



Aaron Rosenfield
Honored Life Member

His unassuming and modest demeanor belies the fact that Aaron Rosenfield has been one of the most important movers in the field of shellfish pathobiology over the past 40 years. At the Oxford, Maryland Laboratory, he led a team of researchers that made outstanding contributions in this field. Studies on the distribution, causes, and effects of diseases on aquatic biota have been his main research specialty. Information and technical transfer have also been a particular strength. He has played a major role over the past three decades in bringing together talented individuals with creative minds for symposia, workshops, and conferences. These assemblies have resulted in the synthesis of scientific information into reports and books for use by resource managers, industry regulators, and other decision makers, particularly in relation to the control of biological and anthropogenic pollution, fisheries conservation, and aquaculture.

Aaron was born in Boston Massachusetts on October 14, 1924. He grew up in nearby Cambridge, where he attended public schools, graduating from Cambridge Latin School in 1942. He then enlisted in the Navy and served for the remainder of World War II as a quartermaster on P.T. boats in the South Pacific, where he saw action in the Solomon and Philippine Islands, New Guinea, and Palau.

After his discharge from the Navy in 1946, Aaron entered the University of Massachusetts. His interest in science had been stimulated in high school by the Sinclair Lewis novel "Arrowsmith," about a microbiologist, and he pursued a degree in bacteriology and public health which he received in 1950. He remained at U. Mass to study for a Master's degree in bacteriology and food science which he received in 1951. Diploma in hand, Aaron entered the world of industry where he worked as an analytical chemist for a company that produced emergency rations for the military. He quickly decided that industry was not for him and in the fall of 1952, he was awarded a Sara Hays teaching fellowship at Brandeis University where he taught laboratory courses in general biology, botany, microbiology, and plant physiology. At the same time, he began graduate work at Boston University. During this period he worked summers with Carl Sindermann, whom he had met at Brandeis, at the Maine Department of Sea and Shore Fisheries Laboratory at Boothbay Harbor where they collaborated on a herring parasite project.

Aaron became a full-time graduate student in 1953 when he enrolled at the University of Texas at Austin. From 1954 to 1956, Aaron returned to teach at Brandeis with his new bride Clarice, whom he had married in 1953. In 1956, he returned to Texas to complete his doctoral degree while Clarice worked at the University's Chemistry Department to provide living expenses for the family, which soon included a daughter, Sandy. Despite his early interest in bacteriology, Aaron switched focus during his PhD research to a project examining the physiological consequences of heterosis in corn. The quantification of DNA to standardize other measures was a newly emerging technique, which Aaron adopted and which inspired his life-long fascination with cell and molecular biology. After obtaining his PhD in 1960, Aaron remained for several months at the University of Texas as a postdoc studying mechanisms of bioluminescence in marine organisms. At the end of 1960, he returned to the Boothbay Harbor Laboratory where he became Microbiology Program Leader with the US Bureau of Commercial Fisheries (BCF). His research projects included *in vitro* tissue culture of molluscs, mechanisms of disease transmission and resistance, and cytogenetics. In 1962, Aaron was invited to take charge of the Shellfish Mortality Program at BCF's new Oxford Laboratory on Maryland's Eastern Shore. At Oxford, Aaron became deeply involved in research on the newly emerging oyster diseases, MSX and SSO, as well as Dermo. He and his research team discovered and described the elusive spore stage of the MSX parasite (*Haplosporidium* [then *Minchinia*] *nelsoni*). During this period, Aaron also made occasional forays across

Chesapeake Bay to the Washington headquarters of BCF where he held temporary duty assignments, including Chief of the Bureau of Shellfisheries and Chief of the Division of Resource Research and Management.

Aaron's roots in New England showed themselves forcefully when he first came to the Oxford Lab. He had a pronounced accent. So did this technician, only she came from South Carolina and had a heavy southern accent. The two often had difficulty understanding each other and colleagues recall having to act as interpreters in the laboratory. Aaron's accent has diminished over the years, but one is never in doubt about his origin.

In the early 1970s, the BCF was transferred to the National Oceanic and Atmospheric Administration (NOAA) and renamed the National Marine Fisheries Service (NMFS). The Oxford Laboratory was then assigned to the Middle Atlantic Coastal Fisheries Center, with headquarters at Sandy Hook, New Jersey. Aaron became its Officer-in-Charge of the Oxford Laboratory and its Director of Pathobiology Investigations. In this position he had the responsibility for establishing and supervising major national and international research programs in coastal aquatic animal health, biomedicine, and comparative pathobiology. His work put him in close contact with the shellfish industry, university and government researchers, and resource managers. These contacts became increasingly important as diseases and die-offs of fish and shellfish, and pollution associated problems, began to increase not only in North America, but in other parts of the world as well. Meanwhile, the Oxford Laboratory's pathology program expanded to include projects and personnel at the Milford, Connecticut and Sandy Hook, New Jersey Laboratories. Pathobiology research also expanded to encompass studies on other invertebrates, especially crustaceans, and finfish, as well as studies on microbial pathogens and tumors in "lower animals." In the mid 1970s, with still another NMFS reorganization, Aaron continued to head the Oxford Laboratory as its Director and as Chief of the Northeast Fisheries Research and Science Center's Division of Pathobiology.

One of the most important contributions of the Pathobiology Program under Aaron's direction was the establishment of cooperative alliances with other federal agencies, with state agencies and commissions along all U.S. coasts, with foreign governments, and with scientific and professional organizations around the world. The Oxford Laboratory's reputation grew until it was recognized world-wide as one of the foremost institutions in the detection and control of marine fish diseases. Students and established researchers from all over the U.S. and from dozens of foreign countries traveled to Oxford to study pathology of marine fish and shellfish, or to engage in joint studies with the Laboratory's expert staff.

Because the Laboratory's activities had such a wide geographic scope, Aaron's outlook on the problems of diseases in marine organisms also became global. The potential transmission of disease organisms among marine ecosystems developed into a major concern and focus of efforts. Aaron and his staff were instrumental in the design of strategies and programs for aquatic animal health, including quarantine and inspection to prevent the spread of pathogens, pests, predators, and competitors in previously unaffected areas. Early in his career, he urged all of the state fishery commissions (Atlantic, Gulf, Pacific) and the International Council for the Exploration of the Sea (ICES) to consider the consequences of introduced genes (both hosts and parasites) on indigenous populations. These efforts have resulted in guidelines for the movement of fish and shellfish, which are now used by many states and foreign countries. In another move to foster global communications and data analysis among fish and shellfish pathologists, and to house and catalogue the growing collection of pathology specimens found by the Oxford Laboratory's own investigators or sent to them by distant collaborators, Aaron conceived of the Registry of Marine Pathology, now incorporated into the Registry of Tumors of Lower Animals at the George Washington University Medical Center. Submissions to the Registry are compared with archived samples, thus providing a world-wide data base of marine parasites and pathogens and a mechanism whereby new discoveries can be evaluated in the light of existing information.

During his career as a government scientist and administrator, Aaron maintained unusually close ties with academic institutions. He has been a research associate at Georgetown University's Biology Department, an associate faculty member at the Johns Hopkins School of Public Health and Hygiene, and an adjunct professor at the University of Maryland, Center for Estuarine and Environmental Studies. He has been highly supportive of university researchers, enlisting funds from NOAA, the Army Corps of Engineers, the Environmental Protection Agency, the National Institutes of Health, the National Science Foundation, and other agencies for equipment, publications, and especially for meetings and workshops on special topics in marine pathology. Among the most important and influential of these were the "Shellfish Mortality Conferences," stimulated by the outbreaks of MSX disease in the late 1950s and early 1960s, which brought together most of the founding generation of molluscan pathologists in the US. Again in the 1980s, Aaron was instrumental in supporting a second series of these conferences, where a new generation of researchers, as well as many of the original participants, gathered to discuss the current status and future direction of molluscan pathology.

In addition to the Mortality Conferences, Aaron helped organize and support workshops in this country and abroad on pathology and *in vitro* biology for the American Fisheries Society, the Society for Invertebrate Pathology (of which Aaron was the permanent program chair), the American Institute for Biological Sciences, the National Shellfisheries Association, and the Society for *in Vitro* Biology. He helped found the Society for Invertebrate Pathology and was elected treasurer for 1983–1984. He has been an NSA member since 1962, becoming vice president in 1978 and president in 1979. Aaron has been very active on the international scene also, serving on oversight committees for collaborative programs in fisheries, aquaculture, and pathology between the US and Asia, including Japan, Indonesia, Taiwan, South Korea, and the People's Republic of China.

In recognition of his many achievements in government service, Aaron has received numerous awards from the US Department of the Interior and the National Oceanic and Atmospheric Administration. He was recognized by the Chesapeake Bay Foundation with an award for his conservation efforts, was awarded certificates of recognition by Maryland members of the US Congress, and received a certificate of achievement from the Governor of Maryland for his work on state resource issues. He was made an Honorary Life Member of the National Shellfisheries Association in 1991.

In 1987, when the Oxford Laboratory was turned over to the State of Maryland, Aaron took an Interagency Personnel Assignment at the University of Maryland's Center for Estuarine and Environmental Studies. There he continued his mission to organize workshops

and symposia, and to publish the resulting output. One of the most important of these was a session at the 1989 NSA meeting in Los Angeles on the subject of introduced species, which resulted in the seminal work "Dispersal of Living Organisms into Aquatic Ecosystems" (Maryland Sea Grant), published in 1992 with Aaron as senior editor. Aaron officially retired from NMFS in 1993, but he and Clarice continue to live in Easton, near the Oxford Laboratory (now the Sarbanes Cooperative Oxford Laboratory), where he can be found working in his office each day as a visiting senior scientist. In his "retirement," he has retained his global perspective, conceiving of and organizing symposia that attract participants from around the world. One of these, also held in conjunction with an NSA meeting (Orlando, FL in 1992), on the history and status of molluscan shellfisheries, resulted in a massive, three-volume set entitled "The History, Present Condition, and Future of the Molluscan Fisheries of North and Central America and Europe" (NOAA Technical Publications, 1997), of which Aaron was a co-editor. In 1996, he organized another major symposium, "The Blue Crab Fisheries of North America." Results of this symposium occupy the entire September 1998 issue of the *Journal of Shellfish Research*. Aaron is currently exploring the possibilities of organizing a similar meeting in conjunction with the Organization of American States on "Crustacean Fisheries in the Americas." Aaron's ever active mind is constantly coming up with new ideas, which are focusing more and more on helping promote and invigorate the Eastern Shore of Maryland. Among these ideas are the establishment of aquaria on routes traveled by vacationers to the Atlantic beaches, which would have both educational and heritage components and would encourage participation by watermen; a summer teacher's institute where local teachers could learn about biotechnology; and a natural products laboratory that would investigate potential uses of estuarine organisms. Aaron's mind is sure to be stimulated even more by the Internet, which he has recently discovered, and which astounds and delights him.

In a typically self-effacing manner, Aaron measures much of his achievements by those of the Oxford Laboratory. He cites its impressive qualitative and quantitative publication record and its contributions to the scientific community through joint participation in professional and fishery conservation activities. He is most proud of the Laboratory's outstanding contributions toward advancing the fields of marine fish health research and comparative pathobiology, both of which were barely recognized by most fishery scientists and resource managers as integral parts of the marine fisheries ecosystems, or marine science in general, before he joined the Laboratory.

Susan Ford
Port Norris, New Jersey
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