SUPPLEMENT TO THE NOTE ON NECROBIOTIC RAYS[1]

IN his note on necrobiotic rays, due to the lack of space, the writer failed to express his thanks to the institutions and scientific men who were of assistance to him in his experiments, postponing these thanks until the appearance of his full paper. In view of the fact that this paper may not appear for a long time, the writer wishes to express his thanks at this time to the persons concerned.

The experiments on necrobiotic rays were begun at the Desert Sanatorium (Tucson, Arizona, in January, 1931), continued for about two months in the laboratory of the Biological Department of the California Institute of Technology (Pasadena, California), and then in the laboratories of the University of California (Berkeley, California), where they first succeeded. Accordingly, the writer wishes to express his thanks to Dr. Pinner and Dr. Davis, of the Desert Sanatorium, for their interest in his work and their valuable advice, to Dr. T. H. Morgan, of the California Institute of Technology, for making it possible for the writer to continue the experiments in the laboratory of the institute, to Professor Zaikovsky and Dr. Strong, of the same institute, for their interest in the writer's experiments, and their advice and help in carrying out these experiments, to Dr. Holman, of the department of botany of the University of California, for furnishing a dark room for the experiments, and to Dr. White, of the Department of Physics of the same university, for his advice and assistance.

The writer wishes to express his especial thanks to Professor V. M. Zaikovsky for his outstanding interest in the experiments on necrobiotic rays. It was he who drew the writer's attention to the possibility of an explanation of the protective effect of ultra-violet rays on protoplasm by a synthetical process which they may produce in the cell. He also suggested, after the failure of the writer to prove the presence of the rays by means of dry photographic plates, that the writer should use silver bromide emulsions for the same purpose. According to his order, the quartz tubes initially used in the experiments were made for the writer. He also constructed a special apparatus to photograph the rays. Professor Zaikovsky's advice was found to be very useful in the writer's experiments at the University of California, where the rays were first observed.

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SOME HUMAN EYE-SPOTS CLASSIFIED ZOOLOGICALLY

THIS note might have some slight interest to oculists and to entomologists. During the last few weeks my eyes have become very dim and I can no longer read. Awaiting the time for an operation, I have been interesting myself by watching my eye-spots—those fragile things that float before one's eyes, apparently in space. I have recognized three species of insects, two plainly, and the third rather dimly. The first would be *Pelecinus polyturator,* except for the fact that it has spotted wings and apparently the venation of a trypetid fly. Were it really an insect, I would call it *Pelecinoidea* (new genus) *trypetoidea* (new species). The second is the pupa of *Culex pipiens.* It has a very long abdomen and I can not see the anal flaps. But I can see the respiratory trumpets on the thorax and it is plainly Culicine—not Anopheline. Of the third I am not so sure. It looks like one of those curious parasites of ants that belongs near Orasema, species of which are so beautifully figured by Peter Cameron in the "Biologia Centrali-Americana," and by Wheeler in his well-known book on ants.

Other biologists who have misused their eyes (as I have) may amuse themselves by classifying their eye-spots. The entomologist should have no trouble. Perhaps the botanist can do something of the sort. The herpetologist should have no trouble. The bacteriologist will have difficulty for lack of culture media. The nematologist should, I think, be able to do a lot of imaginary work, but I can't imagine that the chemist or the mathematician can use this method of passing the time away.

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WASHINGTON, D. C.
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SCIENTIFIC BOOKS

Studies on the Variation, Distribution and Evolution of the Genus Partula. III. The Species Inhabiting Moorea. By HENRY EDWARD CRAMPTON. Carnegie Institution of Washington, Publication 410, 1932.

IT is well known that it was the existence of closely related but distinct species in the different islands of the Galapagos Group that first convinced Charles Darwin in 1835 that such species must have arisen by descent with modification from common ancestral species. Ever since that time the fauna and flora of oceanic islands have been favorite objects of investigation with students of organic evolution. The extraordinary interest which has been shown by naturalists

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in the extremely varied forms of land snails of the Pacific Islands has its origin in the fact that here one comes into close contact with evolution as it is occurring in nature in restricted and isolated areas. Many of these islands have their own peculiar species of snails and even adjoining valleys on the same island may have distinct but related species and varieties. Many naturalists have realized that an intensive study of these narrowly localized species and varieties might be expected to throw much light upon the methods and causes of organic evolution as it is taking place in nature.

Professor Crampton undertook an extensive and intensive study of the genus Partula, one of the most variable of these land snails, more than twenty-five years ago. Working under the auspices of the Carnegie Institution of Washington, he has made many journeys to the widely scattered islands of the Pacific and has collected hundreds of thousands of snails of this genus, noting in particular the exact geographical and ecological situation of each species and variety and making a most detailed biometrical study of their shells. The results of this work have appeared in three volumes, the first of which was issued in 1917 and dealt with the species of Partula inhabiting Tahiti; the second, published in 1925, with the species on Guam and Seipan, the third, recently issued, with the species inhabiting Moorea. Altogether this series probably represents the most extensive and monumental work ever published on a single genus of invertebrate animals. The first volume contains 311 pages of letter press, 252 statistical tables and 34 plates; the second, 116 pages, 62 tables and 14 plates; the third volume, 335 pages, 156 tables and 24 plates—a total of 762 pages, 470 tables and 72 plates, 32 of which are colored lithographs of nearly 1500 shells—and all devoted to a single genus of pulmonate gasteropods.

The author states that this third volume of the series goes farther than the previous ones and the results are more numerous and more definite. Especial efforts have been made to evaluate the environmental and genetical factor in evolution and the conclusion is reached that environment has little if any effect,—a conclusion which is contrary to the opinions of many previous students of this group. In explanation of the aims of his work and its relation to experimental studies of evolution, he says (p. 191): "The present study deals with species and varieties in a state of nature and with the differences displayed by the snails down to the unitary items of individual diversity. Its category, therefore, is sharply contrasted with that of experimental studies in the laboratory and garden, although the two have the common element of an interest in the initial episodes of organic differentiation. The results of my own studies accord fully with those of experimental genetics, as I understand them to be capable of formulation in the above-stated terms." Nevertheless it is unfortunate, as the author himself acknowledges, that he has not been able to apply experimental breeding to the analysis of these many so-called varieties and mutations. Until this is done, conclusions as to their origin and relationships must remain largely hypothetical. From the standpoint of a complete study of this genus it is also unfortunate that the only characters of these snails that are dealt with are those of the shells, although when one considers the extent of the biometrical tables needed to analyze these, one shrinks from the thought of what would be necessary to deal with all the organ-systems in this manner.

Only the most general summary of the principal results of this work can be mentioned in this review. The occasional appearance of sinistral forms in dextral species, or the reverse, has received careful attention. In some instances both dextral and sinistral young are borne by the same parent and the author concludes that the cause of this reversal of the usual asymmetry is genetical, which accords with the findings of Boycott, Diver, Garstang and Turner on certain species of Limnaea, where mendelian segregation does not occur until the third filial generation, instead of the second, as is usually the case.

The author finds no evidence in favor of orthogenesis, although he does find that there is a direct correlation between the degree of likeness of different forms and the geographical proximity of their habitats. Furthermore, each species has its own characteristic degree of variability. "The evidences are cumulative," he says (p. 194), "without any discrepancy, that so far as the present material is concerned the factors responsible for specific, varietal and lesser distinctions are congenital in nature and location (*sic*) and that environmental circumstances produce no discernible effects upon the course of organic differentiation." However, he acknowledges elsewhere (p. 187) the influence of natural selection in directing the course of evolution, although, in common with most modern authorities, he denies its power to originate variations and he doubts that the individual diversities he has observed have survival value.

The manner of distribution of related but distinct species of Partula in the Society, Cook and Austral Islands leads the author to the conclusion that "an earlier land-mass extended all the way to the extreme borders of Oceania, that subsidence has led to the

segregation of one coulisse after another, and that these separated ranges subsided later to greater degrees. Some of the peaks have remained above the surface as the present 'high' islands, while others were more completely submerged to serve as the bases for the growth of corals and corallines."

Finally he states that so far as the distribution of the species and varieties of this genus throughout the island of Moorea is concerned, "the only tangible conclusion is that it is completely accounted for by local differentiation among the members of ancient stocks, more or less disseminated by their own unaided movements."

In the Galleria Antica e Moderna in Florence there is a tapestry representing God giving Adam supremacy over the animals, and the long winding procession of all animals known to the artist, which is passing before Adam, is led by a land snail. This artistic conception should form the frontispiece of any future volume which Professor Crampton may publish on the genus Partula, as indicating the important place occupied by this humble animal in the procession of the living.

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Morphologische Gesetzmässigkeiten der Evolution. By PROFESSOR DR. A. N. SEWERTZOFF. Gustav Fischer, Jena, 1931. xv, 372 pp., 21 diagrams, 131 figures. Gr. 8vo.

PROFESSOR SEWERTZOFF, in this work, brings to culmination the chief results of over forty years of study of the embryology and comparative anatomy of the vertebrates. It is, however, the immediate product of the new "Laboratory for Evolutionary Morphology of the Academy of Science of the U. S. S. R." where the author and his colleagues now continue their investigations.

The discussion centers about the evolutionary history of the lower vertebrates. An attempt is made to develop the course of phylogeny of the main groups from the facts of embryology, paleontology and comparative anatomy and with the aid of schematized, hypothetical "primitive" forms built up by combining the most general characters of existing types. Remarks are made concerning the morphological methods of phylogenetic investigation and monophyletic theory of evolution. Some of the author's previously published concepts—branchiomery, the theory of the roofing bones of the skull, the theory of the articulation of the lower jaws with the neurocranium—are elaborated. Also one notices some changes in the classification of the ganoid fishes and a criticism of Stensiö's views on the relationships of the Ostracoderms to the two modern groups of Cyclostomes. This first part of the work is intended as a basis for the subsequent section dealing with a chain of related morphological theories.

In this second part the author is concerned more with the courses than the causes of evolution. He seeks the cause of organic change in the changes of the environment and inclines to the Darwinian explanation without definitely committing himself. Believing that the whole course of evolution is an adaptive process he deals principally with structural adaptations—attempting to gain insight into the ways in which these manifest themselves, their various categories, their manner of origin in the embryo and their behavior in regressive or degenerative forms.

He seeks to develop what he calls the morphological laws of phylogenetic development, adopting a rigid system of classification of adaptations, structures and embryological processes together with elaborate definitions, and a brand new set of terms. He finds it desirable, for example, to segregate organs into two classes—those which are directly influenced by the environment and those which are not so influenced. Changes induced in the former may secondarily influence certain of the latter, these in turn may affect others functionally or topographically united to them. Upon this foundation are erected two general theories: (1) the morphobiological theory of the course of evolution, in which the general and special laws of phylogenesis are set forth, and (2) the theory of phylembryogenesis, which considers the time element in the development of phyletic changes in ontogeny.

It is believed that evolution "can only follow two chief directions—progressive (struggle for existence) and recessive (extinction)." The one is characterized by increase in number of individuals, increase in range of groups owing to crowding and subdivision of the larger groups into greater number of subgroups. The other path leads to smaller numbers, diminished range and reduction in subgroups.

It is further stated that four general methods of progressive evolution exist: (1) Morpho-physiological progression or altering of the entire construction of the form with general increased intensity of active functioning as in a bird compared with a reptile; (2) special adaptation of organs involving no general bodily change; (3) embryological change without change of adult structure, leading to increased capacity of the young to survive; (4) general morpho-physiological degradation in which some "passive organs" (*i.e.*, reproductive system) develop progressively and active organs are reduced.

There are again set down two groups of phylogenetic changes: (1) in which the function of the evolving organ is only quantitatively changed and