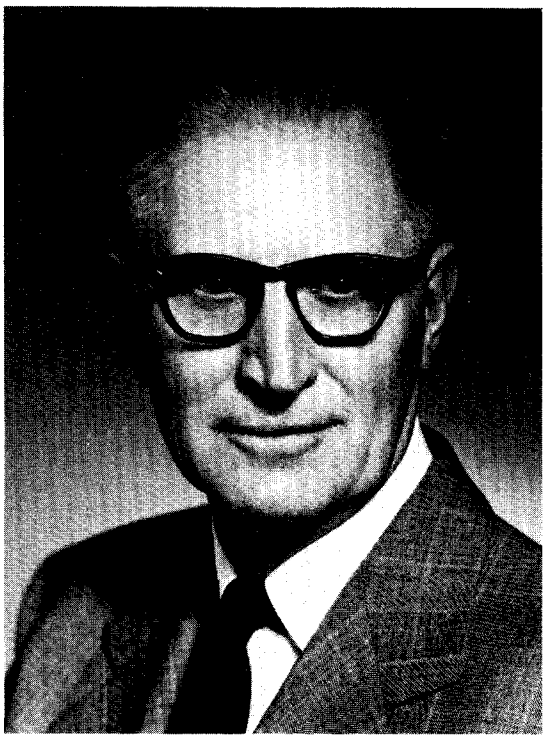
IN MEMORIAM

Martin W. Johnson
September 30, 1893–November 28, 1984

Dr. Martin W. Johnson, professor emeritus at the Scripps Institution of Oceanography, died on November 28, 1984, at Snohomish, Washington, at the age of 91. He had given up his 50-year association with Scripps only a few months earlier; he worked in his laboratory until the fall of 1984.

Johnson was particularly well known as one of the three authors of the landmark text and reference, *The Oceans: Their Physics, Chemistry and General Biology*. He further enhanced his stature with his World War II research, his postwar training of students, and his collaboration with them in describing the pelagic biogeography of the Pacific.



The "deep scattering layer" is probably his major wartime contribution. The use of acoustics, or underwater sound, was (and still is) the main method of detecting submarines. However, many properties of the ocean itself interfere with sound transmission and sometimes make submarine detection very difficult. An especially serious problem was the sound reflection that seemed to be coming from mid-depths. Research engineers spent a lot of Navy time and money trying to determine the source of these signals. Drs. R.J. Christensen, C.F. Eyring, and R.W. Raitt of the University of California Division of War Research asked Martin Johnson to investigate the problem because they had heard him lecture about deep layers of zooplankton and because of his earlier success in recognizing signals produced by shrimp.

It occurred to Johnson that ". . . if the layer was composed of organisms, it should behave as many marine animals do, especially the plankton, and undergo diurnal migrations . . ." He reasoned that the layer should begin an upward ascent around 5:30 p.m. (after engineers' normal quitting time) and migrate downward again around 6:00 a.m. (before shipboard work has normally started). Johnson's resulting hypothesis was tested at sea on the night of June 26-27, 1945. Thus the biological nature of the deep scattering layer was established.

In 1936 the faculty at Scripps had introduced a course in general oceanography in which it was "customary for those giving lectures to join the students as auditors in a following lecture given by some other faculty member." The principle of the interdisciplinary nature of oceanography led to the requirement that each graduate student at Scripps, no matter what his discipline, should take core courses in physical oceanography, marine chemistry, biological oceanography, and marine geology. Both Sverdrup and Johnson felt strongly about this issue, and their views prevailed until recently, when it was determined that the intellectual demands of certain subdisciplines are too great to require that all students be familiar with the whole of oceanography.

To follow through on their ecumenical notions and to provide a textbook for their courses, Sverdrup, Johnson, and Fleming collaborated on a book called simply *The Oceans*. It was, and still is, unique. Published in 1942, it initially received little attention, and some of that was not particulary complimentary. An early review in the *New York Times* read: ". . . this book shows that oceanographers have gone down in the ocean deeper, stayed down longer and come up drier than any other sailors." It is true that the writing style is distinctly reserved, Scandinavian, and in stark contrast to today's bated-breath, discovery-a-minute mode of expression. Nevertheless, the book has been in print and in demand for over 40 years; few authors of scientific tomes can claim that kind of record.

Scripps Institution and the science of oceanography

grew rapidly after World War II, and Johnson felt that an increase in graduate student enrollment was "especially important." He played a significant role in establishing the California Cooperative Oceanic Fisheries Investigations and its Scripps branch, the Marine Life Research Group. Johnson put a group of graduate students to work studying the California Current and its plankton populations, with emphasis on determining which species were present and how their abundances varied in space and time. Only zooplankton were studied because other kinds of organisms could not be reliably and quantitatively sampled at the time (1949). It was typical of Johnson to employ students on such fundamental research as determining the nature and life histories of fauna rather than, say, energy flow through (mostly unknown) trophic levels, a field which even then was considered high fashion.

One of the results of these studies was the determination that much of the plankton fauna of the California Current seemed to comprise a mixture of species that had larger populations in other water masses outside the system. The central portion of the California Current is one of the few places where many of these species co-occur. This discovery of extensive stirring and mixing of populations led to the speculation that much population biology and community diversity here was to be understood in terms of the physics of water movement, rather than as biological function like food limitation, energy flow, or competitive interrelationships between populations. This was such a heretical idea at the time (1954) that Johnson and his students felt more data, particularly descriptive data, were required.

Because many of the species found in the California Current obviously had populations outside of it, broader-scale sampling was clearly necessary to establish the patterns of species abundance. That the major patterns were easily interpretable in terms of Sverdrup's water masses further indicates the predominant role of physics in regulating the biology of the ocean. This approach anticipated by over a decade terrestrial ecologists' renewed interest in biogeography. The large-scale patterns and the proximal reasons for their existence developed by Johnson and his students have stood the test of time.

During formal retirement in the 1970s and early 1980s, Johnson returned to his interest in larval development of the many Pacific lobster species. His descriptions of differing developmental sequences of these leaf-like "phylosoma" stages continued to include his superb illustrations. (He was more than an illustrator: his caricatures and doodles—often made during meetings—might have become legend had he cared to publicize them.)

Martin W. Johnson was born on September 30, 1893, in Chandler, South Dakota, in a sod-roofed farmhouse. Like many other young boys of Scandinavian ancestry, he worked the wheat harvests of Saskatchewan and the Dakotas. In the off-season, he rode herd and was a general ranch hand. When his family moved to Washington state, he worked as a logger and choker setter in the woods and as a guard to protect salmon traps from fish pirates. He has written that these early experiences stimulated his interest in "fundamental ecology" and sense of wonder at the basic differences in "the type of pasturage and resultant type of grazers of each." Thus the Great Plains, the virgin forests of the Pacific slope, and the sea strongly influenced him.

After serving in the army during World War I, he attended the University of Washington, graduating in 1923 at age 30. He was curator of the Friday Harbor biological station, served on the scientific staff of the Passamaquoddy International Fisheries Commission, and acquired a Ph.D. at the University of Washington. In 1934, T. Wayland Vaughan, Director of Scripps Institution, wrote him, offering a Research Associate position at $100 per month, saying "We have on the Institution's staff a few people who are not seagoing. I do not intend to add to the staff anybody else who will not work on water." Johnson was glad to get the low salary ". . . in view of the then nation-wide depression" and the sea-going stricture was, as he said, "not a deterrent to me."

Martin Johnson was, in spite of his adventurous childhood and youth, a quiet, diffident, dignified man. God had not granted him the gift of gab, and his lectures, for the most part, did not sparkle. Even private conversations were, at first, quite formal, somewhat strained. But he was actually an emotional man with a great sensitivity and awareness of the human condition and an intuitive feel for which scientific problems were important and which weren't.

In spite of his basic humaneness, he did not suffer fools gladly. There were events, situtations, and individuals of which he definitely disapproved. But never did he use his position and stature to impose his views. He was completely above academic politics, at which, in any event, he would have been a failure.

An outstanding trait, all who knew "D.J." will agree, was his absolute honesty and integrity. He was simply incapable of deviousness or manipulation. His death marks the end of an era of great growth in oceanography—one of openness and cooperation. Both he and the milieu in which he worked will be greatly missed.

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