Book Reviews

Nucleo-Cytoplasmic Relations in Micro-organisms. Boris Ephrussi. Oxford Univ. Press, New York, 1953. vii + 127 pp. Illus. + plates. $3.75.

Embryology and developmental differentiation have long been recognized as subjects with which genetics must eventually make a firm alliance. The history of modern attempts to achieve a synthesis, taking into account the results of both experimental embryology and chromosome investigations, begins in the 19th century. An exhaustive account and penetrating critique of the accomplishments of this period appeared in 1895 in Y. Delage's monumental book [*La structure du protoplasma et les théories sur l'hérédité et les grands problèmes de la biologie générale* (Reinwald, Paris, 1895)], which in some important respects was a generation ahead of its time. During the present century genetics, cytology, and experimental embryology have been intensively cultivated, but relatively little investigative and theoretical activity has been directed toward their synthesis. Yet at no time was this totally neglected. Between 1915 and 1940, it was dealt with in a number of books, such as those of E. G. Conklin [*Heredity and Environment* (Princeton Univ. Press, Princeton, N.J., 1915)], E. B. Wilson [*The Cell in Development and Heredity* (Macmillan, New York, 1925)], J. S. Huxley [*Problems of Relative Growth* (London, 1932)], T. H. Morgan [*Embryology and Genetics* (New York, 1934)], H. S. Jennings [*Genetics* (Norton, New York, 1935)], R. Goldschmidt [*Physiological Genetics* (McGraw-Hill, New York, 1938)], and G. H. Waddington [*An Introduction to Modern Genetics* (Macmillan, New York, 1939) and *Organisers and Genes* (Cambridge Univ. Press, New York, 1940)]. In the last decade or two, there has been a notable increase in the amount of attention given to the problem.

Attempts at synthesis have differed fundamentally with respect to the genetic significance ascribed to the cytoplasm. On the one hand, the great majority of geneticists, especially in this country, have agreed with H. J. Muller's ["*The gene as the basis of life*," *Proc. Intern. Congr. Plant Sci.* **1**, 897 (1929)] view of the nuclear gene as the ultimate physical basis of life and have maintained that genetic functions of the cytoplasm exist but rarely and exceptionally. According to this view, the cytoplasm is

> . . . the moat that guards the hereditary estate from the inroads of the variable environment; the dual highway across which supplies from the outside are conveyed to the nucleus and products of cellular activity are transported to the outside world; the factory in which these cross-currents of materials interact to yield produce for home consumption and for export . . . the cytoplasm is the protector of the genes, their purveyor, their workshop, and the display case in which the products of their activity are shown. [T. M. Sonneborn, "The role of cytoplasm in heredity," *Centennial, AAAS*, 243 (1950)].

Developmental differentiation is therefore traced to the action of nuclear genes alone. Assuming that the initial cytoplasmic organization of the uncleaved egg is a consequence of prior gene activity, schemes may be devised to account formally for progressive developmental divergence of both cells and cell regions.

On the other hand, a relatively small group of geneticists is unwilling to concede that the methods of analytic abstraction, which have demonstrated that the nuclear genes intervene in every activity of the cell and the organism, have excluded the possibility of an equally pervasive participation of cytoplasmic materials with genetic properties. They hold that nucleus and cytoplasm form together an autoreproducing system in which both components have essential and genetic functions. Evidences for this view are drawn mainly, but not exclusively, from studies on plants and microorganisms; and these studies have provided a number of models for possible mechanisms of developmental differentiation. Some of the main discoveries, inferences, and developmental models emerging from recent work on microorganisms are set forth and discussed in this small but important book by Ephrussi, based on three lectures given in 1952 at the University of Birmingham.

Ephrussi starts with the familiar argument that reproduction of diverse tissue cells true to type in tissue culture implies a cytoplasmic basis of these genetic differences on the cellular level, for all the diverse cell types in a metazoan body are alike in the kinds of genes they contain. He then reviews a number of examples in microorganisms in which cells with the same genic constitution manifest persistent diversities owing to cytoplasmic differences. After a brief account of cytoplasmic particles or structures that manifest genetic continuity (chloroplasts, kinetosomes, kinetoplasts, and so forth), he presents more extensive accounts of the genetics of "little colony" in yeast, killers and antigenic types in Paramecium, and the barrage phenomenon in Podospora. Other examples are dealt with only in cursory fashion. This limited survey brings out, however, that a number of diverse physical bases and mechanisms are involved in persistent cell differences. Some involve genetic cytoplasmic particles; others involve persistent "cytoplasmic states." Some are irreversible; others are long-lasting but reversible. All these provide models for developmental differentiation and all illustrate how nuclear genes and the cytoplasm together constitute the underlying genetic system.

One of the chief factual reasons why most geneticists are unwilling to accept such views as being of general validity and applicability is the relative scarcity of the evidence for cytoplasmic inheritance. Ephrussi deals with this difficulty in a penetrating and stimulating addendum, which is one of the outstanding features of the book. It includes two brilliant analyses: (i) of the concept of fundamental character-

istics on the cellular, organismic, and species levels; and (ii) of the significance and limitations of the concept of covariant reproduction.

In the course of the book, Ephrussi refers to the more important alternative interpretations that can be placed upon the facts he discusses, but in so small a book one cannot expect to find them all treated exhaustively and critically. He frankly admits at the start his theoretical bias and conceives his function to be primarily the presentation of evidences and reasons for it. He succeeds admirably in accomplishing his purpose. The book is a clear, informative, lively, and stimulating treatment of a controversial and exceedingly important area of modern biology. It should take and hold an honorable place in the list of books by eminent biologists who have attempted to work toward the synthesis of genetics and embryology.

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Nuclear Theory. Robert G. Sachs. Addison-Wesley, Cambridge, Mass., 1953. xi + 383 pp. Illus. $7.50.

Books on theoretical nuclear physics are not yet numerous, so it is a pleasure to note the appearance of a new one by an eminent and qualified author. Sachs' book is not an elementary one, in the sense that a good working knowledge of quantum mechanics is demanded of the reader. It might, however, be called elementary in the more literal sense that it is concerned with the "elements" or fundamental ideas of nuclear theory. The central unknown in nuclear physics is, of course, the nature of the forces that act between nucleons; they are not like gravitational forces or electromagnetic forces. They are unfamiliar in our experience and are known only by such qualitative aspects, as, for example, that they are intense and of short range. Their nature can be expected to be revealed most directly in the simplest nuclear systems, and in pursuing these basic concepts the author devotes nearly half of his book to a discussion of two-body systems in which a single proton interacts solely with another proton or with a neutron.

In extending the discussion to the many-body problems encountered in more complicated nuclei, Sachs includes a most praiseworthy description of the shell model and the associated quasi-spectroscopic coupling schemes, including in the treatment a discussion of isotopic spin and supermultiplets. This is perhaps the outstanding part of the book. These subjects are confusing to a student who has to dig them out from original research papers, where they have too often been set forth in unnecessarily complicated language. The basic type of treatment given in this book gives one a chance to see the various aspects of the subject placed in coherent relationship.

Other chapters deal with nuclear reactions, the interaction of electromagnetic radiation with nuclei, and beta decay. Few concessions are made to pictorial representation of the matters under discussion. There are not many figures, and experimental data are not woven extensively into the text, although they are adequately referred to in footnotes. Nevertheless, the logic is developed lucidly and the book is well written, so that the advanced student will not find it formidable reading.

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Encyclopédie Entomologique, Catalogue Illustré des Lucanides du Globe. Texte. 223 pp. Illus. ***Encyclopédie Entomologique, Catalogue Illustré des Lucanides du Globe.*** Atlas. 112 plates. R. Didier and E. Séguy. Lechevalier, Paris, 1953. Both volumes, F. 8000.

The Lucanidae, commonly known as stag beetles because the males of many species have enlarged mandibles resembling antlers with which they often engage in combat, have long been favorites with collectors. Other entomologists have attempted to explain the pattern of wide variation in mandible size that occurs among the males of a single species. This new catalog lists nearly 1100 species, most richly represented in southeastern Asia and the East Indies. Only a few dozen species are Nearctic.

The text volume contains general information, indexes, and some illustrations, in addition to the main catalog. The atlas consists of outstanding illustrations, drawn mainly by the master artist Louis Marie Planet. The majority of plates are designed to show the variation exhibited by a single species. Both authors are veteran entomologists at the Paris Museum. Didier has published regularly on Lucanidae since the middle 1920's, while Séguy is best known for numerous major works on Diptera. The last previous world catalog of Lucanidae, in the Junk series, appeared in 1910. In the United States, Bernard Benesh has been the leading modern student of Lucanidae.

This catalog is in a very useful form, with full generic references and the type species of synonymous genera cited. Original references to species are followed by the main subsequent references. A bibliography of about 220 titles is followed by an index of geographic localities, including the catalog numbers of each species recorded from those localities. An index to species, genera, and higher categories is included. One section (pp. 23–61) has notes on various species and descriptions of new species.

This is a well-prepared work of fundamental importance to all serious students of the family. Although the catalog and plates comprise the main contribution, there also are brief sections of a general character, and readers may wish that they had been expanded. For instance, the discussion of geographic matters has relatively few comments on faunistic relationships. In the concise review of important type categories (p. 19), a cotype is defined differently from the meaning attached to it by most modern taxonomists. The authors prefer the term *variety* for an infraspecific category, and they treat *aberration,*