Harold Heath, Naturalist: 1868–51

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HAROLD HEATH, professor emeritus of zoology in Stanford University, died at his home at Pacific Grove, California, April 22, 1951, after a long illness. He was born at Vevay, Indiana, in 1868, but spent most of his school and college years with his widowed mother and his young sister in Delaware, Ohio, where I first came to know him. He was a born naturalist in the sense that he had an inherent love of and curiosity about nature, and a determination to learn all he could at firsthand. On one occasion, when he was a student in the Delaware High School, there was some disagreement in class over the number of eggs in a crow's nest. Harry disappeared at noon and returned later in the day with a crow's nest and its eggs, which he had taken from the top of a tall tree, to settle the dispute.

In his college work at the Ohio Wesleyan University, he took all the science courses and was a voluntary laboratory assistant in chemistry. When I was organizing a biological laboratory there in 1891 he became my chief assistant, and in the summer of that year he made his first visit to the seashore at Woods Hole, in part to help me gather material for my classes in zoology. As an illustration of his enthusiastic and direct approach to any problem I may cite the following incidents. I met him at the railroad station on his arrival at Woods Hole, but he left me at once and ran down to the shore, where I saw him dipping up water in his hand. I asked him what he was catching and he said, "Nothing. I just wanted to taste sea water to find out how salty it is."

Such behavior was characteristic of Heath—he was always exploring and testing for himself. Drifting in a boat over one of the pools between the islands he saw on the bottom the gorgeous spread of tentacles of a tube worm, which he later dug out of the mud in its leathery tube and brought to the laboratory, where it was greatly admired and later found to be the well-known annelid *Chaetopterus*. Assistant Director Bumpus asked Heath where he found it, and when others failed to find it there offered to give Heath a well-preserved specimen of *Amphioxus*, which he had recently brought from Naples, for every *Chaetopterus* he brought him. Heath went out at once and after an hour or two came back with half a dozen specimens, whereupon Bumpus called off the bargain. *Chaetopterus* has ever since been one of the most useful animals at Woods Hole for work in experimental embryology.

In fitting up the biological laboratory at Ohio Wesleyan, in the search for best material for classwork, in teaching the proper use of microscopes and microtomes, Heath was, I am sure, the best assistant I have ever had. And he was such a charming fellow, so good-natured, unselfish, and stimulating, that all who knew him in college were sorry to say "good-bye" after his graduation in 1893.

For a year thereafter he was professor of biology at the College of the Pacific at Stockton, California, and from 1894 to 1896, instructor in invertebrate zoology at Stanford. During 1896–98 he worked with me at the University of Pennsylvania, where he was one of the first group of Harrison fellows, and in the year last named he received the Ph.D. with distinction. Thereafter, he was continuously on the faculty at Stanford, first as assistant professor (1898–1901), then associate professor (1901–09), and finally full professor (1909–33), after which he became professor emeritus.

During all his years at Stanford he was closely associated with that institution's Hopkins Marine Station at Pacific Grove, where he taught in summer courses for many years, conducted his own researches and that of advanced students, and after 1925 became an all-year resident member of its staff.

His love of exploration and adventure led to his association with several expeditions to distant places, In 1906 he occupied the Smithsonian Table at the Stazione Zoologica in Naples. For several years he was acting naturalist on the U. S. Fish Commission's *Albatross* in her work in Hawaii, Alaska, off the coast of California, in Japan, and on a trip around the world. In 1911 he was a member of the Stanford expedition to the coast of northern Brazil. In 1913 he was sent by the U. S. Fish Commission to a point near Sitka, Alaska, to study the food of salmon. He spent the summers of 1910 and 1917 on the Pribilof Islands, in work for the U. S. government on fur-seal investigations, and it was during this last-named year that he suffered such serious injuries in a fall from a fifty-foot cliff that he was unable to take part in any further strenuous expeditions.

His research work was influenced largely by the peculiar animals collected during his explorations and by his desire to learn about their phylogenetic relationships. In his first year at Pacific Grove he found certain species of the primitive mollusk *Chiton*, with eggs and embryos, and he began a detailed study of their development with a view to learning about their relations to other orders of mollusks and other zoological phyla. In particular, he made a thorough study of their "cell lineage" and its relations to that of the annelids, gasteropods, and lamellibranchs, which were occupying much attention at that time. This became the subject of his first extensive paper, which he offered as his thesis for the Ph.D. degree, and which

was published in the *Zoologisches Jahrbücher* (Vol. XII [1898]) in more than 90 pages of text and with five beautiful lithographic plates. This admirable study, and some six others on *Chitons* that followed it, tended to establish the Amphineura as the most primitive order of mollusks and to show their phylogenetic relations to annelids.

In his expeditions on the *Albatross* he had collected from dredgings in Hawaii, Alaska, and off the coast of California a beautiful lot of specimens of an aberrant and wormlike mollusk known as *Solenogastre.* He wrote four papers on the morphology and habits of this mollusk and a notable monograph on *The Solenogastres* (Memoir XLV, Mus. Comp. Zool. Harvard, pp. 179, pl. 40, with more than 400 figures [1911]).

He was also much interested in the group of beautiful pelagic gasteropods, the pteropods, and he prepared three papers on their anatomy and classification. He also prepared a monograph of some 25 pages and 10 lithographic plates on a primitive group of bivalves, *The Anatomy of Some Protobranch Mollusks* (*Mem. mus. roy. d'hist. nat. Belg.,* Deuxiem Ser., Fasc. 10 [1937]).

A group of bivalve mollusks of much interest to geologists for purposes of dating and identifying strata is the family of Arcidae, but the anatomy and classification of fossil forms were necessarily limited to their shells. Heath undertook a study of the anatomy of some 32 living species and thereby corrected certain errors in classification based on the shells alone. This work was summarized in a monograph entitled *The Anatomy of the Pelecypod Family Arcidae,* which was published by the American Philosophical Society (*Trans.,* 31, 287–319, 22 plates [1944]). This was his last major publication. A smaller paper, with which he was much pleased, was on "A Connecting Link between the Annelida and the Echiuroidea (*Gephyrea armata*)" (*J. Morphol.,* 49, [1930]).

Much of his work after his accident in 1917 had to do with material which he had on hand, or which could be found near his home; among these subjects the development of the castes in termites and their functions occupied a prominent place. In all, he published 42 articles in scientific periodicals and was a joint author with others of two books. He was a fine artist with pen and pencil and all his publications are beautifully illustrated.

In a minute prepared by one of his colleagues of the Stanford faculty, from which I am permitted to quote, it is stated that

> As a teacher he was preeminent; kindly, quizzical, and inspiring. He contributed greatly to Stanford's high position in the biological sciences. This was recognized by his "starred" position as one of the 1,000 outstanding scientists (150 zoologists) in the first edition of *American Men of Science.* He was a member of the Western Society of Naturalists, Phi Beta Kappa, Sigma Xi, American Society of Zoologists, and a fellow of the California Academy of Sciences. He received the honorary degree Sc.D. from his *alma mater,* the Ohio Wesleyan University, in 1919.

Dr. Heath married Elsie Shelley, of Son José, in 1897. She survives him, as do two sons (Ronald W. and James P.), a daughter (Phyllis Heath Walker), a sister (Mary Heath Lee), and seven grandchildren.

Technical Papers

A Possible Connection between Certain Metamorphic Phenomena and Anomalies in the Earth's Magnetic Field

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It has long been apparent that the reference of the various mineralogical changes and orientation effects that accompany metamorphism to the two variables temperature and pressure (which in their turn are referred to depth of burial or proximity to igneous intrusions) is inadequate to explain completely the phenomena observed. In several cases, geosynclinal sediments have been buried to depths of up to 10 miles without suffering any marked metamorphic effect, whereas in other instances—as, for example, the young metamorphosed rocks of the East Indies—strong metamorphism appears to have occurred without the rocks having been buried to any great depth. These examples illustrate the difficulties that are met in the endeavor to explain metamorphism on the basis of depth of burial alone.

To direct attention to additional factors that may enter into these problems, the following observations are brought together:

1) In 1934, Visser (*1*), in presenting the results of his analysis of magnetic observations carried out in the East Indies, indicated that certain anomalies in the earth's magnetic field appear to be related to areas that are disturbed geophysically; in particular, he refers to the line of the Lesser Sunda Islands and the Molluccas, a line coinciding with Vening-Meinesz' line of negative anomalies. Unfortunately, observations are too few to judge the validity of this correlation, though it would seem reasonable to anticipate anomalies in the magnetic field over areas beneath

[1] The writer is indebted to Walter H. Bucher for much helpful discussion of this subject.