er into a book. It is evident that all three authors are basically radio astronomers; the discussion of optical and x-ray observations would no doubt have been different in emphasis had they been written by specialists from these fields. The few mistakes in these discussions are unimportant to the main concepts.

The books will be used by advanced astronomy students and by astronomers and physicists whose specializations are in other areas. The "small band of pulsar specialists" (a phrase from Smith's preface) already know this material, although the books may serve them as useful compilations. Nonphysicists will have trouble because much knowledge of physics is assumed (of electrodynamics and the physics of nuclear matter, for example). But those who want to read most of what is known about pulsars should read one or both of these volumes.

JEFFREY D. SCARGLE
Theoretical and Planetary Studies Branch, Space Science Division, NASA-Ames Research Center, Moffett Field, California 94035

Outbreeding Mechanism

Incompatibility in Angiosperms. D. DE NETTANCOURT. Springer-Verlag, New York, 1977. xiv, 232 pp., illus. $24.70. Monographs on Theoretical and Applied Genetics, 3.

Self-incompatibility in flowering plants is the inability of a fertile hermaphroditic plant to produce zygotes after self-pollination. Self-incompatibility is genetically controlled by one or more loci, with from two to hundreds of different alleles, depending on the particular system. Fundamentally, it is a cellular recognition phenomenon in which self is rejected and nonself accepted.

Self-incompatibility is common in angiosperms and is a major mechanism for enforcing outbreeding in plant populations. It is therefore instrumental in determining the genetic structure of populations and is of considerable evolutionary significance. It is also of importance in agriculture, particularly in dictating the pollination requirements of certain fruit and seed crops.

Incompatibility in Angiosperms is the first book in English devoted to the subject. De Nettancourt has collected and summarized a large amount of widely scattered literature. The result is comprehensive and up to date, although many aspects of the subject are treated very briefly and the book is written in a rather telegraphic style.

More than ten different systems of genetic control of self-incompatibility are now known. A polygenic system with at least three or four loci has recently been discovered in *Ranunculus* and sugar beets. In this system the loci are complementary; that is, the three or four loci together specify one unique pollen incompatibility phenotype. Such complex systems are difficult to elucidate genetically and may be more common than is now apparent.

The biochemistry of the incompatibility reaction remains largely unknown. The book summarizes the limited data available and the abundance of wild and wonderful hypotheses. The sporophytic incompatibility system of the Cruciferae is the best understood. The evidence suggests that the diploid sporophyte synthesizes recognition proteins in the tapetum of the anther and in the stigmatic papillae. The tapetal proteins are transferred to the exine of the pollen grain and the stigmatic proteins are transferred to the pellicle that covers the surface of the stigma. At pollination the exine bound proteins diffuse out and interact with those of the pellicle. If the proteins are identical, a rejection response occurs in the papillae and pollen tubes do not penetrate the stigma.

The natural evolutionary breakdown of self-incompatibility systems is treated briefly. More coverage is given to the experimental modification of incompatibility, particularly as a tool for the plant breeder. Included are such sexual exotica as electrically aided pollination and mutilation of the stigma with a wire brush.

One-fifth of the book is devoted to interspecific incompatibility, the failure of pollen from alien species to germinate on a stigma—that is, the rejection of nonself pollen. This is a subject about which virtually nothing is known. The author concludes that the self-incompatibility gene is involved in the control of interspecific barriers to fertilization. The evidence is the phenomenon of unilateral incompatibility. Interspecific crosses between a derived self-compatible species and a closely related self-incompatible species often succeed when the self-compatible species is the pistillate parent, but the reciprocal cross usually fails. In this special case the self-incompatibility system may function as one barrier to hybridization, but it seems unlikely that it is the mechanism by which plants as unlike as apples and oranges recognize each other.

The major strength of the book is that it covers almost everything. The major weakness is that the author is usually noncommital and tends to present every conflicting hypothesis and bit of data at face value. One example: in a study of self-incompatibility in *Capsella* in the 1930's, Riley correctly concluded that the incompatibility behavior of the Cruciferae could not be explained by any known system. He proposed a system with two alleles at each of two loci to explain his data. After the elucidation of the one-locus, multiallelic, sporophytically controlled system in the Compositae and Cruciferae in the 1950's, Bateman showed that it could account for Riley's data and that it was extremely unlikely that *Capsella* differed from all other Cruciferae. Nevertheless, de Nettancourt seems to accept Riley's model, as well as a similar, earlier, model by Correns.

In some cases where the author does take a stand, his position seems to be dictated by historical precedent. He accepts the traditional dogma that one-locus gametophytic self-incompatibility is a primitive feature in the angiosperms, despite the fact that the system is found only in relatively specialized families and that self-incompatibility itself has never been conclusively demonstrated in any supposedly primitive angiosperm. He hedges later in the book, however, and admits that the recent discovery of polygenic systems may necessitate a revision of the traditional view.

There are a few mistakes in the book. For example, the segregations given for tristyly in figure 3 on p. 29 are incorrect.

All in all, the author has compiled a concise yet comprehensive summary of the subject, but he leaves it to the reader to recognize which conclusions are compatible and which are incompatible with the facts.

FRED R. GANDERS
Department of Botany, University of British Columbia, Vancouver V6T 1W5, Canada

Intelligent Invertebrates

The Biology of Cephalopods. Proceedings of a symposium, London, April 1975. MARION NIXON and J. B. MESSENGER, Eds. Published for the Zoological Society of London by Academic Press, New York, 1977. xviii, 616 pp., illus. $41. Symposia of the Zoological Society of London, No. 38.

This volume is the published version of a meeting held to honor J. Z. Young on his "retirement" from University College, London. Young in fact continues his research at the Wellcome Institute for the History of Medicine, hence the quotation marks. Most American