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-