whom Birkhoff, Sperti and Taylor were present at the opening meeting. Carrel is the only one of these who was a member of the antecedent Nuovi Lincei.

Two particularly interesting material provisions are for publication within a few days of all papers presented to the academy, and the exceptional facilities for bringing the members to the two principal annual meetings.—CORRESPONDENT.

SCIENTIFIC BOOKS

THE SPECIES PROBLEM

Genetics and the Origin of Species. By THEODOSIUS DOBZHANSKY. New York: Columbia University Press. 1937. 364 pp.

THIS book will be welcomed by all students of genetics or evolution, all those who care anything about the "Why is it?" in biology. The chapter headings give a good idea of the contents: Organic Diversity, Gene Mutation, Mutation as a Basis for Racial and Specific Differences, Chromosomal Changes, Variation in Natural Populations, Selection, Polyploidy, Isolating Mechanisms, Hybrid Sterility, Species as Natural Units. In my estimation it is the best book on these subjects ever written. It is the best because, being thoroughly well done, it includes the results of so many important recent researches, and so brings us up to date. In future years, still better books will be written, not necessarily by more gifted authors, but including the new knowledge which has been gained in the interval. Biological workers everywhere, whether teachers or investigators, will need to read Dobzhansky's book, and it will be a revelation to them. Few there are who have the time or opportunity to keep up with the literature published in many countries, in different languages; and even those who may have read all the more important papers need a synthesis of the results. I have found the book very stimulating and suggestive, so that it would be easy, in reviewing it, to fill a whole number of SCIENCE. The several discussions call to mind other facts which might have been cited, or open up new avenues of thought. Sometimes I have wished that Dobzhansky had dealt with this or that matter, but for practical reasons it was expedient to keep the book down to a moderate size, and had it been two or three times as large, it probably would not have served its purpose as well. Yet I should like to see a series of other books, dealing with special groups of animals and plants in the same spirit but giving all the essential information available. Such books might treat of such things as roses, mice, butterflies, land snails, freshwater fishes, and so forth. It is of great importance to get down to actual facts, instead of reasoning about abstract principles, with mathematically conceived examples which may not correspond with anything in nature. There are two principal modes of approach, extremes which meet in a synthetic treatment. We all know how Mendel made his great discovery by fixing his attention, not on the genus, species or even the individual as a whole, but on certain characters of the individual. Modern genetics has developed along the same lines, but it is obvious that the realities of nature include individuals, species, genera and larger groups, and finally the whole biota, animal and plant life together. The Mendelian is likely to feel that while the biota is very interesting, it is too complex to be intelligible. No one ever knew all the forms of life existing on a single hillside. The ecologists, to judge from their published work, usually simplify their problem by ignoring a large part of the facts, and sometimes the botanical journals, following this trend, publish a class of papers which I have called "Botany without Plants." Dobzhansky faces this dilemma as well as it can be faced at the present time, and one has the feeling that although the brevity of human life and the limitations of the mind forbid a complete analysis even of the knowable, yet it is possible to approach life intelligently and understand many of the more interesting phenomena. There is no reason, indeed, why such knowledge should not form part of the equipment of every educated person.

It will be a surprise to many to see how much of the discussion is based on very recent work. The bibliography, of twenty-eight pages, does not include the names of Darwin, Mendel or Morgan, the three great foundation-builders in the field covered. This does not imply, of course, any lack of appreciation of these masters, but merely that the book is essentially a description of the superstructure raised on their foundations. The authors who have ten or more titles cited are Dobzhansky, Federley, Goldschmidt, Sturtevant and Timofeeff-Ressovsky. Of course no one would pretend that the number of titles is necessarily indicative of the importance of the work, yet it does show activity. In the index, those cited ten or more times include the above, and also Blakeslee, Darwin, R. A. Fisher and S. Wright.

Among the broader topics discussed are those concerning the nature of species and the tendency of populations to break up into races and species. "There is, however, a single systematic category which, in contrast to others, has withstood all the changes in the nomenclature with an amazing tenacity. This is the category of species" (p. 306). But it is pointed out that species, in the ordinary sense, are to be observed in bisexual organisms, but are much less easy to define in those which reproduce vegetatively or without sexual union. An illuminating example, not cited by Dobzhansky, is that of the perennial sunflowers. In the north-central states there are species which rarely reproduce by seed. If, as sometimes happens, hybrids

are formed, the various segregates reproduce vegetatively, and may come to occupy large areas. Their differences, no matter how minute, are faithfully perpetuated, so that if one defines a species as a segregated type existing in nature, there may be hundreds of species of these plants. Similarly, the most minute mutations may be perpetuated, so that the segregates appear to the botanist as a crowd of excessively "difficult" species. To further complicate the matter, those "species" may apparently arise many times, in different places. "In asexual or self-fertilizing forms any gene combination is at once fixed and isolated from others, and is ready to undergo the process of testing by natural selection" (p. 319). With regard to populations, it is pointed out that isolated groups tend to be differentiated, and good reasons are given why this should be so. It is justly remarked that few if any species occupy the whole of their recorded range. They actually exist in more or less isolated colonies, where conditions are favorable to them. Thus there is a tendency to the development of local races, some of which perish while others amalgamate with adjacent races. It would probably be of value to determine, in the case of isolated races or species, whether they represent the remnants of a once widely distributed and continuous population, or whether they were colonies arising from some chance migrants. But these discussions are endless, and are cited now only to illustrate the character and value of the work reviewed.

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HERPETOLOGY

Snakes Alive and How They Live. By CLIFFORD H. POPE. Viking Press, 238 pp., illus., 1937.

THE need for popular scientific books written by competent authorities, preferably by specialists in the subjects treated, is only too well known. For the most part, the specialists either are too busy with their technical interests (or worse, with a burden of routine), or they are unable to set forth their interests in popular language. This results in a "lag" in the popular books, which ordinarily are several years behind the state of knowledge reflected in the technical literature. The present book about snakes essentially eliminates this lag. It is by a well-known specialist on the natural history of reptiles (he is the author of the monumental "Reptiles of China," published by the American Museum of Natural History), and in what is so fortunately the fashion among American museum zoologists, he has combined wide field experience with detailed laboratory studies. The book resulting is admirable from every standpoint. It is readable, and can be offered to a child or an interested amateur, with the assurance that their attention will be held. It is thoroughly reliable and up-to-date in its information, notably on such subjects as breeding habits, the development of the senses and hibernation, in which important recent advances in knowledge are incorporated. Much of this "up-to-date" information will interest professional zoologists. Thus we find the extraordinary observations of Woodward on the African night adder, which produces successive clutches of fertile eggs after removal of the male; this is in agreement with the process of fertilization in turtles, which does not seem to have attracted the attention of modern students. The interesting results of studies on the sense of smell and of the unknown function of the facial pit in the pit vipers, on which experiments have been in progress in the American Museum of Natural History, are reported by Mr. Pope from personal knowledge of the experiments and of the experimenters. The accumulated field observations on hibernation, which are highly interesting, are especially valuable, since they can not fail to stimulate much desired further observation.

Through the informal account of much of Mr. Pope's personal experience the book bears an unmistakably personal stamp, reflecting his own vivid interests. Large parts of the general chapters, however, are necessarily a compilation from a multitude of sources. On these pages, Mr. Pope mentions so many of his colleagues by name, in connection with their special interests, that the reader acquires a wide acquaintance with the modern herpetological group. The book is strongly to be recommended to school and public libraries, and it will be a valued addition to the shelf of every one interested in natural history, whether his interests be technical or amateur.

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SPECIAL ARTICLES

TROPOSPHERIC RADIO WAVE REFLECTIONS

THE brilliant auroral display observed by Mr. Ernest Cherrington, Jr.,[1] at the Perkins Observatory of the Ohio Wesleyan and Ohio State Universities during the night of August 1 and 2, 1937, has been found to check excellently with a very unusual set of observations of the reflection of radio waves from the troposphere (the C region).[2] Observations of the C region

[1] Ernest Cherrington, Jr., SCIENCE, 86: 2229, 265, September 17, 1937.

[2] R. C. Colwell and A. W. Friend, *Nature*, 137; 782, May 9, 1936; R. A. Watson-Watt, L. H. Bainbridge-Bell, A. F. Wilkins and E. G. Bowen, *Nature*, 137; 866, May