

JOHN DOVE ISAACS III

1913 - 1980

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John Isaacs never fit comfortably into any disciplinary niche at Scripps. He roamed energetically through physics, chemistry, biology, geology, engineering and even helped to introduce what was then a new field at the institution—~~atmospherics~~. He was almost certainly the least typical scientist and educator ever to work here. Consider this. His only formal degree was a B.S. in engineering from University of California, Berkeley, obtained when he was 31 years old. He spent more years at sea (as a professional fisherman) before he came to Scripps in 1948 than many of his oceanographer peers did in their entire academic careers. Still minus the usually requisite Ph.D. badge, he was appointed an associate professor in 1955 at the age of 42 and was a full professor six years later, serving as assistant director of Scripps for 10 years. This civil engineer was director of the Marine Life Research Group for 16 years and of the University of California Statewide Institute of Marine Resources for 9 years; these are two of the largest organizations in California with strong marine biology charters. He was one of those rare individuals who was elected to both the National Academy of Sciences and the National Academy of Engineering.

Isaacs came to Scripps in the expansionary post World War II era as a research oceanographer after having worked as a research engineer on ocean-related projects at



John Dove Isaacs near survey station at Pt. Arguello, 1948.

Berkeley for four years. At the end of the war he had worked with Willard Bascom on wave measurement in the giant surf off the Oregon coast. Bascom and Isaacs became close lifelong friends and only Bascom's recent death, resulting from an automobile accident, kept him from writing this appreciation of John Isaacs' monumental contributions to Scripps. Isaacs worked at Scripps for more than thirty years until his death in 1980. This was the era of almost explosive growth in the funding of academic research, particularly in oceanography, that grew out of the World War II experience. These were the years when funding went out in search of new ideas. It was the perfect climate for John Isaacs. Ideas he had aplenty. They rushed out, tumbling over one another, too fast for most mortals (and all graduate students) to catch on the first, or even the second bounce. He had unusually rapid reflexes and enjoyed challenging and beating anyone who would take him on in ping-pong or in a game involving attempting to slap the others outstretched palms.

What are the characteristics of this man? Roger Revelle, who was then director of Scripps, wrote in his recommendation for Isaacs' appointment to the faculty: "He has a wide knowledge of many sciences rather than a profound knowledge of one. This knowledge is working knowledge, however, rather than that of a dilettante—especially in the fields of physics and biology." Revelle went on to say "Isaacs is an individualist, not readily classifiable into any of the conventional academic categories. He is, exclusively, neither engineer nor theoretician; neither physicist nor biologist; neither office administrator nor field scientist. His inflammable interest and insatiable curiosity lead him to activity in any of these fields as occasion presents itself. To one not acquainted with the man and his work, the frequent and abrupt shifts of interest might give an impression of instability and superficiality, but any such impression is dispelled by familiarity with his current work or by a critical examination of his career." To this, we can only add some observations of our own on what was uniquely John Isaacs. Education, old-fashioned mentoring, was among his highest priorities. He always had time for meeting with his students, even if it meant pushing off other tasks. He thought about and studied and experimented with educational techniques. The Socratic Method seemed as natural to him as ordinary conversation. He was passionate about getting his students involved in pursuing his conjectures. He had the most astounding memory for detail—numbers, dates, names, densities of obscure materials, formulas, poetry—seemingly everything. As Betty Boden commented, "John reads widely, if obscurely." A large copy of the Periodic Table hung on his office wall, and he would manage to find some insight to be derived from it in almost every student encounter. He was an orthogonal thinker and immediately saw the non-obvious connections. His humor was spontaneous and full of auditory puns and double meanings—mental workouts, as we believed, for his uncanny ability to find the unexpected link that led to the creative idea. He was kind and compassionate with his staff and his students and never used the keenness of his own mind to embarrass or belittle other humans. He was intellectually fearless. No expert in any field would inhibit him from airing his wildest idea.

It is difficult to rank the importance of John Isaacs' many lasting contributions to Scripps. Perhaps the most significant grew out of his pioneering insights into the global-scale impacts of broad-area changes in the Pacific, which he first published with Oscar Sette in *Science* in 1958. As director of the Marine Life Research Group, the Scripps component of the statewide California Cooperative Oceanic Fisheries Investigations—CalCOFI—Isaacs was

able to steer this group into basin-wide rather than local research. He developed the Bumblebee Buoys (named for their rounded profile and broad orange and yellow stripes) which survived typhoon winds and seas in the North Pacific for two years gathering atmospheric and upper ocean temperature data. This eventually led others to create the larger North Pacific Experiment (NORPAX), which was housed in a new building named after the project (in September 1998, after his death, the NORPAX building was very appropriately renamed Isaacs Hall). Meanwhile, Isaacs had induced Jerome Namias, a world-renowned long-range weather forecaster, to leave the Weather Service in Washington and start a climate research program at Scripps. This has grown over the past 30 years into an equal partner in the ocean-land-atmosphere triumvirate that constitutes Scripps at the end of its first century.

Perhaps second in lasting significance was John Isaacs' major role in establishing the University of California as a Sea Grant College, with its headquarters at Scripps. The California Sea Grant College Program, which has supported marine research at more than 35 institutions within the state, is the largest such program in the country. As part of the founding of the California Sea Grant program, a new curriculum group called Applied Ocean Science (AOS) was created in cooperation with two of the UCSD engineering departments. AOS provided a mechanism for students to conduct research that was cross-disciplinary or which had a strong technology or engineering thrust. The Sea Grant program was administered for the university by the Institute of Marine Resources, which Isaacs headed from 1971 until his death in 1980. He was instrumental in obtaining state matching funds for Sea Grant through the Resources Agency. Isaacs was associated with the AOS curricular group from its inception and many of his students were recruited from there.

Perhaps third place belongs to the many significant technological developments that John Isaacs contributed to Scripps and the oceanographic community. The first of these was a solution to the undersampling problem that existed in 1950s because trawls used for sampling sealife could only be used near the surface or dragged along the seafloor, and both could only be towed at slow speeds. The huge midwater zone remained unsampled. Carl Hubbs introduced the need for a deep, fast sampling device and Isaacs and an engineer



Isaacs with his students near survey station at Pt. Arguello, 1948. Photo by Willard Bascom.

named Lewis Kidd, from John's staff, worked on the problem and developed what became known as the Isaacs-Kidd Midwater Trawl. It allowed rapid (2-4 knot) underway sampling at depth and was adopted worldwide. John Isaacs and his staff worked on the development of free vehicles (untethered) for almost his entire career at Scripps. These are instruments of various types—still or video cameras, traps, samplers, current meters, which can be launched from the deck of a ship and will fall freely to the ocean floor, cast loose from ballast after a set time, and return by themselves to the surface for recovery. Isaacs did not invent the idea of a free vehicle, but he was responsible for the development of many of the elements of technology that made them possible. Of particular importance was the release mechanism. Ship time was too valuable to wait around very long for the vehicle to surface and a great premium was attached to precision in the release time without sacrificing the overall reliability of the retrieval. Early efforts centered on magnesium links that corroded in seawater. Isaacs worked with William Van Dorn on the design and development of a device that was a standard for decades. Later, Isaacs would direct the development of an explosively actuated release that could be triggered from the ship by an encoded acoustic signal. He developed underwater cameras and lights that could operate at depths of more than a thousand meters and returned dramatic pictures of a rich assortment of large animals living at or near the ocean bottom that had been largely unexpected. The Bumblebee Buoys required the development of highly reliable, lightweight, deep water mooring systems capable of service lives measured in years rather than weeks. This technology led to the capability of gathering continuous data in mid-ocean over very long time spans.

John Isaacs believed mightily in direct observation. When the Sea Grant program received a proposal to study a serious outbreak of skin disease on a commercial fish species, Isaacs asked the proposed investigators if they had ever seen a live fish with this disease. They hadn't, having limited their work to preserved specimens. He kept insisting that they do this, and eventually they did. The bodies of the fish were uncharacteristically dry—without the coating of mucous that they should have had for protection. Isaacs let out a hearty "ah ha" when he heard this and lectured the researchers on the lack of a substitute for looking at and feeling the real thing. Again, an eminent hydraulic modeler from Berkeley submitted a Sea Grant proposal to study "sneaker waves" in Tomales Bay, which had been responsible for many small boats capsizing and a few deaths. The Berkeley engineering professor had never been to Tomales Bay, and apparently didn't intend to go. He hadn't written any field work into his proposal. Isaacs suggested a meeting at Scripps, and Isaacs discovered that the engineer hadn't seen fit to correlate the observed time of the accidents with the stage of the tide, even though Tomales Bay is famous for its tide races. By the time the meeting was over, flow meters and wave gauges had been inserted into the plan.

The disappearance of the Monterey, California, sardine fishery, blamed on overfishing, was a hot topic at Scripps in the 1950s. One of Isaacs' more significant findings was proving, with his colleague Andrew Soutar, that the generally accepted theory on the disappearance was wrong. The way that this happened tells us a great deal about how John Isaacs approached mysteries. In 1949, just a year after joining Scripps, Isaacs made a trip northward to study coastal rock formations. Near Point Conception he found unusual structures containing multiple thin layers in which the remains of marine animals, including fish scales, could be seen. The idea of finding such a mechanism on the seafloor as an

indicator of past climate was filed away, but not forgotten. More than ten years later, K. O. Emery, then at the University of Southern California, published on varved sediments (annual layers like tree rings) at the bottom of the Santa Barbara Basin. The oxygen content in this basin was low enough to preclude worms and other bottom-living animals from disturbing the sediments. Soutar wanted to use the chronology to calibrate the radiocarbon dating method. When a grab sample brought up many fish scales, Isaacs convinced Soutar to work on fish and forget the radiocarbon. By 1970, the techniques of box coring had been worked out by Soutar and Isaacs such that the surface layer was not blown away by the device and complete columns dating back more than 17 centuries could be obtained. By laborious counting the fish scales of sardines, anchovies, and hake, Soutar and Isaacs showed that the sardine was



John Isaacs with a sablefish, January 1950.

only an occasional visitor to these waters, with numerous disappearances prior to the establishment of a fishery, and that the anchovy, rather than filling the niche of the departed sardine, had been there throughout the whole record. Mystery solved.

As a professional and lifelong amateur fisherman, John Isaacs was driven to capture a live Coelacanth, the bizarre fish that had been thought to be extinct for millions of years until taken in 1938 by fishermen off the Comoros Islands. Reminiscent of Melville's Captain Ahab on his search for Moby Dick, Isaacs finally joined an expedition to the western Indian Ocean in 1971 but was never successful in photographing or catching the elusive fish.

The role of freshwater for agriculture was a recurring topic of interest to Isaacs, prompted in part by spending much of his life in the coastal deserts of San Diego County and Baja California. This led him to encourage research into crossbreeding halophytes (salt tolerant plants) with food crops so that brackish water supplies could be used for irrigation. He promoted the idea, originated by others, for towing Antarctic icebergs northward across the equator so they could be melted and used for freshwater along a dry coast. He once envisioned a 30 foot diameter fiberglass reinforced plastic pipe hundreds of miles long, moored just off the bottom of the ocean, that would float when filled with freshwater. A low dam at the mouth of a river in Northern California would provide the head to drive water through this pipe to the arid south. He discussed, and encouraged students to study, the use of very cold seawater pumped up from deep in the ocean as a means of condensing

freshwater from the atmosphere. He felt that desalination in conventional thermal systems was foolish because the sun and the ocean together created an unlimited distillation apparatus and all that was needed was to condense some of the vapor. He was intrigued by the enormous energy potential that was represented by the osmotic pressure between saline and freshwater. Eventually, because of engineering problems associated with maintaining osmotic membranes, Isaacs and associates switched emphasis to studying a system of power generation that depended on the vapor pressure difference between saline and freshwater.

John Isaacs was a close friend of a San Diego entrepreneur philanthropist named Robert Peterson. Peterson and a partner created the Foundation for Ocean Research (FOR) mainly to fund Isaacs' most speculative ideas. Among these was the notion that graduate students freed from the distractions and aggravation of competing for laboratory or field investigation resources and working together in a highly supportive environment would be far more creative than their peers embedded in the Scripps establishment. An off-campus facility was created with shops, laboratories, office space, and support staff. Isaacs met at least once a week with a group of specially selected graduate students who were supported by FOR. Out of this experiment in education came a number of demonstrations of Isaacs' ideas, including the salinity power concept and the breath heater. Isaacs believed that the concept of attempting to warm scuba divers by heating their suits through various means was wrong, and that most of the heat loss came from breathing cold dry air from their tanks and then exhaling warm moist air at the expense of their body heat. He conceived of the idea of adding a very small amount of hydrogen to the breathing air and then passing it through a platinum catalyst that both warmed it and formed water vapor. It worked spectacularly, was patented, and was licensed by FOR, after Isaacs' death, to an entrepreneur who saw its much larger potential in medical applications for reducing the stress on patients who breathed cold, dry oxygen. The FOR as incubator provided a rapid means of testing many of John Isaacs' ideas. He tossed them out around the FOR conference table and a student could decide to work on one of them, occasionally leading to a Ph.D. dissertation. One such was his 1970s idea that the rotational momentum put into the atmosphere by lines of cars passing in opposite directions would increase the incidence of tornadoes in North America (where cars pass on the side proper to induce counterclockwise rotation). This difficult to prove concept was not readily accepted by atmospheric scientists, although the Berkeley physics department scientists took it very seriously when Isaacs presented a lecture there on the subject.

In the last years of his life, he expressed some serious disappointment about the FOR experiment. It seemed to him that the students worked on his ideas exclusively, rather than generating their own and that they spent little time thinking about their projects, as opposed to working on them, except under his direct questioning at the weekly seminars. Perhaps the FOR students who most closely met his ideal of creativity and self-motivation were the Vidal brothers. They were Mexican nationals and worked jointly on different aspects of submarine hot springs off Baja California. The brothers discovered thermophilic bacteria that thrived at temperatures above the boiling point of water long before the discovery of the mid-ocean ridge hot springs with their surprising collection of radically different life forms. Without the Isaacs inspiration, FOR gradually disappeared, although the weekly seminar continued for a few years under the guidance of one of his ex-students.

In the years immediately following World War II, Isaacs played a significant role in the team that Scripps fielded to monitor the testing of nuclear weapons at the Pacific atoll test sites. He was also an advisor to the Navy on mine warfare and concocted an idea, which he later convinced himself was impractical, for a ship that could proceed through the water without creating a pressure wave and could therefore avoid setting off pressure-detonated mines. In the late 1960s, before large ocean-hopping amphibious aircraft were phased out, Isaacs decided that it might be useful to arrange for a calm spot in mid-ocean as a safe place to land if that type of plane was in trouble. Years later, after hearing about the unexpected lurches of his taut-moored Bumblebee Buoys, he conceived of a mid-ocean breakwater consisting of thousands of spherical floats tethered just below the surface that would extract energy from waves by the friction resulting from their rapid responses counter to the wave motions. One of his students eventually demonstrated this idea at ocean scale, but in shallow water, as a portable breakwater for protecting military landings on open coasts.

Roger Revelle once said that John Isaacs' favorite ideas, the ones he never really abandoned, were among his worst. At the top of this list was a dream vehicle that would fly like an airplane, land on the water, and submerge like a submarine. No amount of practical objections would dissuade him from the ultimate utility of such a craft.

John Isaacs wrote a unique chapter in the Scripps annals as a creative, sometimes wildly impractical, thinker, an effective manager in spite of his lack of interest in that function, a dedicated and innovative teacher deeply interested in fostering creativity in his students, a practical and accomplished engineer, and a scientist with interests perhaps best described as trying to understand how the world works. Maybe he said it best himself, "Just as the sea is a challenge to science as we now know it, so it is a challenge to our institutions as they now exist. Understanding of the sea, and the welding together of fragmented disciplines into a comprehensive science, should reflect upon other sciences, education, and our social institutions. Education will come to discover how to nurture and develop attributes of the intellect still too often neglected—conceptualization, intuition, curiosity, judgment, and perhaps even intellectual fervor. With these examples, our social sciences will come to recognize the necessity of assembling their own disciplines into a coherent whole for the guidance of mankind."

