

Dispersal Mechanisms

Fungal Spores. Their Liberation and Dispersal. C. T. INGOLD. Clarendon (Oxford University Press), New York, 1971. viii, 302 pp. + plates. \$13.

This volume constitutes a new edition in combined form of two of the author's earlier books, *Dispersal in Fungi* and *Spore Liberation*, and it is the most comprehensive and up-to-date review of the subject available. It is the culmination of almost 40 years of the author's research in this field.

Knowledge about fungal spores and their distribution is of interest not only to students of fungi but also to pathologists, allergists, and, in fact, all of us. Fungal spores in the air rank with pollen as major causes of human respiratory allergies. Therefore it is important to learn, as one can from this book, how the quantity and quality of air spora fluctuate in accordance with time of day, season, and weather conditions.

Even many mycologists will probably be surprised at the great variety of methods of spore liberation that have evolved among fungi. Methods of forcible discharge include rounding off of turgid cells, bringing about their sudden separation; expulsion of spores from within a turgid sac (ascus); ballistospore discharge; and discharge connected with drying which results either in hygroscopic movement of structures associated with spores or in the sudden rupture of "stretched water" in a conidiophore that causes release of the conidium. A fair discussion of conflicting ideas on the ballistospore mechanism in basidiomycetes is presented.

Mechanisms of spore dispersal in which the fungi are passive involve the agencies of wind, rain, water, insects, and larger animals. One learns that no agent is more active in wide dispersal than air currents, which may carry both pathogenic and nonpathogenic spores for many miles and to great heights (up to 90,000 feet) and that the splashing effect of raindrops is more effective in dispersal than is the washing away of spores. Though fungi have obviously not evolved in relationship to insects in as many ways as have flowers, methods of dispersal by insects have evolved independently on repeated occasions. For example, the sugary nectar in rust pycnidia attracts flies and other insects, spores of the anther smut of *Lychnis* are carried by a nocturnal moth that pollinates the flowers, and the foul-smelling spore slime of the stinkhorns

draws numerous flies. One of the stinkhorns (*Aseroe*) even has fruiting bodies with scarlet rays resembling the petals of a flower.

Many of Ingold's own research endeavors have centered on spore dispersal in aquatic fungi, and the chapter on this subject acquaints the reader with the variety of spore forms that have evolved in relation to dispersal and attachment in aquatic environments. One of the most common types is the tetradiate spore, found most abundantly among aquatic hyphomycetes. Evidence is presented that such spores remain suspended longer in water and become more readily attached to their substrates than do less modified spores.

Missing is a discussion of spore dispersal in dermatophytic fungi, but this is a minor point in view of the wealth of information presented. Ingold's writing is facile and lucid and his illustrations are excellent. The book contains much information useful in mycology, and scientists in other fields as well as the educated layman could also find a great deal of interest here. The volume is an indispensable aid in mycological teaching and research.

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Bioenergetics

The Mammalian Mitochondrial Respiratory Chain. WALTER W. WAINIO. With a contribution by Alice A. Greene. Academic Press, New York, 1970. x, 500 pp. + plates. \$23. Molecular Biology series.

It is a fact of life that in the absence of specific molecular information about biological phenomena the true "facts of life" remain obscure and only the behavioral "veneer" of the living system is discernible prima facie to the investigator. Yet when such molecular information is sought, we touch upon another apparent truism, which is that the overwhelming number of variables comprising life processes, regardless of how well parametered the experimental system, makes it excruciatingly difficult to obtain molecular answers to questions about mechanism.

The mitochondrion, however, whose biological *raison d'être* has been increasingly scrutinized for over 30 years, provides us with a surprisingly self-

contained system, one about which we know quite a lot on the microcosmic level. From this microdynamic vantage point, the mammalian mitochondrion, the source of most cellular bioenergetics, is spread before us in awesome molecular detail by Walter W. Wainio. The individual pieces of the puzzle, collected and refined for so many years, are thrown on the table, so to speak, painstakingly assessed, and ordered by Wainio into logical agglomerates of structural as well as functional information, ultimately to be handsomely presented as a concise encyclopedia of the mitochondrion and what it does.

It is a difficult task to keep in mind and compare the sites and modes of action of the numerous respiratory inhibitors, uncouplers, and artificial electron donors and acceptors thus far employed in the study of mitochondrial oxidative phosphorylation. Then, too, one must be continually cognizant of the electron carrier cofactors themselves, each of which is capable of detailed characterization individually but when integrated into the structure of the mitochondrion manifests a distressing array of possible interactions with its environment. Understandably, no one has discovered an ideal manner of communicating such an assortment of advanced scientific minutiae. The organization of Wainio's book, which segregates the reporting of recent and past data (including brief analyses along the way) from the general narrative account of the mitochondrion, is as successful as practicality permits.

The greater part of the volume is a discussion of the molecular transactions of the mitochondrial respiratory chain components in the manner of the familiar series *Methods in Enzymology*, that is, of a well-documented review article. Before and after these sections, either through general introductions or through analyses of current mechanistic hypotheses, Wainio briefly leads us through the research history and general meaning of the reported data, with the touch of a storyteller. The opening section of the book elegantly summarizes the controversies over mitochondrial fine structure, and electron micrographs abound. A detailed methodology follows, relating the tissue from which the mitochondria were obtained to procedures for isolation and characterization. Chapters 2 through 4 present biochemical specifics on the various components of the respiratory