

he will need to be somewhat industrious and patient. This may be said with full appreciation of the excellent list of references that is added at the close of every chapter. But the non-technical reader, if he becomes impatient because the demands of the student are not fulfilled, becomes reassured when he looks back into the preface; for he has forgotten that "the book has been prepared for the worker in applied optics rather than the student."

The next chapter is on the design and testing of optical systems. This subject likewise is mathematical, and the treatment is open to some pedagogical criticism; but the amount of information, non-mathematical in form, is increasing; and the individuality of the author as a careful and resourceful investigator is becoming more clearly manifest. Prior to the publication of this book he had become well known through his published work in several branches of optics; and for development in his chosen field it would be hard to find a better place than the Bureau of Standards.

From this point on, the successive chapters contain less material requiring skill in the art of presentation, but much that reveals the author's rich experience in the optical laboratory. He is at home in the discussion of optical instruments and the conditions under which they may be used to best advantage, in the methods of measuring refraction, and in the intricacies of physiological optics. In the treatment of colorimetry, illumination, photometry and spectrophotometry, radiometry and spectroradiometry, polarimetric analysis, plate grain and sensitometry, and interferometry, he has evidently worked with great skill and ardor, enjoying the work thoroughly. He has gleaned information from all possible sources, and has recorded in small compass what might well have been greatly expanded. The present volume is indeed apparently tentative. This is indicated in the preface, where the enterprise is referred to as an entering wedge, since the full treatment of applied optics "could be adequately treated only in a number of volumes by a dozen specialists." It is to be hoped that these volumes will appear in due time, but that upon them better

editorial care may be applied than is manifested in this initial volume.

W. LEC. STEVENS

LEXINGTON, VA., July 10, 1912

Distribution and Origin of Life in America.

By ROBERT FRANCIS SCHARFF. New York, The Macmillan Company. 1912. Pp. xvi + 497, 21 maps.

Students of zoogeography the world over will welcome this book, for the author's masterful treatment of the European fauna¹ leads one to expect that he will bring to it the same wealth of ideas, sound knowledge and good judgment that characterize his previous work. In the opinion of the reviewer this expectation is fulfilled. The data are presented about as exhaustively as is possible in a work of this size, the opinions of different students are summarized in an unbiased way, the generalizations and data are carefully weighed, and the author's conclusions are clearly expressed.

Very little but good can be said of the general method of attack. Dr. Scharff fully realizes that problems of origin and dispersal can not be approached from the standpoint of zoogeographical regions, and no space is given to this subject. He analyzes separately the faunas of different parts of North, Central and South America, and of the Antilles, Bermudas, Galapagos and other American islands, and endeavors to discover the sources and migration routes of the different elements. He goes to some length to show the very small rôle which he believes accidental dispersal plays in the populating of distant lands—a method that has been clearly overestimated since the classic works of Darwin and Wallace—and expresses the conviction that the facts of North American zoogeography can best be interpreted by postulating various land bridges. When such land bridges are apparently called for, the author endeavors to gather evidence for them from botany, geology and paleontology.

Dr. Scharff argues for the existence in pre-Glacial or Glacial times of a North Atlantic land bridge, connecting Scotland, Iceland, Greenland, and Labrador, and a North Pacific

¹"The History of the European Fauna."

bridge across Behring Strait. Unlike many students, however, he does not think that these are sufficient. He contends that there must have been an early Tertiary trans-Atlantic bridge from southern Europe to a hypothetical "western land" lying just west of the present American continents. This land bridge, according to Dr. Scharff, included the Antilles and parts of Central America, and was, by means of the "western land," first connected with both North and South America, then separated from North America, and subsequently reunited with North America and separated from southern South America. By such an hypothesis one can explain the European elements in southwestern North America and the Chilean region.

The "western land" was, Dr. Scharff believes, part of a great arc "which stretched mainly northward, communicating from time to time with Central America and the Antilles, and also with Mexico and western California, and then eventually bending across to eastern Asia in a great loop and thus joining New Guinea, Australia and New Zealand." This bridge is made to account, among other things, for the evidently continental fauna of the Galapagos Islands, the relationships between the living and extinct faunas of western North America and southern South America, and for the Asiatic elements in these faunas.

As has been intimated, Dr. Scharff believes in a former union of the Antilles with each other and with the trans-Atlantic land bridge and the "western land." He also thinks that the Bermudas and the end of the Florida peninsula (then an island) were also connected with this land mass. He further postulates a direct connection between Chile and New Zealand, but not by way of an Antarctic continent, and is willing to grant slender bridges between southern South America and South Africa and Madagascar. Although he does not dwell upon these southern bridges, he suggests that incentives to migration may have been found in changes in climate due to changes in the direction of ocean currents, so that Simroth's pendulation theory need not be relied upon.

The author's treatment of the Ice Age in North America will undoubtedly come in for a large share of criticism, for his views are quite different from those now almost universally accepted in this country. Very briefly, it may be said that he denies the existence of continental ice-sheets in the Pleistocene, although admitting that this was an age of extensive glaciation, and believes that the climate at that time was temperate and even warmer than at present. The large bodies of water forming the Pleistocene great lakes he attributes to a marine invasion. He does not believe that there was a general southward migration of northern forms in the Pleistocene, or that the southeastern states served as "biotic preserves" during the Ice Age, but thinks that the fauna in the drift area was in part destroyed and in part persisted in favorable localities. He emphatically denies that the evidence is sufficient to warrant the theory that zones of northern animals and plants were spread out beyond the margin of the drift area in a manner comparable to the present distribution in the far north.

The author himself scarcely ventures the hope that his views on the physical conditions during the Ice Age will be readily accepted. A growing number of zoogeographers in this country will, however, be quite willing to agree with him that current geological opinions are permitted to dominate biological thought to a far greater extent than the facts of distribution warrant. We should have more evidence of Pleistocene distribution and not try to erect elaborate theories principally upon geological evidence. It may be pointed out that, granting the ice-sheets, there is still no reason to believe that the margins of these were not covered for miles back with soil and vegetation, as Russel found to be true of the Malaspina glacier, in which case no zonal arrangement would prevail comparable to conditions in the Arctic regions at the present time.

A conviction expressed by Dr. Scharff that will have adherents is that southwestern North America is and has been in the past a very important center of dispersal, as some previous

writers have contended. He believes that many of the forms that now have their center of dispersal in the southeast originally came from the southwest, either directly or possibly by way of the West Indies, and that changes in climate since the early Tertiary have extinguished the primitive forms in the southwest.

It has been possible in this review only to touch upon a few of the main points in the book, but enough has been said to show that many of Dr. Scharff's conclusions will not meet with general acceptance. However, even if they should be entirely overthrown, the general usefulness of the book will not, in the opinion of the reviewer, be impaired, for the summary of data and generalizations can only be of the greatest use and a source of inspiration to students of the American fauna.

ALEXANDER G. RUTHVEN

RECENT ANTARCTIC WORK

National Antarctic Expedition, 1901-1904.

Natural History, Vol. VI., Zoology and Botany. London, British Museum. 1912. 4to. Pp. xvi + 81, 8 plates.

With the publication of this volume, the series of reports of this expedition relating to the natural history is brought to a close. The special reports included in it are "On a Collection of Young Holothurioids," by Professor E. W. Macbride; on the Polychæta, by Professor Dr. E. Ehlers, and on the freshwater algæ, by Dr. F. E. Fritsch, these being the only freshwater organisms obtained by the expedition.

The series comprises altogether some fifty memoirs descriptive of the fauna and flora of the Antarctic region. This area, like other cold seas, teems with species, of which 227 new forms have been described in these volumes. Of some Amphipod Crustacea 10,000 to 30,000 were occasionally taken at a single haul and in the collection one species of Schizopod is represented by nearly 10,000 specimens. The great kelp (*Lessonia*) has a frond as much as 24 feet long, but the mosses show signs of degeneration. No evidence in favor of the theory of "bipolarity" has been

gathered from the collection. Twenty-three new genera of animals, and 201 new species were obtained, and 26 new species of plants. The collection of young echinoderms includes free-swimming larvæ of three out of four groups of echinoderms, which is of interest in view of the opinion, which had been expressed, that all species of the polar seas would be found to have development of the shortened type without free larvæ.

The freshwater algæ are exceptionally numerous in species, 91 in all, belonging to 35 genera, of which 25 species are Diatoms. Huge sheets of *Phormidium* and occasionally of *Lyngbya* flourish in the ice and during the milder portion of the year in the waters of the ponds and lakes. These sheets serve as a substratum for a rich growth of other forms and are probably the breeding places for the bulk of the algal flora. The scarcity of green algæ is notable, while Diatoms are rather scarce, but desmids are relatively abundant. *Microcystis* sometimes colored the ice of a dull brick red. The conclusion is reached that reproduction in the bulk of the Antarctic algæ is a very slow process and possibly several seasons elapse before a new generation reaches maturity.

The plates of this volume attain the same high degree of excellence noticeable in the previous issues of the series, and a convenient index to the whole set is included both for authors and subjects.

Expédition Antarctique Française, 1903-1905,

Commandée par le docteur Jean Charcot.

Hydrographie-Physique du Globe, par A. MATHA et J. J. REY. Paris, Bureau des Longitudes. 1911. 4to. Pp. vi + 615, 9 plates, with figures in the text.

The expedition of Dr. Charcot on the schooner *Français* was due to the enthusiasm of its leader and the generosity of private individuals aided by the efforts of the Parisian journal *Le Matin*; through which after a hard struggle something less than \$100,000 was obtained, a small three-masted schooner built, and outfitted for two years. Instruments and books were lent, the members of the party served freely or for a nominal wage,