Book Reviews

Evolution after Darwin. vol. 1, *The Evolution of Life*. Its origin, history, and future. Sol Tax, Ed. University of Chicago Press, Chicago, Ill., 1960. 629 pp. Illus. $10.

From 24 to 28 November 1959, the University of Chicago celebrated the centenary of the publication of Charles Darwin's *Origin of Species*. Scientists and scholars were assembled to participate in panel discussions; as a preliminary to the discussions, the panelists were asked to submit papers bearing upon the subject of evolution. These papers were circulated in advance to the participants. Twenty of these papers, revised in the light of the discussions, are published in this volume. Since each essay is written by a specialist in the field, and since each specialist had the further advantage of expert, critical comments, the essays can be described as authoritative. In every aspect of evolution that they cover, the essays show the present state of our knowledge of the subject, and a comparison of the essays with Darwin's original work indicates how much our knowledge of evolution has grown during the past hundred years.

The essays, however, have a value over and beyond their demonstration of how much we have learned during our century of progress. Most of them are written as review papers, and as such, they contain a great deal of well-condensed information. Graduate students in biology, as well as those biologists whose specialties do not impinge directly on the field of evolution, should find this volume exceptionally useful; reading the essays should be an easy and pleasant way for members of both groups to bring their information up to date. All the papers are clearly written, and some of the writers have even allowed themselves to indulge in a little subtle humor. These essays educate painlessly.

In a review of reasonable length, it is possible only to indicate the ground that is covered, but I would like to express the hope that the abstracting journals will undertake the task of recording in more detail the important material the papers contain. The first paper, by Sir Julian Huxley "The emergence of Darwinism," gives an account of the development of the theory of evolution during the first part of the 19th century. Sir Julian describes not only the scientific discoveries made by the classical evolutionists but also the limitations of their data and the consequent persistence of unsolved problems. He separates the over-all course of evolution rather sharply into distinct phases such as the inorganic, the biological, and the psychosocial phase. Incidentally, he commits himself definitely to the view that evolution results in progress.

Harlow Shapley, in "On the evidences of inorganic evolution," writes with his usual verve. He deals primarily with the evolution of the cosmos, with the origin of the elements and of the stars. Hans Gaffron, in "The origin of life," Earl A. Evans, Jr., in "Viruses and evolution," and C. Ladd Prosser, in "Comparative physiology in relation to evolution theory," discuss the recent advances in biochemistry which have given us our first significant hints about how life could have originated on our planet. The prevalent view, that life came into being when the earth had a reducing atmosphere or at just the time when a reducing atmosphere was changing to an oxidizing one, is explored in some detail. Here, perhaps, we could wish for a closer integration of the sciences, and we might even ask the astronomers to explain how our planet could have originally accumulated a great quantity of the reducing hydrogen that it was unable to hold. This request, however, may be premature because the hypotheses that have been suggested to account for the existence of our planetary system have shown a very high mortality rate. Several of them have died quite recently.

During the past few years, however, experimental work has shown that the carbon in the complex, preliving compounds that served as the basis for life probably came from the hydrocarbons rather than from carbon dioxide. The ultimate living compounds would, moreover, have had to be formed in an aqueous medium. This has led some scientists to assume that life originated in the oceans which then existed beneath a reducing atmosphere. The oceans apparently were chosen (i) because they were big, and (ii) because they were there. Now the origin of life is a subject that I know nothing whatever about; but I have never heard of anyone's refusing to express his ideas on the subject because of his ignorance or because of incomplete or conflicting data, and I do not feel that I should be the first one to do so. I admit that I like E. T. Wherry's hypothesis that life originated where local conditions of heat and pressure could have reduced the carbon, where phosphorus was abundant, where potassium predominated over sodium, where the ammonia produced by lightning could collect, and where the preliving organic soup could be concentrated easily by a little evaporation. Thus, I like the notion that life started on the surface of quartz particles in a pond on the south side of a volcano (in the Northern Hemisphere, of course). But I also believe that those who disagree are not, by definition, wrong.

Bernard Rensch, in "The laws of evolution," summarizes in a number of generalized statements the course that evolution follows. He lists the types of changes that species achieve under the particular conditions in which they evolve. In one of the longer papers, "The history of life" (64 pages), George Gaylord Simpson covers excellently the rather large field staked out by his title. He gives a critical evaluation of the fossil record, but he also illustrates how much unexpected information an intensive study of fossils can yield. E. B. Ford, in "Evolution in progress," discusses such topics as mutation in bacteria, and he describes in addition the recent displacement in Britain of one form of a moth (*Panaxia*) by another, perhaps the best known example of the effect of selection in nature. G. Ledyard Stebbins, in "The comparative evolution of genetic systems," is concerned primarily with plants, and he discusses in some detail such topics as the origin of the alternation of sexual and asexual generations. He also brings into the evolution picture the distinction between the Procaryota and the Eucaryota and the evolutionary problem presented by their different cellular structures.

Daniel I. Axelrod, in "The evolution of flowering plants" (79 pages), has the longest essay in the volume; it is practically a small book. His treatment, however, is exceptionally condensed and well worth the extra pages. Alfred E. Emerson, in "The evolution of adaptation in population systems," shows how, in all gregarious species, the group as a whole becomes one of the major selective agents and that, in all such species, both the separate individuals and the groups themselves are units of selection. The effects of these two selections, taking place concurrently but on two different levels, produce results that seem, at first sight, to be anomalies. Ernst Mayr, in "The emergence of evolutionary novelties," defines an evolutionary novelty as "any newly arisen character, structural or otherwise, that differs more than quantitatively from the character that gave rise to it." He includes within this definition "any newly acquired structure or property which permits the assumption of a new function." In this essay, Mayr brings together our existing knowledge of one aspect of evolution which has puzzled biologists since the time of Darwin.

The contributors to the panel who have been mentioned thus far all seem to agree essentially in their evaluation of the factors that have caused evolution. On the other hand, C. H. Waddington, in "Evolutionary adaptation," begins his essay with a major shift both in the aspects of evolution that he emphasizes and in its philosophical background. His paper starts out as if it were to be a defense of what Darlington has called "the evergreen superstition," as if he were determined to rescue Lamarck from some biological hatchet squad. He redescribes Lamarckism in terms of a rather subtle concept, and he gives the term a meaning that would have been a complete anachronism at the time of Lamarck. He goes even further and reduces natural selection to a tautology, in that, "It states that the fittest individuals in a population (defined as those who leave the most offspring) will leave the most offspring." This, of course, is not a fair statement of what natural selection is or even what it was understood to be a century ago. Darwin observed that certain variations which he could recognize were inherited, that some were better adapted to the living conditions than others, and that a differential survival and reproductive rate of the individuals who varied would cause their species to change. In toying with the meaning of Lamarckism, Waddington also points out the well-known fact that, in one sense, all characters are acquired in that they all developed in one environment or another and that they do not occur, as such, in the fertilized egg. Swinging from the same stance, he emphasizes the variations which can be traced to the environmental variable, although his choice of an illustrative example may be unfortunate, namely, ". . . characters to whose variation hereditary differences contribute only a small fraction, such as the milk yield of cattle."

The above comments and quotations from Waddington's paper are highly selective and, thus, they are not an adequate or true sample of the whole. Actually his treatment of evolutionary adaptation is clearly written, informative, and scientifically honest. The point in calling attention to such passages, even in quoting several of them, is that they were published in a contribution of real merit and high scientific standards. The attitude that they indicate should be noted because it also appears in the essays of some of the other participants in the panel. Thus, Everett C. Olson, in "Morphology, paleontology and evolution," indicates that he does not find the natural selection theory (or synonymously the synthetic theory) very satisfying. In fact, he shows that he does not like the theory at all, although he acknowledges, very honestly, that it serves a real purpose, that it has been remarkably productive, and that it fits the known facts. Olson calls attention to what he calls "a generally silent group" of biologists who are in disagreement with the current theory but who feel that it is futile to combat the generally accepted view. Even if he is at odds with much of the modern evolution doctrine, Olson treats it fairly and includes in his essay much valuable information.

Marston Bates, in "Ecology and evolution," also admits to having an "uneasy feeling that some important pieces are still missing from the structure of our [synthetic] theory," although he states that he does not know what these pieces are. Students of evolution, he writes, seem to investigate its genetic rather than its ecological factors because, he suspects, they fear to fall into the "Lamarckian heresy," and he writes that he hates to see Lamarck's name used as a dirty word. The greater part of Bates' paper, however, consists of a very lucid account of the role of the ecological factors in evolution. Only in spots do a few simple "either or" propositions intrude, for example, "A basic issue, I think, is whether to look at the biological community as competitive or co-operative." A geneticist would have to consider the biological community as being both.

But if some of the contributors have reservations concerning natural selection others—for example, Th. Dobzhansky, in "Evolution and environment," S. Wright, in "Physiological genetics, ecology of populations and natural selection," and A. J. Nicholson, in "The role of population genetics in natural selection," scientists whose experimental work has added so greatly to our modern knowledge of evolution —accept natural selection wholeheartedly and are able to treat it quantitatively and, under the conditions of their experiments, accurately. Dobzhansky, especially, fits natural selection into its interacting role with mutation pressure and random genic drift and, with his usual clarity, puts a great deal of information in a few words. Nicholson connects natural selection, as Darwin understood it, with our present understanding of it, based, as our knowledge is, on carefully controlled experiments. Because some of the most important work in the field is his own, Nicholson is in an excellent position to present natural selection free from any emotional overtones.

N. Tinbergen, in "Behavior, systematics and natural selection," develops the role of selection further and demonstrates that not only are morphological characters selected for survival but that behavior patterns are also. In fact, certain behavior, especially in birds when they seem to be driven by conflicting impulses, makes sense only when evaluated in terms of its contribution to the past survival both of the individual and of the species. C. F. Gause, in "Darwinism, microbiology and cancer," suggests that certain pathological processes may be investigated more easily in the lower organisms and that what is learned from such research may contribute to our knowledge of what causes cancer.

The above comments do not indicate how much *The Evolution of Life* contains. Each paper is loaded with well selected factual information, and the collection as a whole is almost encyclopedic. In fact, I found that only one important aspect of evolution was

omitted completely: the role of polyploidy in species formation and the part played by species hybridization in producing new species in a number of plant genera. Our knowledge of the course of evolution within such genera as *Nicotiana, Crepis, Oenothera, Quercus* and so forth, is important, and what we have learned from the study of such plants has added greatly to our understanding of evolution in general. But even with these omissions, the book contains more useful material than any other work on evolution published in this centennial year.

We may close on a triviality. In a footnote on the first page of each paper is a very brief vita of the author. This is very convenient for the reader and, as the authors are all distinguished scientists, the vitas are impressive, even if the tone of their composition reminds us unpleasantly of the blurbs that we have to tolerate on dust jackets. One of the contributors will probably be surprised (and annoyed) to discover that he has published "countless" papers.

CONWAY ZIRKLE
Division of Biology, Botanical Laboratory, University of Pennsylvania

Galathea Report. Scientific results of the Danish deep-sea expedition round the world, 1950–52. vols. 1–3. Danish Science Press, Copenhagen. Illus. vol. 1, 1957–59. 260 pp. Kr. 90; vol. 2, 1956. 253 pp. Kr. 75; vol. 3, 1959. 88 pp. + plates. Kr. 60.

Deep-sea exploration has never gone completely out of fashion since the days of the Challenger, but the reports of the expeditions have not always lived up to the style of the *Challenger Reports*. We do not know whether the *Galathea Reports* will go to 50 volumes (for one thing, material collected near the surface or in shallow water will be reported elsewhere); nevertheless, the printing and the content of the published parts of the series are in the great tradition. Volume 1 includes a list of stations, a report on primary oceanic production (Steeman Nielsen and Jensen), reports on bacteria (ZoBell and Morita), the bathymetry of the Philippine trench, and some shorter systematic papers. Volume 2 is devoted entirely to reports on various invertebrate groups, and volume 3 includes the long-awaited monograph on the anatomy of *Neopilina* (by Lemche and Wingstrand), followed a paper on its shell structure (by Schmidt) and a paper on the eyes of *Ipnops* (by O. Munk). The monograph on *Neopilina* (that fascinating irrelevancy, as C. M. Yonge calls it) is a model of thoroughness and precision of illustration, and it will be the mainstay of textbook compilers for years to come. The Danes are to be congratulated for making this volume, in particular, available at a modest price; the *Latimeria* monograph, published in France, was not so reasonably priced. In short, the *Galathea Reports* are off to a fine start.

J. W. HEDGPETH
Pacific Marine Station, Dillon Beach, California

Dictionary of the American Indian. John L. Stoutenburgh, Jr. Philosophical Library, New York, 1960. 462 pp. $10.

This 462-page dictionary averages about 6 or 7 entries per page. It is somewhat difficult for me to see what purpose it is intended to serve. Most of the entries are evidently abstracted from Bulletin 30 of the Bureau of American Ethnology, *The Handbook of American Indians North of Mexico.* While this is an authoritative source, it was published more than 50 years ago, and much of the information it contains is now obsolete. Apparently no effort has been made to bring this antiquated material up to date. For example, under *banner stones* it is stated that their use is unknown. This was the case in 1907.

Curiously enough, the other source most used by the author appears to have been Strachey's *Vocabulary of the Virginia Indian Language*, as published by J. P. Harrington. The dictionary is well larded with words from the extinct Powhatan language, such as *accoondews*, meaning "large blueberries" or *asapan*, the Powhatan word meaning "hasty pudding."

Terms in other languages seem mainly to have been taken from the *Handbook*. The majority of these are old place names of insignificant and long forgotten localities or the names of personages of no consequence in Indian history; still others are ethnic terms that mean little when detached from their general ethnic context. For example: *Ift*, a Karok village inhabited in 1860, *Xagua*, a Chumash village active in 1542; *Xinesi*, the name given a religious leader by the Hasinai; *Ye*, the former lizard clan of the Pueblos of San Ildefonso and San Juan; *Tetanauoica*, the name of an Indian who was buried at the San Francisco Solano Mission in Texas; *Gweundus*, a low social order of the Eagle clan of the Haida.

While we also find reference to *Milky Wash Ruins* in Arizona, no mention is made of the many important archeological sites excavated during the last 50 years but unknown a half century ago.

Under *Hopewell* we find "Hopewell, New York, an Indian site, see Onaghee." Under *Onaghee*, we see "A settlement of the Seneca which had been abandoned before the settlement."

Occasionally terms such as *caliche* and *calcium carbonate* are briefly defined, but without reference to any connection with Indians.

There are, of course, many terms of general interest, but these are buried in such a matrix of trivia that they are almost lost.

The professional anthropologist certainly will find no use for this book, and the selection of words is such that the layman will find little to interest him.

M. W. STIRLING
3311 Rowland Place, NW, Washington, D.C.

Strahlenbiologie. Grundlagen und Ergebnisse. Hedi Fritz-Niggli. Thieme, Stuttgart, 1959 (order from Intercontinental Medical Book Corp., New York). xvi + 379 pp. Illus. $15.50.

Written by an expert in radiation genetics, this book is a valuable contribution to the contemporary literature on radiation biology. An introduction to the fundamentals of the field (radiation physics, radiation chemistry, and radiation biochemistry) is followed by nine chapters on general and specific radiobiological problems and questions. The presentation is clear and leads systematically to well-established observations and facts. The generally accepted interpretations of the findings are discussed with emphasis on their primarily hypothetical character.

A. T. KREBS
Biology Department, University of Louisville, and *U.S. Army Medical Research Laboratory*