

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 ϕ X174, 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 These fields move so fast, however, that the reviews are now somewhat out of date.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: ϕ X174 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 ac-

count 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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