whole, the discussions of mechanism, where given, are of good quality, with but few exceptions (among them the discussion of the hydrochloric acid–catalyzed racemization of optically active tertiary arsines found on p. 159, which is somewhat confused).

The compilations and discussions of spectral data, bond lengths, bond strengths, dipole moments, ionization constants, and related matters are a valuable feature of this book. The nature of bonding in some of the different types of compounds is brushed off too lightly, however. Also, some of the structural formulas are of poor quality. Irrespective of such minor faults, the book will be of great value to all research workers in the fields covered.

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Ontogeny of Immunity

Foetal and Neonatal Immunology. J. B. SOLOMON. North-Holland, Amsterdam, and Elsevier, New York, 1971. xvi, 382 pp., illus. $23. Frontiers of Biology, vol. 20.

It is probably inevitable in science that the most successful conceptual advances, while stimulating a flood of productive experiments in some areas, tend also to inhibit progress in others. This has been true in immunology, where Burnet's clonal selection theory of antibody formation and the concept of immunological tolerance proposed by Burnet and by Medawar and his colleagues appeared for a long period almost to require that the fetus *in utero* or *in ovo* be immunologically incompetent. These concepts have now survived the loss of one of their supposed foundation-stones: as is made abundantly clear by the present volume, the fetus exhibits a variety of immunological activities.

This book contains much of specific interest to the immunologist and of more general interest to the developmental biologist. Despite some large gaps in our knowledge, Solomon has done an admirable job of putting together and in some instances evaluating the surprisingly large body of data that have accumulated, in great measure during the past decade. Thus, although the chapter devoted to the maturation of reticuloendothelial function is perforce somewhat sketchy, lymphogenesis and, especially, the current theories of thymic and bursal control of lymphoid maturation are more fully explored, as are the structure and function of the placental barrier between mammalian mother and fetus and the manner in which the fetus and newborn benefit from passively acquired maternal antibody. A discussion of the phenomenology and implications of immunological tolerance then leads into chapters on the ontogeny of immunoglobulin synthesis and on active immunity in birds and mammals and their resistance to fetal and neonatal infections.

One of the great strengths of this book is its comparison, based on data gleaned in bits and pieces from a large variety of animal species, of mammalian immunogenesis and that observed in birds, the latter being a phenomenon the author himself has done much to elucidate. The more general reader will also benefit from the occasional excursions into one or another of the interesting immunobiologic byways that have so enriched this field, such as the human immunologic deficiency diseases, the hazards that may accompany fetal or neonatal receipt of the normally protective maternal antibodies, or the curious role of the mammalian fetus as an alien homograft within what should be, but is not, an inhospitable maternal uterus.

If this book suffers from a defect, it is one that stems directly from one of the strengths of the author's approach, his attempt to consolidate so disparate a set of data. Solomon argues, reasonably, that one should not be surprised that the young of some species may achieve immunological competence relatively early in gestation whereas in other species such competence does not appear until after birth, since the degree of maturity at birth among mammalian species (and other vertebrates as well) is such that some newborns are still virtually embryos at birth whereas others are almost adult in their capacities. A strong argument is therefore made throughout this book that the variations in fetal and postnatal immunology among different species may be unified in terms of the "age-equivalence" of the developing young, as estimated by the time of appearance of certain embryonic features, the time of attainment of puberty, or, most significant in the author's view, the rate of increase of weight gain (weight velocity). Although age-equivalence has proved to be a useful concept in many areas of developmental biology, and indeed serves to remove much of the mystery from developmental immunology, its application has been questioned in many specific areas (for example, brain development and myelination). In the present context, the author seems to have been so carried away by his hypothesis as to discount certain data that do not accord with it. Moreover, the hypothesis that there is *an* age at which the immunologic apparatus matures appears to be too rigid, in view of the increasing body of evidence that immunologic competence matures in a stepwise fashion, immune responses to some antigens appearing early in development and to other antigens only much later. It should be understood that this criticism is not intended as a *caveat emptor* for the specialist, but rather as a *caveat lector* for the generalist, since the book will prove interesting and useful to all.

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Spermatozoan Structure

Comparative Spermatology. Proceedings of a symposium, Rome and Siena, Italy, July 1969. BACCIO BACCETTI, Ed. Accademia Nazionale dei Lincei, Rome, and Academic Press, New York, 1971. xii, 572 pp. + plates. $22.50.

A statement by R. H. Bowen, "The sperm seems never to transgress the few rules which govern the production of its fundamental parts, but in the arrangement of these parts every sperm (flagellate or non-flagellate) seems to be a law unto itself," quoted by Afzelius in the concluding chapter, would serve well as the motto of the Symposium on Comparative Spermatology. The papers presented at the conference deal with the structure of spermatozoa or parts thereof from most phyla of the animal kingdom, from Cnidaria to Vertebrata. (Two chapters present the structure of spermatozoids of lower plants.) Although in most cases the reader has to make the comparisons for himself, there are chapters that are truly comparative—by Fawcett and Phillips on mammals, Nicander on vertebrates, Billard on fishes, Baker and Baker on urodeles, Furieri on reptiles, Brown on crustaceans, Rosati *et al.* on arthropods, and Manton on lower plants; however, with the exception of Nicander's few electron micrographs and brief com-

ments, birds are neglected. Several chapters deal with comparative aspects of certain parts of the spermatozoon—the neck region in urodeles (Werner), the flagellar tubular pattern in insects (Phillips), mitochondria (Favard and André), the development of the nuclear pattern (Chevaillier), and the centriolar adjunct (Cantacuzene), to mention a few. A number of investigators were enticed by the esthetic pleasure provided by the patterns of insect sperm and by the fascinating variations and modifications they offer; 20 out of 47 contributions are devoted either wholly or in part to aspects of spermatogenesis or sperm structure in insects.

Throughout the book, emphasis is on conventional electron microscopy of fixed and thin-sectioned material, with a very few papers dealing with freeze etching (Koehler) and histochemical techniques (Anderson and Personne, and Bigliardi *et al.*). Although mentioned on the dust jacket of the volume with equal emphasis, the physiological aspects of spermatozoa and spermatogenesis are not in fact adequately represented, although the volume includes studies of the motility of spermatozoa (Brokaw *et al.* and Nelson *et al.*).

The space allotted to each author is ample in that the data are presented and discussed adequately and the findings are well documented with illustrations. The group of participants was small enough and well enough selected that significant questions were further explored in the discussions, which add valuable information in several instances and help to round out the presentations. The participants took full advantage of this opportunity.

In the closing chapter Afzelius raises several physiological questions and puts them in perspective. The significance of the morphological changes of the components of the spermatozoa has tended to be abstracted from their functional roles when isolated segments of the male reproductive tract are examined, and Afzelius redirects attention to the essential role of the spermatozoon in fertilization and development. Not only does he reflect on our current understanding of the functions of sperm components but he calls attention to a long list of unsolved problems whose attack in the future he believes would lead to the solution of riddles which have been posed by recent studies. One of these riddles, important but neglected, concerns the presence or absence of DNA in sperm mitochondria and whether it may contribute in any way to the development of the offspring. This question was at least raised during the discussion period.

The papers and illustrations are uniformly of good quality, and some contributions are outstanding. This volume will serve as a valuable summary to "spermatozoologists" and as a source of material for students just embarking on a new field.

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