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# JOHN DOVE ISAACS III

*1913—1980*

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*A Biographical Memoir by*
WILLARD BASCOM

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*Biographical Memoir*

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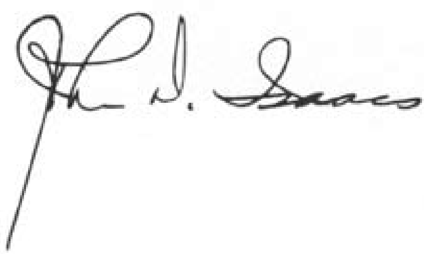

# JOHN DOVE ISAACS III

*March 28, 1913–June 6, 1980*

BY WILLARD BASCOM

JOHN DOVE ISAACS III was born in Spokane, Washington, and he was raised in Oregon where his maternal grandparents had located after crossing the plains by wagon train. His paternal grandfather, John D. Isaacs, Sr., was chief consulting engineer for the Southern Pacific and Union Pacific systems, which was of particular import to John who vastly enjoyed travels with his grandfather in his private railroad car. A bronze plaque at Stanford University credits the senior Isaacs with conceiving and developing the principle of making motion pictures; the first photographic experiments were carried out with Edward Muybridge at Leland Stanford's farm in Palo Alto, California. John's father, also a railroad engineer, died in a hunting accident when John was six.

During his childhood, John lived on the 120,000-acre Hay Creek Ranch in central Oregon with his mother, his sister Emily, and his favorite aunt and uncle. Later he moved to his pioneer grandparents' first ranch home near Pendleton, Oregon. Ranch life gave him a solid background in practical ecology as well as an opportunity for his strong naturalist instincts to develop.

Early in life John showed intense scientific curiosity and a capacity for invention. As a Pendleton High School student in the early 1930s, he proposed to his physics teacher a way of detecting distant objects by means of reflected radio waves. (Unfortunately, the fellow did not grasp the possibilities and thereby lost an opportunity to become a coinventor of radar.) To his chemistry teacher, he had to confess that his chemistry lab was the scene of the production of the hydrogen-plus-acetylene balloons that had recently been exploding over Pendleton and that had even ripped the shingles off the minister's roof.

Young John enjoyed reading encyclopedias, and he had an excellent memory. As an adult he would sometimes launch into detailed dissertations on esoteric subjects—such as the complex life cycles of oriental parasites—that he had read twenty to thirty years earlier.

In 1933 he joined the new Civilian Conservation Corps. He became a camp office manager and—because there was a good supply of logging and construction accidents as well as stabbings and shootings—an accident investigator. Two years later John became camp manager at Cape Perpetua, Oregon, a Resettlement Administration facility. (The Resettlement Administration was a New Deal agency that resettled low-income local families on more productive lands.) By the following year he had saved enough money to return to college at Oregon State, where one of the attractions was Mary Carol Zander.

When school was out, John got a job as a forestry service lookout on Mt. Hebo in the Siuslaw National Forest. When it wasn't raining, this meant twenty-four hours a day atop a high tower accompanied only by Sampson, his trusty cat. During the period Isaacs spent in Oregon's coastal forest, he learned not only the names of all the trees and the undergrowth plants but also the intricate relationship among them and how it changed with logging and fires. In later life when he would drive along the highway, he would amuse himself, and sometimes his companions, by intoning the Latin names of each species of passing tree. One of the monuments he leaves behind is the stand of one thousand trees he planted on his estate in Rancho Santa Fe, California.

In 1938 he moved to Astoria, Oregon, just as a great run of albacore tuna appeared offshore. It was said that everyone in Oregon who had a lettuce crate went after the albacore; John was no exception. He joined with a friend who owned a small boat just a little bigger than a lettuce crate. After long hours of work to make it ready for fishing, John took the boat well out to sea for a test run. Coming back into the Columbia River entrance—always a scary experience in a small boat—events occurred that almost proved fatal. The boat's engine coughed and stopped dead in the turbulent waters of the bar. After frantic work, John realized there was no chance of getting it running again and that the boat would soon crash on the jetty. He stripped off his shoes and pants, put on a life jacket, and committed himself to the river. He vaguely remembered seeing one large wave fling the boat on the unforgiving rocks and watching splinters drift away. After half an hour in the icy waters he was picked up by a passing tug. The crew put him in a cold shower to warm him up; he remembered it as scalding in relation to the river. It was thought at the time that one could not survive in those rough frigid waters more than 10 minutes, but he knew by his watch otherwise. His body was black and blue, totally bruised from head to foot, and he was hardly able to walk for some time after the ordeal.

The next day John and Mary Carol walked out on the jetty. She found the only surviving relics of the wreck: his trousers with his wallet in the pocket, and in it his social security card. He carried the card for the rest of his life as a reminder of his good luck that near-tragic day. Later in that year the two were married. The young pair occupied the captain's cabin and officer's quarters aboard the sailing ship *William Taylor,* which was moored in Young's Bay near Astoria.

As a young commercial fisherman working out of the Columbia River, Isaacs was outraged one day by a passing tourist who said something to the effect that "these fishermen don't know much about what they're doing." John—with a 6-foot 3-inch frame and one of the highest recorded I.Q.'s in the state of Oregon—rather firmly suggested that this unwary soul sit down and observe while he dissected a salmon and explained in detail the function of each organ and tissue.

John Isaacs was a fisherman throughout his life, and he appeared to enjoy cold, wet, miserable weather as long as he could fish. He felt he could think better with a fishing pole in hand. Some of his best thoughts about who eats whom in the sea, under what conditions, and how the sea's biological energy is distributed were developed over fifty years of random observations. These were set down finally in a landmark piece in *Scientific American* entitled "The Nature of Oceanic Life"—illustrated, of course, with photos of deep sea creatures taken by his monster camera. But that was much later.

As a commercial fisherman with a boat that was considered large for the pre-World War II period, John—and occasionally Mary Carol—would fish out of the Columbia River, sometimes going north to Grays Harbor or the Quillayute River, or south to Tillamook Bay. It was the perfect school for a future oceanographer and it left him with an ever-ready bag of stories, as well as a good sense of the lore of the sea.

After two years of commercial fishing John and Mary Carol returned to school and spent the academic year of 1940–41 at Oregon State University. Afterward John took a job with a survey crew on the construction of Tongue Point Naval Air Station near Astoria, Oregon. As various construction problems arose, John devised solutions that moved him rapidly up the job ladder. For example, the ceiling beams in one of the buildings under construction flexed excessively because of poor design. To solve the problem, Isaacs derived the formula for computing bending stresses in beams and redesigned the offending structure "so the plaster below would stay on." When the chief engineer unexpectedly quit, he was offered the job. In 1943–44 Isaacs studied at the University of California at Berkeley, receiving a B.S. in civil engineering, his only degree. While at Berkeley he came to know and appreciate Dean Morrough (Mike) O'Brien who greatly influenced his life.

Thereafter he spent his life with the University of California, beginning as a research engineer on the WAVES Project at Berkeley, which is where I met him. John's enthusiasm for the sea and his sense of humor attracted me to him at once. After listening to him for two hours on our first encounter in 1945, I switched immediately from mining to oceanography. The following week we began surveying the beaches of northern California, Oregon, and Washington using amphibious trucks (DUKWS), seaplanes, radio-controlled cameras, and a small party of men who didn't mind daily dousings in cold seawater. In the late 1940s at Berkeley he invented such things as a wave direction indicator using a Rayleigh disc, several varieties of wave meters, a wave-propelled "sea-sled" to carry surveying rods through the surf zone, and a means of measuring and modeling stress in torpedo nets. Later he and I worked together measuring the effects of nuclear explosions in Eniwetok and Bikini.

John Isaacs was present at four nuclear test series; he especially distinguished himself during two of them. The first was Crossroads in 1946 for which John's job was to measure waves from the blasts. For this purpose he arranged to have large aerial cameras (with a film size of 9 by 18 inches) set up on two camera towers on Bikini Island. These cameras were to be started a little before the explosion, simultaneously taking a picture every three seconds for several minutes. This wave-measuring technique had previously been tested on the northern California coast, but at Bikini the problem was a little different.

Because the objective of that first test was to learn the effects of an airburst and an underwater burst on a fleet of warships, it was necessary to know the exact distances between the explosions and specific parts of each ship. The ships were to be anchored, and the original plan had been to run aerial photo sorties over the fleet a day or two before the shot. These were to have been assembled in a mosaic in order to determine the distances from ship to shot. As any seaman knows, however, ships at anchor move about in a "watch circle" whose radius is the anchor line, which is at least three times the depth of the water (some 200 feet in Bikini lagoon). As a result, matching successive lines of pictures was impossible; between photo runs some ships had moved several hundred feet. Weapons effects decrease as the cube root of the distance; thus such errors in position were unacceptable.

At the uncomfortable moment when this fundamental flaw in the great test was discovered, Isaacs' proposal to use the wave-measuring cameras to triangulate ship positions was gratefully accepted. For months afterward he had a group of people using a traveling microscope mounted on a large steel micrometer stage measuring photos and precisely computing the position of ships in the test fleet. The wave measurements became almost incidental. Using automatic cameras that fire every three seconds he had the fantastic luck to get a picture of the Baker shot's lighted bubble breaking the surface.

During the Castle series at Bikini in 1954, John became very concerned about the possibility of the shots causing a tidal wave that would wash over some of the islets on which people were intending to stay during the shot. Some of us thought there was little likelihood of that happening because John was jokingly known as a "calamatologist" (who often foresaw unlikely calamities). Nevertheless, he had the ear of the admiral, and at the last minute, just to be on the safe side, that worthy ordered everyone except the firing team off the atoll.

The first shot of the series (Bravo) went with about twice the expected yield. When it did, it destroyed many camp buildings on the islands and dumped heavy radioactivity on the atoll. The firing party was trapped in the bunker for a time, and no one went back ashore for several days. There was no substantial tidal wave, but I am convinced that if Isaacs' hunch had not been followed, lives would have been lost both to the blast and the subsequent radioactivity.

John Isaacs liked to think, and the more complex the subject, the better he liked it. Some of his favorite topics were far from oceanography. They included such diverse matters as black holes in space, the groundwaters of the upper Indus valley, growing food plants in saline water, and esoteric aspects of mine warfare. He did not think in mathematical terms, but in later life he wrote equations for ideas that to him were self-evident.

John philosophized about a great many diverse subjects including economics ("The more money is expended for nothing, the more it approaches nothing as a value," and Whitehead's universe where "the possibilities are not only infinite but actual"). He revitalized Epimetheus, the hind-thinker, rampant on a field of greenbacks, who proposed panaceas for vaguely defined scientific problems. And he worried about the communications disjuncture between those who possess scientific understanding and those who are responsible for the direction of governmental action.

John was a big man with quick reactions, but he was not especially athletically inclined. Instead he played games like "slaphands" in which two persons face each other and extend their hands, each parallel to the other's, but with the hands below, palms up. The object is for the hands below to slap the back of the hands above. No one came close to beating Isaacs at this. He was also expert at ping pong and delighted in "teaching" it to graduate students who had an overly high opinion of their prowess. He loved chess, including blind chess, Kriegspiel, and triple cylindrical chess, but he often had a hard time finding worthy opponents.

Isaacs had a marvelous sense of humor that began with outrageous puns and extended upward to jokes that were so sophisticated that almost no one would get the point. Having delivered some such witicism he would cautiously look around the audience to see if anyone had caught on. On such occasions I would just perceptibly move my head from side to side to show that his remarks had not gone completely unnoticed—but as a matter of principle I never cracked a smile. Isaacs was in his glory when it became fashionable to devise a horrid form of joke known as a Tom Swifty. As with puns he was always trying to invent ones with double and triple meanings. These were marvelously idiotic, and when we all laughed he would be encouraged to attempt an even more outrageous version.

John Isaacs moved from Berkeley to the Scripps Institution of Oceanography in 1948. From this vantage point he could involve himself wholly in all aspects of sea studies.

About that time he heard of the existence of huge freshwater icebergs in the Antarctic, some ten miles long and a mile wide. He promptly set about thinking of ways in which they could be used to increase California's water supply. Isaacs posited that they could be towed into the Peru current, which would move them north to the equatorial currents, which would carry them westward and into the Kuro Siwa, which would move them eastward toward Vancouver and eventually south along the California coast. The ice would take on a streamlined form as it moved, powered by a temperature-difference "engine"; and it would produce more water from rain than from ice melt. Eventually—somehow—the berg would be parked behind Catalina Island. The worst objection to this plan was that it would change the weather in southern California. In a year or so we found that this idea had been invented several times before, but by then Isaacs had gone on to bigger schemes.

Isaacs' curiosity about the animals that live in the depths led to the development (with Lewis Kidd) of the Isaacs-Kidd midwater trawl. This net had a hydrodynamic depressor across the bottom to hold it down while being towed at a depth of several hundred meters. He was also keen on making photos of the animals that live on the deep-sea bottom. In the late 1960s, in association with Richard Schwartzlose, Richard Shutts, and others, he developed baited automatic cameras that were freely released in water as much as 7 km deep and recovered a day later. In several places he photographed a surprisingly large number of active invertebrates, fishes, and some gigantic sharks that changed man's thinking about the sparsity of life at such depths. The nets and the cameras were extensions of his senses as he sought to find out: What's going on down there?

In 1958 he became head of the Marine Life Research Program, which was concerned with discovering whether man's overfishing or pollution had caused sardines to disappear from California waters in the early 1950s. His unconventional approach was to examine (with Andrew Soutar) the yearly layers of undisturbed sediment layers in the Santa Barbara Basin. These layers contained the scales of fish species going back for some 1,200 years. Counting the scales, year by year, showed that sardines had—for natural reasons—

come and gone many times before man arrived. This led to a new question: Why were sardines so plentiful when they were present? The answer is not yet known.

In 1950 I invented the deep taut-moored buoy and used it for wave measurements at the nuclear shots. The buoy was held about 100 feet beneath the sea surface by a slender steel wire some 6,000 feet long; the wire connected the buoy to a heavy anchor clump installed on a sea-mount, which furnished a steady platform for instruments in deep water. John always wanted to "go me one better," and in 1966 he devised the "sky hook." The sky hook was a taut-moored earth satellite that was to be held just beyond synchronous orbit by a wire. If it could be built it would permit large amounts of material to be moved into space without the use of rockets. Aside from the problem of actually constructing this device, however, the wire into space required a tensile strength far beyond any known material. Someday it may be possible; in the meantime the idea has been duly credited in Arthur Clarke's book, *The Fountains of Paradise.*

While thinking about how to deal with sea mines activated by a ship's pressure signal, Isaacs also devised a ship hull that trapped its own waves. This was basically an ordinary hull, "sliced" down the middle, with the pieces transposed and separated by a closed bottom so that only straight sides were exposed. The propeller was between the hulls, and the ship carried a substantial breaking wave just inside the stern, the forward part being a raceway. I piloted a model of it through a number of test runs without disturbing the surface of a glassy reservoir.

Later, Isaacs and Hugh Bradner proposed that the earth might be appreciably heated by neutrinos. John Isaacs also gave a good deal of thought to the matter of extracting power from the sea. In 1954 he studied the Claude thermal difference process and started to build a resonant wave pump for the end of the Scripps pier. Later he reinvestigated tidal power schemes, pointing out that much of what seemed to be available head (usable water height) in an estuary would be lost as soon as any structure was built because the kinetic run-up would be much reduced.

In the 1970s he and various associates at the Institute of Marine Resources, including Walter Schmitt, Gerald Wick, and David Castel, reexamined the utilization of energy from ocean waves. John liked to remind his listeners that more power is expended by waves in heaving—that is, vertically moving—a ship up and down as it crosses the ocean than by the thrust of its screws. He noted that waves are a form of solar energy; as such their very nature requires that a great number of small devices be used if much energy is to be extracted. Their special feature is that if waves are cropped by some extraction device, the wind builds them up again; thus there could be a hundred times more power available than is observed in a steady-state condition.

Isaacs and his associates established design criteria for wave-powered machines and then proceeded to construct a wave-powered pump. A photo of a small version of this pump appeared on the cover of *Science* (January 18, 1980) spouting water some 6 meters into the air in waves of only 0.6 meter. The advantages of zero fuel costs and only one moving part led him to suggest that a 50-kilowatt plant of this type in trade-wind seas using a pipe 0.9 meter in diameter and 153 meters long would be very efficient—if only there were a suitable application.

Next Isaacs (and Wick) looked into salinity gradient energy. This is a potentially large source of usable energy that can be tapped if the osmotic pressure between two fluids of different salinity can be harnessed. Where a stream flows into the ocean, this pressure is equivalent to 240 meters of head; it is more than ten times that much if it flows into the Great

Salt Lake. Several schemes for tapping salinity gradient energy were reviewed, most of which required better and cheaper semipermeable membranes than currently exist. John pointed out that there may be greater amounts of energy available from the salt in salt domes than in the oil and gas that has been extracted from them.

At the end of his paper on the forms of and prospects for using the ocean for human power needs, Isaacs concluded: "The most important . . . will be in the employment of seawater for heat rejection and of the deep region below the sea floor for the disposal of nuclear wastes."

Isaacs the whimsical philosopher also liked to consider the positions of events and energy in perspective. He and Walter Schmitt constructed an energy "ladder" and made order-of-magnitude estimates that included some of the following:

| | |
|---|---|
| Big bang | $10^{75}$ |
| Sun's radiation (one year) | $10^{41}$ |
| Ice age latent heat | $-10^{33}$ |
| Marine biomass (one year) | $10^{28}$ |
| Large salt dome | $10^{26}$ |
| Largest H-bomb | $10^{24}$ |
| Tornado | $10^{22}$ |
| Lightning flash | $10^{17}$ |
| Human daily diet | $10^{14}$ |
| Melting ice cube | $-10^{9}$ |
| Striking typewriter key | $10^{5}$ |
| Flea hop | $10^{0}$ |

After carefully considering the implications of the above, he concluded (in *Science*) that the sun's radiation for one year could fuel the leap of $10^{41}$ fleas.

One of his inventions was an elegantly simple means of controlling heat and moisture loss in divers, mountain climbers, or other individuals subjected to cold–dry stress. In normal breathing, inhaled air is warmed and humidified as it moves toward the lungs; with exhalation, most of that heat and moisture is lost. Under extreme conditions, the heat–moisture losses are 250 times those that occur at rest at room temperature. As Isaacs pointed out, by far the largest part of the heat lost is that required to vaporize water, and divers and climbers can have a serious problem of dehydration.

Previously existing techniques were complex and heavy, and required some stored water. His solution was to equip the explorer with a small cylinder of hydrogen under high pressure. The hydrogen is then premixed with incoming air in a breathing mask and passed over a catalytic metal where it is combusted. This provides a supply of warm, moist air. As long as the amount of hydrogen is less than 3 percent, there is no danger of explosion.

The patent for this device is held by the Foundation for Ocean Research. Isaacs' name does not appear on it but, as he liked to say, "There's no limit to what a man can accomplish if he doesn't care who gets the credit."

John Isaacs was committed to the conservation and protection of natural resources, but he was incensed by regulations that attempted to control the discharge of human wastes into the sea. It was his opinion that:

> The return of organic waste and plant nutrients resulting from the most natural of acts to the sea is most probably beneficial. The benefits of putting the same material on land is clear to any farmer but the advantages to the sea are not so easily appreciated. The sea is *starved* for basic plant nutrients and it is a mystery to me why anyone should be concerned with their introduction into coastal seas in any quantity we can generate in the forseeable future. (Testimony of October 19, 1973.)

On other occasions Isaacs liked to note that if the human population of the southern California coast (about 10 million persons) were compared on a weight basis with the anchovy populations (then about 3.5 million tons), the anchovies would produce about ten times as much fecal material. "Why should the human product be worse?" he would ask dramatically. "Don't you know that most sea animals live in a soup of fecal material and feed on it directly?"

During the first decade of work by the Southern California Coastal Water Research Project (of which this writer is director), Isaacs was the chairman of the scientific consulting board that guided its efforts. His wise counsel in the beginning established the attitude that has continued to this day. He believed that we should try to understand the overall picture—including all sources of contaminants—against the background of changing sea conditions. The project's contribution to man's knowledge of marine food webs, toxicity, and the understanding of marine biological processes derives in part from John's intuitive suggestions.

One of his more dramatic ideas was based on the sixfold increase in the recorded incidence of tornadoes in the United States over the forty years prior to 1975. He claimed that part of the increase was caused by streams of motor vehicles moving in opposite directions on highways: these vehicles imparted angular momentum as a counterclockwise torque to the atmosphere. He suggested that the center of tornado activity had steadily moved eastward in recent decades and that there were fewer tornadoes on Saturdays when two-way truck and commuter traffic is at a minimum. Subsequent study by James Stork substantiated this forecast and showed specifically that there were, on the average, 300 less tornadoes per year on Saturdays than on other days.

Publication of this novel thesis in *Nature* created a storm of controversy at first, but after extensive exchanges Isaacs' views seem to have prevailed. His position was that shear, caused by the flow of autos and trucks, is the largest identifiable source of nonrandom cyclonic vorticity. His analysis showed that rotating storms of the dimensions of hurricanes are energy limited, whereas those of tornadoes are limited by angular momentum.

Isaacs loved Beethoven, Brahms, Tchaikovsky, Mozart, and Rimski-Korsakov—when he wrote or studied at home it was often to the accompaniment of great music. In literature his tastes remained consistent throughout his life; the Bible, Shakespeare, Omar Khayyām, Mark Twain, and Kipling were his favorites. He constantly quoted the first three, often used analogues to Mark Twain scenes (seeing himself as a latter-day Huck Finn), and traded many a quote from Kipling with me. He was very fond of writing quotes from Omar Khayyām on blackboards or reciting them to students—carefully noting which of the five editions was used.

In 1961 Isaacs became a full professor at the University of California. In 1971 he was named director of the University's statewide Institute of Marine Resources, and in 1976 he was elected president of the Foundation for Ocean Research of San Diego. He was elected to the National Academy of Sciences in 1974 and to the National Academy of Engineering in 1977. He was also a member of the World Academy of Arts and Sciences and was president of the Pacific Division of the American Association for the Advancement of Science. In addition to these affiliations, he was involved in dozens of other clubs, societies, committees, and chairmanships.

Among the posthumous tributes he received were the naming of a research vessel after him (the RV *John Isaacs*); the establishment, by the National College Sea Grant Program, of the annual John D. Isaacs Memorial Scholarship for excellence in marine science by a high school student; and the endowment of the John D. Isaacs Chair of Natural Philosophy at the University of California at San Diego.

John and Mary Carol produced four children: Ann Katherine, who is professor of modern history at the University of Pisa, Italy; Caroline Marie, a research sedimentary geologist at the U.S. Geological Survey, Menlo Park, California; Jon Berkeley, a student at the University of California at San Diego; and Kenneth Zander, a neurologist in private practice and research in Walla Walla, Washington. There are also two grandchildren: Alessandro Marcello and Jessica Ann Marie.

Only rarely do scientists leave a clear, succinct statement of their opinions about the state of science and its relation to government and education. Fortunately, John Isaacs recorded his for a plenary address to the Pacific Science Congress at Vancouver, British Columbia, in 1975. Those who remember his unique manner of expression will recognize the following excerpts from that speech as pure vintage Isaacs:

> I believe that the vast reaches of the Pacific Ocean, covering more than one-third of the planet, hold and conceal minerals, energy, food, aesthetic resources, and intellectual challenges of immense potential to the peoples of the Pacific Basin—can we but learn to discern these possibilities and intelligently approach them.
>
> I believe that there are many remarkably simple but undiscovered ways of achieving understanding of and dealing with the resources and forces of this great realm.
>
> The scientific hierarchy demands deeper penetration of nature, not broader and broader comprehension! Yet it is the development of increasing breadth and comprehension as well as penetration, that we must espouse with open-eyed, broad, undogmatic intellectual fervor, confidence and devotion if we are to understand the complexity of nature. It is increasingly clear that our crucial task is now to learn how the pieces fit together, for it is interaction on this planet, rather than its components, that form the limiting problem of mankind.
>
> Our educational system in science and technology tends to train only those faculties of the human intellect that are readily testable: memory and formal reasoning. Untaught, unevaluated and, indeed, often suppressed, since they are so challenging to teachers, are those other vast components of intellectuality: conceptualization, that allows one to conceive of complex interactions as a system; intuition, the mysterious quality

that leaps to truths through a jungle of confusing detail; the trilogy: mental adventurousness and fervor, attention to the unexpected, and curiosity, those intellectual attributes that can challenge established dogma by discerning its underlying flaws, and judgment, the equally mysterious faculty of recognizing the "likelihood" of something, a mental quality that went out of fashion a hundred years ago.

My point is, of course, that the intellectual qualities that we neither teach nor know how to teach, and hence tend to suppress, are precisely the ones essential to dealing with the complex systems of this planet, and since these qualities are suppressed in our educational system, untutored people often possess them in more highly developed form than do the educated.

I have much greater faith in simple observations and untrammeled thinking than I have in sophisticated observations and simplistic thinking! And I have much greater confidence that man's relationship to the sea and its resources will be enhanced by thoughtful and observant people closely involved and broadly acquainted with the sea—scientist and non-scientist alike—than by frantic bureaucratic responses to public hysteria or by the pontification of the scientific hierarchy.

John Isaacs spent his last few months fighting cancer. He tried to live a reasonably normal life, doing the teaching that he loved in his regular seminars at the Foundation for Ocean Research. He committed his major energies, however, to work on a book that he envisioned as presenting a total conceptualization of current multidisciplinary knowledge of the sea. It was his belief that a broad and penetrating study of the sea and man's interventions and relationships there could provide some guidance in solving the complex problems threatening man's future.

In his own words lies his theme: "It was largely the challenge of the seas that brought medieval man out of the dark ages and into the modern world. His discoveries of the oceans and continents, and his development of navigation instruments and ships, gave him new confidence in his ability to surpass the achievements of the ancients, the darkness of his times, and the inadequacies of his institutions.

"The sea again challenges our sciences and our institutions and presents again those same opportunities to guide ourselves out of the present age and into a new and future world."

On June 6, 1980, John Isaacs passed—as Mark Twain put it—"to that mysterious country from whose bourne no traveler returns."

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