wildlife management, for they will find many lessons here exemplified.

The book's greatest appeal, however, should be to those who are interested