value to the nonexpert. These are the articles on neutron-scattering spectroscopy by J. W. White, the pair potential function approach to the properties of molecular crystals by S. H. Walmsley, spin polarization and spin-lattice relaxation in lowest triplet state of pyrazine by M. A. El-Sayed, L. Hall, A. Armstrong, and W. R. Moomaw, and a discussion of excitons and magnons in antiferromagnetic crystals by D. S. McClure. Many of the remaining articles are also well written but will be comprehensible and of value only to those close to the particular subject they cover.

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Immunity and Development

In Vitro. Vol. 3, Differentiation and Defense Mechanisms in Lower Organisms. A Tissue Culture Association symposium, Philadelphia, 1967. M. MICHAEL SIGEL, Ed. Williams and Wilkins, Baltimore, 1968. xii + 212 pp., illus. $11.50.

Immune responses may have evolved to control mutated cells that might become neoplastic. This book considers immune systems and therefore may be indirectly concerned with control of abnormal differentiation. Thus, some relevant questions are: Do invertebrates have immune responses and, if so, are the parameters the same as those in vertebrates? Can we observe true neoplasms in invertebrates? On the other hand, in the absence of true neoplasms, can we infer the existence of immune systems functionally equivalent to vertebrate types? Results from several laboratories have shown that immune responses undoubtedly occur in lower species, but we await more convincing demonstrations of specificity and anamnesis in invertebrates, particularly.

This book should appeal to two main audiences, developmental biologists and comparative immunologists. To provide evolutionary perspective, it is divided into three sections, dealing with cell aggregations, methods of culturing tissues from lower invertebrates and plants in vitro, and primitive mechanisms of resistance to infection in invertebrates and poikilotherms (fishes).

Much emphasis is placed on *Hydra* as an experimental animal; yet representative work involving other invertebrates could well have been included. The *Hydra* grafting studies reported deal with cell movements; tissue incompatibilities should also be considered. Since cell affinities and disaffinities are real in numerous other phyla, they may be demonstrable in the Coelenterata as well, and if present could well suggest a type of primitive immune response.

Cell aggregation has been crucial in understanding differentiation. In this symposium it was appropriately presented, for what may have been the first time, as an all-important preface to the understanding of primitive mechanisms of resistance (treated in the last section of the volume). Undoubtedly, recognition of the difference between self and not-self was manifested early in ontogeny and phylogeny in the manner in which single, disaggregated cells respond to each other; patterns form as a result of this kind of recognition, which is thus germane to development. Yet, when considered from the viewpoint of immunological competence, specific recognition lies at the foundation of defense reactions. When cells react to surface differences and fail to aggregate, this kind of specificity insures precise morphogenetic interactions in development or antigenic recognition in immunity.

The most important section of the book deals with primitive mechanisms of resistance to infection, evidenced, for example, in the work on cellular immunity in oysters. Rather than specific immunity, nonspecific host-parasite relationships are stressed. Cellular immunity at this level suggests that antigen processing by vertebrate macrophages may have come about early in phylogeny. Using the oyster to search for evidence of humoral immunity, the contributors pose the provocative and basic question of the origin of immunoglobulin chains among the invertebrates. With regard to primary clearance, oysters can, like sharks, clear bacteriophage at the same rate in 24 hours, but after secondary injection no phage was detected in shark serum, which generally was found to contain neutralizing antibody. The enhanced clearance of phage probably occurred via a cell-mediated mechanism. In the oyster a naturally occurring hemagglutinin exists which has physical and chemical properties analogous to molecules in higher forms.

With regard to immune-like phenomena, it is noteworthy that some fishes usually do not synthesize immunoglobulin A or G in response to certain antigens. The capacity to produce interferon as a means of recovery from viral attack may have evolved as an alternative to the ability to synthesize certain classes of immunoglobulins. The gene (or genes) that code for several of the immunoglobulins apparently did not differentiate until later in phylogeny.

Aggregation, cell and tissue culture of plant and animal cells, and evidence of immune phenomena are subjects that have been treated separately elsewhere. This volume fills the great need of uniting the superficially different disciplines of immunology and development. Both can profit by exchange of technical and conceptual approaches, since the disciplines cannot be strictly delineated. Many comparative immunologists were once and maybe still are concerned principally with answering questions in developmental biology.

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