Book Reviews

Evolutionary Stratagems

Oenothera. Cytogenetics and Evolution. RALPH E. CLELAND. Academic Press, New York, 1972. xii, 370 pp., illus. $21.50. Experimental Botany.

Oenothera is one of a relatively small number of genera intimate knowledge of which has brought us to our present level of understanding of cytogenetic phenomena and their relation to evolutionary events and history. Even in this select company of peas and *Drosophila*, corn and grasshoppers, *Escherichia coli* and the lowly bacteriophage, *Oenothera* stands alone because of the unique, almost bizarre, route it has followed in achieving its measure of evolutionary success. It has, as it were, incorporated several seemingly independent, but intimately related, features of cytogenetic abnormality into a complex but workable system of survival.

Oenothera, or at least that portion of the genus which has been extensively investigated, probably has its origins in the Mexican and Central American region. Even the well-known *O. lamarckiana* is believed to be of Texan origin, but naturalized in Europe. The ancestral species of the genus are normal in their reproductive behavior. They are large-flowered and open-pollinated, with meiosis, and its attendant recombination and segregation, possessing no unusual characteristics. As the genus spread to the north and the east, the wide-ranging species evolved into small-flowered and self-pollinated forms. Translocation complexes formed with extraordinary frequency; all 91 of the possible combinations of the 14 ends have been found, and 162 different arrangements of complexes exist in the American forms. In addition, permanent chromosomal and genetic heterozygosity has been established through the retention of recessive lethals within the individual translocation complexes, a system which also permits the maintenance of maximum hybrid vigor. All this is made possible by the structure of the chromosomes of *Oenothera* and the character of the translocations. The chromosomes are equal-armed, with substantial amounts of centric heterochromatin, and the equal-armedness is maintained even when translocations form since the breaks are always in the vicinity of the centromeres. This is a necessary feature if a ring of 14 chromosomes is to maneuver reasonably at meiosis to insure the alternate segregation of chromosomes required for high fertility.

The *Oenothera* system of translocation complexes is not without its disadvantages. Permanent heterozygosity prevents the exposure of recessive mutations to the action of natural selection and reduces drastically the intraspecific diversity available to explore new environmental situations. The ends of the chromosomes, where pairing and recombination take place, tend toward homozygosity, further reducing genetic diversity, and the chromosomal complexes are so tightly ordered as to limit sharply any future evolutionary change. Only through occasional outcrossing between different complexes can new combinations of genes and chromosomes take place, with success leading only to similar, albeit new and different, complexes of equally limited potential. One can only marvel at the deviousness whereby a genus seeks out the means of survival and a sufficient degree of open-endedness for future change, however fragile and temporary such successes may be and however blind the alley in which it finds itself.

Despite the uniqueness of the *Oenothera* system, it is not a good experimental organism for the investigation of a variety of cytogenetic problems, and it has not attracted to it a large body of research talent. Yet a roster of those who, over a span of 70 years, have contributed to an elucidation of the *Oenothera* is an illustrious one. Hugo de Vries used *O. lamarckiana* to explore certain aspects of Darwinism which he could not accept, with the results leading to his now discredited mutation theory; Otto Renner early recognized the great reduction in crossing-over and segregation that took place in the genus, and developed the concepts which are now referred to as Renner complexes and Renner effects; the brilliant John Belling provided the idea of segmental interchanges to explain the meiotic configurations that had been observed; Harley Bartlett, Bradley Moore Davis, G. H. Shull, and Friedrich Oehlkers contributed to the growing understanding; and Ralph Cleland, with his students, clarified the cytotaxonomy and evolution of the North American species and species complexes.

In presenting the *Oenothera* story, Cleland elected to use the historical approach, beginning with the work of de Vries around the turn of this century. Except for the contributions of de Vries, the volume, in large part, is a personal history of Cleland's investigative life. He published his first paper on *Oenothera* in 1922, collaborated with Renner, Oehlkers, and A. F. Blakeslee through the 1930's, and continued his studies until his death in 1971, a few days after this book went to press. The book is a fitting capstone to a long and distinguished career, a career as cytogeneticist, botanist, teacher, administrator, public servant, and, in every good sense of the word, humane scholar.

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Defensive Cells

The Macrophage. B. VERNON-ROBERTS. Cambridge University Press, New York, 1972. viii, 242 pp., illus. $21. Biological Structure and Function, 2.

Five years ago the macrophage seemed to have accepted the role of Cinderella to its more glamorous sisters, the thymocytes and bursacytes of specific adaptive immunity. Stripped of any claim to specificity, the macrophage must remain subservient to the intermediary factors provided by activated lymphocytes or fall back on the role of scavenger. Several monographs have appeared recently that make it possible to assess more accurately the multifarious roles of this cell system. It is now known, for example, that the macrophage performed a useful recognition and disposal of intruders long before the arrival in phylogeny of specific adaptive immunity and that it has continued to adapt to intricate new tricks in evolution with the lymphocytes and their specific globulins in higher vertebrates. There is a great need for an integration of the time-honored concepts of pathology and this new knowledge, and Vernon-Roberts has in this monograph attempted the task.

The approach is conventional: anatomy, cytology, life history, and special-

ized functions are all considered in chapters which eventually lead up to a consideration of the role of macrophages in cell-mediated immunity and other immunological responses. I enjoyed following the author's discussion of the new facts of about 450 references against the conventional background of morbid anatomy. Nevertheless, too often, I was left in doubt concerning the exact implications of the new work for the residual hypotheses of the subject. Broad unifying concepts such as that of the mononuclear phagocytic system as opposed to the reticuloendothelial system of Ehrlich are not as clearly discussed as one might have hoped in regard to problems such as, say, the derivation of alveolar macrophages under varying circumstances and the composition of the red pulp of the spleen.

This book will, I am sure, be welcomed by established pathologists for the wealth of new data it introduces. The immunologist who wishes to broaden his acquaintance with the many specialist roles of the macrophage will find much to interest him. The graduate student will find a good introductory account of the nature and kinetics of phagocytosis, and of the exogenous and endogenous factors affecting phagocytosis, but is advised to look elsewhere for a clearer and more thoroughly resolved account of the experimental data relating to the macrophage's immunological role.

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Immunogenesis

Ontogeny of Acquired Immunity. A Ciba Foundation symposium, London, Nov. 1971. Associated Scientific Publishers (Elsevier, Excerpta Medica, North-Holland), New York, 1972. x, 284 pp., illus. $12.75.

The initiation of an immune response results from the interaction of antigenic receptors on preselected cells of bone marrow and thymus origin. There is a complex, cooperative interaction between thymus cells, bone marrow cells, and macrophages. The nature of the molecular genetic events that culminate in a given lymphocyte's expressing immunoglobulin receptors of single specificity, from among hundreds of thousands of possible specificities, is the central problem awaiting solution in immunology today. Its solution will illuminate the shadows in all of experimental biology and will sharpen the focus on methods of treatment of many human diseases. Preselection of lymphocytes with respect to antibody specificity occurs during ontogeny. This book is a progress report on our understanding of how this comes about, and, as it illustrates, progress has been substantial.

The book will be appreciated by the advanced student and the professional immunologist. The contributors are leading immunologists. The papers vary from theoretical and speculative discussions to reviews of specific topics to reports of new information. All are, more or less directly, concerned with ontogeny of immune responsiveness or with immunological phenomena during development. There are papers that deal with appearance of immunological competence in animals and man, with ontogeny of macromolecules and suppression of immunoglobulin allotypes, with immune deficiencies and attempts at treating deficiency diseases with bone marrow and fetal thymus transplants. Of considerable interest to the reviewer are the papers concerning (i) the fetus as a homograft and the possible role of blocking factors in preventing its rejection (Beer and Billingham; Hellström and Hellström) and (ii) the hierarchy of hematopoietic stem cells and their differentiative potentialities (Owen). Each paper is followed by extensive discussion among the participants. These discussions are almost as informative as the formal papers. In addition, they reveal the impressive exchange of ideas and information that was possible between the laboratory-oriented and clinically-oriented participants. The melding of basic research results and clinical trials and experience reveals how rapidly information obtained from animal experimentation is being applied to the treatment of human diseases such as hematopoietic defects, immune deficiency states, and cancers. Upon completing the book, one is left eagerly awaiting the next symposium, with the feeling that successful treatment of many diseases by immunotherapeutic methods may not be far away; and that it will, indeed, be a calamity if the present penury in federal support of research substantially retards the endeavor.

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Organogenesis and Oncogenesis

Tissue Interactions in Carcinogenesis. D. TARIN, Ed. Academic Press, New York, 1972. xviii, 484 pp., illus. $24.50.

This volume brings together anatomists, pathologists, and developmentalists to provide a new look at what the editor calls "the behaviour of the tumour as a whole." In his preface and introductory statement, the editor rejects as simplistic the notion that tumors represent merely escape from control mechanisms that regulate proliferation. Instead, he affirms that, beyond proliferation, tumors display cellular pleomorphism, disturbance of tissue organization, invasion by one tissue of the neighboring territory of another, and frank metastasis and dissemination. In an effort to illuminate these properties the volume considers the significance of tissue interaction in original organogenesis; the persistence of such interactive mechanisms in the adult; the interface between interacting tissue components and especially between epithelium and associated stroma; and the relationship of these matters to tumorigenesis itself. The result is a tightly knit account that brings the subjects under discussion up to date. The content, however, is not likely to deflect cancer research from its current direction, nor can the book be recommended as a handy reference on the state of oncology as a whole.

Kratochwil and Saxén make clear that the mechanism of tissue interaction still eludes us but that the weight of evidence is in favor of relatively short-range communication between interactants—shorter-range than diffusion but longer-range than direct interaction of cytomembranes. Tarin carries the story on to the adult, noting that the data are less abundant and that there are similarities with and differences from the embryonic state. Pinkus presents histological evidence of disturbed tissue interaction in both preneoplastic and neoplastic human skin. Sugár extends the evidence, dealing with both skin and other organs. He pays special attention to ultrastructural indications of reduced cohesiveness at the junction of epithelium and connective tissue during the development of human carcinomas. Frithiof deals with the ultrastructure of the epitheliostromal junction in human oral carcinoma, both preinvasive and invasive. In these presentations the nature and properties of the basement membrane figure prominently, and C. J. Smith presents concordant information