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

to do, since the contents of this book are a curious mixture of rather elementary topics, treated in a straightforward way, side by side with quite advanced topics discussed in a very interesting way.

After a brief introduction, we find the following chapters: "The chemical bond," "The ionic bond," "Properties of ionic compounds," "Chemical reactions," "Complex compounds," "Polarization," "Water as a component of compounds and solutions," and "Non-electrostatic bonds." These chapters are full of useful tables of physical properties of numerous compounds. The author has a tendency to attempt to explain almost everything on the basis of purely electrostatic bonds and generally invokes homopolar bonds only where the former approach fails. In the final chapter, on nonelectrostatic bonds, the treatment of covalence is not very deep, when contrasted with the thorough discussions of ionic compounds that are found earlier in the book.

The use of such terms and concepts as *entropy, Madelung constants, free energy, enthalpy,* and *polarizability* and *dipole moment formulas* really makes the book unsuitable for use as a textbook in beginning chemistry courses in this country. On the other hand, the range of topics is not wide enough to justify its use as a textbook in an advanced course. It can be recommended as collateral reading, however, for junior and senior students and as a very good source of review material at the graduate level.

There are, unfortunately, more than the number of typographic errors that one would expect to find in a second edition.

JERRY DONOHUE
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Biogeography. An ecological perspective. Pierre Dansereau. Ronald, New York, 1957. xiii + 394 pp. Illus. $7.50.

I owe to John Tukey, the mathematician, a distinction which is invaluable in discussing such a book as *Biogeography.* Tukey distinguishes between enterprises at the technologic and those at the scientific level. At the technologic (or engineering) level, work has got to be done, buildings have to be put up, and bridges have to be built, whether the fundamental information is at hand or not. The engineer has to use such facts as are available, make the best estimate he can, and go ahead. The scientist, on the other hand, must get down to the fundamentals of the problem. For a long time to come, any author who, like Dansereau, "embraces the entire field of the sciences of environment," who surveys "the origin, distribution, adaptation and association of plants and animals," must be as much an engineer as a scholar. The facts are fragmentary, the field of inquiry is so vast that information from various disciplines must be drawn together; there is little agreement on basic concepts.

Dansereau's book is one man's attempt to view the entire field, to produce a clear, logical presentation of just how plants and animals are distributed over the face of the earth and an analysis of the forces at work. It is divided into five parallel sections: "History of biota," "Bioclimatology," "Synecology," "Autecology," and "Man's impact on the landscape." Although it makes an ambitious attempt to consider animals as well as plants, it is obviously the work of a botanist. Over three-fourths of the cited works are purely botanical; the remainder are about equally divided between zoology and geography. There is nothing parochial, however, about the author's view of his subject. He has traveled widely and has worked and taught in many parts of the world. Of the five most frequently cited authors, only one, Stanley Cain, is an American. The other four are Europeans, each one from a different country.

The omissions are as remarkable as the vast field which has been so effectively surveyed. The author obviously does most of his thinking about the effects of plants that are big enough to be seen with the naked eye. The notion, developed so effectively at Rothamstead, of the ecological importance of a balance between the various kinds of microorganisms in the soil is nowhere presented. Antibiotics are not mentioned, neither is *Encylia farinosa* or any of the literature that demonstrates the lock-and-key relationship which natural selection may eventually force on species which have been associated with each other over long periods of time. The useful concept of the "ecological niche" does not even make the index, which is otherwise pretty inclusive.

The book is beautifully put together. It is lavishly illustrated; halftones, black and white diagrams, and tabular material make up well over one-third of its content. Ingenious and diverting diagrams illustrate the ways in which different kinds of plants of various aspect make up the vegetable cover of our globe. A 20-page appendix illustrates, in detail, the chief plant communities of the Saint Lawrence valley, as analyzed by the author's methods. There is a subject index, an author index, and an 18-page glossary, with clear definitions of the technical terms (some of them pretty fancy) which stud the text. *Tropophytia,* for instance, the "harmonious control of the habitat by a climate inducing alternation of leafing-out and leaf-fall" gets mentioned in at least eight places, and our old friend "short day" becomes "brevidiurn."

Dansereau's book grew out of courses given by him at São Paulo, the University of Michigan, and the University of Montreal. Its clarity, precision, and logical arrangement bear witness to his great skill as a teacher. Fortunate, indeed, are those young biologists who have had such a summary as this as a part of their scientific training.

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Modern Science and Human Values. A study in the history of ideas. Everett W. Hall. Van Nostrand, Princeton, N.J., 1956. 483 pp. $8.

Under the impact of the atomic bomb, many scientists today are troubled by the fact that their theoretical and technical achievements are not accompanied by a comparable progress in morality. How the destructive power of modern technology can be checked is undoubtedly a question of vital importance, and in this connection a well-established framework of values may seem to be highly desirable. Unfortunately, modern science is not able to build up such a framework; on the contrary, its startling success is exactly attributable to the sharp distinction between facts and values and to the rigorous exclusion of the latter from scientific theories.

The emergence of value-free natural and social sciences out of the evaluating Aristotelianism of the medieval schoolmen and the development of these sciences up to the present is the topic of Everett Hall's study. In spite of the modesty shown by the author in the preface, his book turns out to be one of the best semipopular expositions of these problems. It is based on a reliable knowledge of the rather complicated subject matter and avoids many of the widespread misinterpretations of the scope and the methods of modern scientific thinking—that is, of the Copernican, Newtonian, and Einsteinean theories. Furthermore, it shows a sound appreciation of European, and especially German, romanticism as the antagonist of the spirit of enlightenment. Dialectical materialism, selling itself under the label of a scientific world-view, is rightly unmasked as an offspring of romantic obscurantism.

But at the end of his book the author finds himself confronted with the embarrassing question mentioned previously. He has a keen awareness of the difficulties connected with these problems and denounces the metaphysical attempts to smuggle in the normative under the guise of descriptive clothes as