historian of science who has devoted much of his long career to the work of Newton and who is therefore at home in the maze of contemporary sources. Behind the immense amount of concrete information and often subtle analysis of the material lies Cohen's confident sense of Newton the man and the thinker. He has already told us much about Newton; his *Introduction* carries the promise that he can tell us more. We can only hope he will soon do so.

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References and Notes

1. See Newton's own account in various letters of the work achieved during this period in Supplement I of Cohen's *Introduction*.
2. See "The *Annus Mirabilis* of Sir Isaac Newton: Tricentennial Celebration," *Texas Quarterly* **10**, No. 3 (Autumn 1967), republished in 1970 by M.I.T. Press.
3. See Cohen's explanation of the term, *Introduction*, p. 3.
4. To be precise, they are: M (the manuscript printer's copy), E_1 (the first edition), E_1a (Newton's annotated copy of E_1), E_1i (his interleaved copy of E_1), E_2 (the second edition), E_2a (his annotated copy of E_2), E_2i (his interleaved copy of E_2), and E_3 (the third edition).
5. A random spot check using the first edition revealed no discrepancies.
6. Cohen, *Introduction*, p. 231: "Prodded by Cotes, Newton enriched the *Principia* to a degree that would never have been achieved but for Cotes's intervention. It is clear, I believe, from a reading of the Newton-Cotes correspondence that Newton had originally intended a far less drastic revision of Books II and III than he eventually produced. The credit is Cotes's."
7. In particular, this absence of work sheets leaves unresolved the question of whether Newton employed his algebraic method of fluxions to derive the theorems presented in classical geometric form in the *Principia*.

Lepidoptera

Butterflies of the Australian Region. BERNARD D'ABRERA. Lansdowne, Melbourne, 1971 (U.S. distributor, Entomological Reprint Specialists, Los Angeles). 416 pp., illus. $39.95.

Australian Butterflies. CHARLES MCCUBBIN. Nelson, Melbourne, 1971 (U.S. distributor, Entomological Reprint Specialists, Los Angeles). xxxii, 206 pp., illus. $30.

The publication of these two books ends a long period during which there have been no major works on the Australian butterflies, although much new information about them has accumulated. Both books are large and sumptuously illustrated in color and cover their respective fields thoroughly and authoritatively. Diagnostic characters for identification are pointed out, larval food plants are listed, and basic information is given about geographic distribution, life histories, and habitats. The books are, however, quite different from each other in other respects because of the particular interests and abilities of their authors.

Butterflies of the Australian Region covers not only Australia but the whole zoogeographic unit that includes New Zealand, New Guinea, eastern Indonesia, and such island groups as New Britain, New Caledonia, the Solomons, and Fiji. It will, therefore, be especially valuable to zoogeographers, as well as to taxonomists, in its treatment of such characteristic endemic groups as *Ornithoptera* and *Delias*. The author has done a very thorough job taxonomically, studying types when possible and illustrating many of these. The illustrations, which are of the highest quality, consist of more than 3000 color photographs made by the author. Most of these show specimens, but many are of early stages, environments, and habits. Only the true butterflies are covered. Short sections deal with such subjects as the butterflies' place in nature, mimicry and protective resemblance, and classification and nomenclature, and there is a very interesting short history of the collecting and study of the butterflies of the region. (This includes a photograph of the first specimen of the great high-flying *Ornithoptera*, collected in 1884 or 1885 with a shotgun!) A few new subspecies are named. There are also maps, a glossary, a good selected bibliography, and a general index. Unquestionably all taxonomists and other student of Australasian butterflies will find this book particularly valuable.

Australian Butterflies is illustrated by a vast number of paintings by the author, who is a scion of an Australian family distinguished in the arts. The paintings of specimens are excellent and accurate, and entirely adequate for identification. Only Australia is covered. Not only the true butterflies (Papilionoidea) but the very numerous skippers (Hesperioidea) are included. A great many food plants and the early stages of many species are illustrated. Many charming paintings of butterfly habitats and collecting localities and scenes are very attractive. Perhaps one of the most distinctive, and one of the most valuable, features is the large number of descriptions of butterfly habits and behavior, the majority from the personal observations of the author. These include accounts of courtships and mating behavior, flights, oviposition, larval activities, "hilltopping," and the relationships with ants for which so many Australian Lycaenidae are famous. Detailed directions for collecting and caring for specimens will be very useful for the amateur. There are also a large bibliography, a map and key to localities, a glossary, and two indexes, one listing the plants separately. Though not based on such wide taxonomic and zoogeographic studies as D'Abrera's work, this is a very important book that will have special appeal to all naturalists and collectors.

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Various Groups of Viruses

Comparative Virology. A conference, Montreal, Sept. 1969. KARL MARAMOROSCH and EDOUARD KURSTAK, Eds. Academic Press, New York, 1971. xvi, 584 pp., illus. $27.50.

This book arose out of the First International Conference on Comparative Virology. However, it is not a "symposium volume" but a series of long review articles on various groups of viruses written from a comparative point of view. As such it contains a good deal of new material, or at least new ways of looking at known data.

Moves over the last 20 years, initiated by Sir Christopher Andrewes, and brought to fruition by André Lwoff, have resulted in the establishment of an International Committee on Nomenclature of Viruses (ICNV), dedicated to the classification of viruses according to physicochemical criteria, irrespective of the nature of the host. *Comparative Virology*, therefore, comprises much more than just the comparison of viruses of different species of vertebrates or plants; it involves the consideration of physicochemical criteria of the classification of viruses of vertebrates, invertebrates, bacteria, and plants.

The volume opens with an essay on the classification of viruses, in which Lwoff and Tournier acclaim the virtues of their "system" and castigate the mistakes of those who do not yet accept it. Valuable though Lwoff's contributions have been, it is probably a mistake to hasten as rapidly as he would like in classification and nomenclature; however, the "committee" system of the ICNV will probably ensure that changes occur slowly.

In spite of the avowed intentions of the conference and the editors of the book, most of the articles that follow deal with viruses of vertebrates, of

insects, of plants, or of bacteria. This is not surprising, for in fact few viral groups have yet been discovered (except those transmitted by arthropods to vertebrates or plants) in which the vast majority of all known members do not multiply only in a particular kind of host.

M. D. Hoggan gives an excellent review of the present state of knowledge of the parvoviruses and brings together a lot of information on parvoviruses of different species of vertebrate that is rather scattered in the literature. He does not consider in any detail the bacteriophage ϕX174, which has many features of resemblance to the parvoviruses of vertebrates.

The next three articles, on Papovaviridae, Adenovirus, and Herpesvirus, provide "comparative virology" only in the sense that the authors have looked broadly at the families and genera concerned and have written essays in comparative vertebrate virology—for no members of these groups have been discovered in any other sort of host. Nevertheless their articles provide excellent summaries of the state of knowledge in 1970. These fields move so fast, however, that the reviews are now somewhat out of date.

The chapter on poxviruses by M. Bergoin and S. Dales draws together for the first time information on the familiar poxviruses of vertebrates and on the agents very like them that have been discovered in several kinds of insects. The authors adduce good reasons for classifying the poxviruses of vertebrates and invertebrates together, in a single family.

Most bacteriophage workers are much more concerned with using bacteriophages as tools for the study of problems in molecular biology than they are with the biological characteristics of bacteriophages as a whole. D. E. Bradley has written a valuable review of bacteriophages as a whole. Like the three groups of viruses of vertebrates mentioned earlier, there are very few bacteriophages that could possibly be classified with viruses that ordinarily affect other kinds of host: ϕX174 may be an exception, or a coincidence.

The picornaviruses, classified as a family Picornaviridae by ICNV, are an enormous group. Most of its known members are viruses of vertebrates, and it is these that Rueckert discusses in a masterly article. He does not consider the few viruses that have been found in insects and plants that resemble picornaviruses.

Viruses can be classified in many ways, and one of the most useful ways for epidemiologists is according to the mode of transmission, so that one can designate respiratory viruses, enteric viruses, and arthropod-borne (arbo-) viruses. All these groups are heterogeneous taxonomically, in relation to the structure and chemistry of the virus particles. It has taken arbovirologists some time to accept this view, but the doyen of arbovirus classification, J. Casals, here sets forth evidence of the taxonomic heterogeneity of arboviruses. It will clearly advance virology to be able to group together viruses that are similar in their physicochemical properties.

Most nonenveloped rod-shaped viruses infect plants. Hirth discusses this group at some length. He does not consider the rod-shaped bacterial viruses, since they contain DNA.

If any group bridges different kinds of host it is the bullet-shaped viruses, currently classified by ICNV as rhabdovirus. Clearly this large group is complex—one wonders whether we are not seeing the same kind of unsophisticated attitude that formerly grouped almost all enveloped RNA animal viruses as "myxoviruses" or "myxovirus-like." K. Hummeler gives a useful review of the viruses of vertebrates, invertebrates, and plants that have a bullet-shaped morphology. It will not be possible to classify these viruses adequately until much more is known of their chemical composition.

Much the same comment may be appropriate for viruses with genomes of double-stranded RNA (S. Millward and A. F. Graham). The reoviruses of vertebrates and wound tumor virus are very similar in their physicochemical properties, but the group is clearly much more diverse, as evidenced by the bluetongue-like viruses (all arboviruses), cytoplasmic polyhedrosis virus, rice dwarf virus, and some newly discovered viruses of fungi.

Like the rod-shaped RNA viruses, found only in plants, and the isometric DNA viruses, found predominantly in vertebrates, insects have a great range of viruses that do not closely resemble those of other hosts. K. Smith describes the nuclear and cytoplasmic polyhedrosis viruses and the granulosis viruses, but fails to take note of Bellett's observation that some of the nuclear polyhedrosis viruses may be more closely related to granulosis viruses than to each other.

T. O. Diener gives a fascinating account of potato spindle tuber virus, which appears to be a small naked piece of RNA. Perhaps the scrapie agent may have similar properties.

Through no fault of the author the last chapter, on oncogenic viruses (A. F. Howatson), seems out of place in this book. It includes viruses of several taxonomic groups, and of vertebrates only, and there has been a plethora of reviews on the subject.

This is a useful book that reflects a growing attitude toward virology as a mature and independent discipline.

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Books Received

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