

plants; and Bunting, Kuckuck, Gordon, Poissonet, and Henry explain how ecological data can most efficiently be recorded. The problems of quarantine, sanitation, evaluation, storage, and maintenance of seeds and cultures are discussed in a series of articles.

This volume has exceptional value for two reasons: it gives many cogent reasons for devoting more time, money, and human energy to exploring, making inventories of, and conserving our genetic resources of crop plants, and it is an invaluable encyclopedia of methods by which these goals may most efficiently be achieved.

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Mitochondria and Plastids

Control of Organelle Development. Society for Experimental Biology Symposium No. 24, London, Sept. 1969. Published for the Company of Biologists by Academic Press, New York, 1970. viii, 524 pp. + plates. \$17.50.

The stress in this collection of papers, from two dozen research groups, is on the development, the nucleic acids, and the transmission from parent cell to daughter of mitochondria and plastids. There are also brief discussions of protozoan killer particles, ciliate macronuclei, and cytoplasmic influences on the nuclei of protozoa, *Acetabularia*, and amphibians. Except for consideration of protozoan cortical patterns, only passing attention is paid to centrioles and basal bodies, and very little is said about the development of cilia and flagella or endoplasmic reticulum. There are relatively few surprises in choice of authors, and only two or three of the papers are of questionable quality. With occasional exceptions, the photomicrographs range from the adequate to the mediocre. This appears to be a matter partly of space constraints and quality of reproduction; some of the pictures have obviously been reduced excessively so that structures of interest are almost invisible. More annoying is the separation of photographs from text and from legends. The way the book is laid out, one must go to the end of each article to find the electron micrographs referred to in the text and then sometimes make a further search for the

detailed explanation of the figures.

There emerges from the book a portrait of a lively and intriguing field that has recently passed a major take-off point. In little more than a decade, the focus of study of the development and transmission of cytoplasmic organelles has shifted substantially away from formal genetic analysis of "cytoplasmic inheritance" and spirited arguments about hypothetical "de novo" or "self-duplication" mechanisms. Important details are becoming clear about the actual modes of assembly of macromolecules into the enzyme-laden membranes within mitochondria and chloroplasts, and there are some intriguing leads concerning the assembly of other intracellular structures. But by far the most dramatic advances have been made in the analysis of nonnuclear hereditary machinery—notably the DNA, ribosomes, and related systems of chloroplasts and mitochondria. Ten years ago the existence of such components was in doubt. Now, the "bacterial-like" ribosomes of mitochondria and chloroplasts and the circular DNA of animal cell mitochondria are standard items of discussion in the better undergraduate texts. As reflected in the present book, the questions that now are central and are beginning to yield to experimental analysis include the following: How much hereditary information is there in a mitochondrion or chloroplast? Is there evolutionary or functional significance to the fact that mitochondria of higher animals seem to have less DNA-borne information than mitochondria of lower forms? Is there more than one linkage group per individual cytoplasmic organelle, and do the plastids or mitochondria in a single cell normally differ significantly in their nucleic acids? Does the apparent genetic recombination between organelles result simply from fusion of the organelles, or does it also involve the formation of recombinant DNA molecules? Which mitochondrial or plastid proteins are synthesized within the organelles and which come from outside? How does the transfer of proteins from "ordinary" cytoplasmic ribosomes to the mitochondria or plastids come about? How many separable steps in chloroplast morphogenesis can be distinguished by study of mutants or of material in which protein synthesis or nucleic acid metabolism has been experimentally

manipulated? Do the inner and outer mitochondrial membranes differ in origin? Is there exchange of messenger RNA's or genetic regulatory molecules among the nucleus, the chloroplasts or mitochondria, and the rest of the cytoplasm? What does it mean that some chloroplast ribosomal RNA's can hybridize with nuclear DNA? What sorts of steps might be involved in the evolutionary transformation of a symbiotic microorganism into an organelle?

Few of these questions are answered definitively by the contributors to the book. But almost all are well posed, put in context, and presented in terms of relevant present knowledge and reasonable future perspectives. Thus, although like virtually all such books this one will soon be out of date, it seems to have come at a propitious moment and conveys a useful image of a field during a crucial and fascinating period of its history.

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A Non-Taxonomic Treatment

Principles of Paleontology. DAVID M. RAUP and STEVEN M. STANLEY. Freeman, San Francisco, 1971. xii, 388 pp., illus. \$11.50. A Series of Books in Geology.

Paleontology texts have traditionally emphasized the descriptive-taxonomic side of the subject. Raup and Stanley have broken out of this mold, to concentrate on biologic principles and on the application of paleontology to the general problems of science. *Principles of Paleontology* is to be read in parallel with, or subsequent to, a systematic descriptive course. It makes no attempt to deal comprehensively with any particular problem, but highlights a large number of diverse topics, selected mainly from the newer primary literature. Early chapters deal with the specimen, ontogeny, populations, and the species. A fine discussion of the nature of higher taxonomic levels leads to a brief but lucid exposition of numerical taxonomy. Subsequent chapters include treatments of adaptation and functional morphology (including a section on theoretical morphology and computer simulation), of evolutionary patterns, and of biostratigraphy, and the book ends with a discussion of applications of paleontology