Book Reviews

Cytology and Cytogenetics. Carl P. Swanson. Prentice-Hall, Englewood Cliffs, N.J., 1957. 596 pp. Illus. $13.35.

It is difficult to realize that during the 20 years since Darlington's second edition of his *Recent Advances* there has hitherto been only a single attempt to reassess the status of cytogenetics. This was the penetrating, brief critique by H. Bauer, which is incorporated in several scattered chapters of the fourth edition of M. Hartmann's *Allgemeine Biologie* (1953). But the very existence of Bauer's survey is hardly known to English-speaking biologists, and its amalgamation with Hartmann's treatise on general biology has certain disadvantages for the specialist.

The immense productivity of cytogenetical research during the last quarter-century is attested by the fact that *Cytology and Cytogenetics,* by Carl P. Swanson, lists well over 1000 judiciously selected references and that only a very few of these are dated earlier than 1930. Many more could be given, and if the pertinent literature on the fringes of cytogenetics is included as well, the total might well be tripled or quadrupled. We can therefore thoroughly agree with Swanson when he says in his preface that "there is urgent need for a book that asks what has or has not been done," and those of us who have boggled at the task of digesting this wealth of new findings cannot but admire the courage and skill with which he has done it for us—and be thankful.

It should be emphasized at the outset that a consideration of modern cytogenetics definitely constitutes the core of the book. There are lucid, rather brief surveys of the various techniques, of the general features of the cell, and of many aspects of recent developments in the fields of biochemistry and cytochemistry, but care is taken not to diffuse the attack that is made on the central theme. The flowering of cytogenetics, as such, after 1930 had its first incentive in the publications of Belling and Darlington, both of whom recognized the experimental value that is represented in the presence of extra homologs in the cell. But it was Darlington alone who generalized his observations and, leaning heavily on established genetic findings, formulated a set of rules of chromosome behavior which, for the nonce, brought order into the unleavened mass of cytological information that confronted the investigator at that time. All-embracing and logically simple, these rules or generalizations encouraged a very great number of geneticists to add the microscope to their means of analysis, and the sudden increase of publications shows with what renewed zeal they attacked their problems.

The master-key to all of Darlington's generalizations lies in his conclusion that homologous chromosomes attract each other when they are single or "unsplit," but that this attraction ceases or even gives way to repulsion when, in the course of normal events, each chromosome becomes split so as to comprise two chromatids. On this primary generalization also hinges the outstandingly important one that a chiasma that extends between two split homologs must of necessity represent a preceding interchange in which one chromatid of each homolog is involved. This would therefore be cytological evidence that genetic "crossing over" has occurred.

Beginning with Belling, various cytologists have presented arguments that adversely affect the validity of these and others of the generalizations. But although such criticism was often supported by excellent evidence, it has been assiduously ignored by the great majority of cytogeneticists, largely, one presumes, because it could not replace the weakened generalizations with equally usable ones. Swanson now weighs the evidence on both sides of each step of the argument, and there can be no doubt that the balance is against many, if not most, of the long-held rules. Indeed, so imposing is this contrary evidence that even their most confirmed adherent must pause for reconsideration.

Withal, Swanson's conclusions are voiced with commendable reserve and, sometimes, almost regretfully. Thus, when he states (page 212) that the basic rule involving the behavior of single versus split chromosomes "is inconsistent with cytological facts" and that the Darlington hypothesis of crossing over "must be viewed with skepticism" (page 235), he is fully cognizant of the implications of his decisions. He realizes that, although much in Darlington's generalizations may still be profitably employed, the loss of general applicability must inevitably affect their usefulness. In view of the many conclusions that have been and are still being based on them, this is a very serious matter.

Swanson's treatment of the subject clearly points out the future path of the cytologist. It should be remembered that, even at their face value, the generalizations of Darlington rarely go beyond a restatement of his observations on chromosome behavior in the light of genetic findings. Obviously, the cytogeneticist must now step across this threshold and probe more deeply into what determines chromosome behavior. In so doing he would be well advised to join his efforts to those of the chemist and the electron-microscopist. Above all, we must know more about the structure of the chromosome, for, in the final analysis of that structure, a great many—perhaps even most—of the questions posed by Swanson will find their answers. Unfortunately, our progress on this particular path has so far been slow. But when we view the triumphant success that has rewarded such joint efforts in the elucidation of the structure and physiology of the mitochondria—only recently considered to be the prime enigma of cellular structures—there would seem to be little doubt that in this direction lie our best chances for solving this most challenging of our problems.

Swanson has admirably succeeded in his primary purpose of reassessing the status of cytogenetics. In its weakening, or destruction, of long-held ideas, the book may prove disconcerting to the average graduate student, who likes to carry his information in neatly finished packages. But to the student who will soon take his place in the ranks of those who are pushing the front forward, it presents a fascinating vista of possibilities and challenges. And such a student is, after all, the only one who really matters.

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Molecules and Crystals in Organic Chemistry. A. E. Van Arkel. Interscience, New York; Butterworths, London, ed. 2, 1956. 270 pp. Illus. $4.75.

In the first edition (1949) of *Molecules and Crystals in Inorganic Chemistry,* it was stated in the preface that the book "was intended for students in their first year of science or medicine." This statement does not appear in this, the second edition, and therefore the reader must deduce the author's present intent from the contents. This is rather difficult