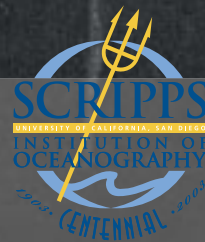




A CENTURY

By Joe Hlebica



In 2003, Scripps Institution of Oceanography will celebrate its first century of oceanographic exploration, research, and discovery. This feature is the ninth in a continuing series of articles that will present special features about the history of Scripps Institution and the science, people, ideas, and technology that have played major roles in its century of leadership.

Scripps director Harald U. Sverdrup (left) and protege Walter Munk on the occasion of Munk's graduation in 1946.

IN THE BEGINNING, in a little green laboratory in the village of La Jolla, a handful of zoology students helped sort and classify marine organisms collected from the richly diverse Pacific Ocean only a few feet away. They were the first students at what was then the Marine Biological Association of San Diego.

Today, a century later, some of the most sophisticated scientific laboratories in the world dot the La Jolla coastline, at Scripps Institution of Oceanography. Here students continue with biological studies, but they also pursue other highly intensive academic and research endeavors in a curriculum that has set the standard for ocean and earth sciences.

THE EARLY YEARS

The education of young scientists has always been an integral part of Scripps's history. University of California Professor William E. Ritter, the institution's founding director, worked tirelessly to secure funding, negotiate land deals, and "erect on this foundation a school or even a college of biological research."

To study with Ritter at Scripps, potential students had to be enrolled at the University of California, Berkeley, then seek Ritter's permission to work with him in La Jolla during the summer months as a supplement to



Justin Kulongoski

HOME: Eugene, OR

RESEARCH AT SCRIPPS Applying isotope geochemistry to the exploration of environmental systems, including groundwater resources.

GRADUATION YEAR: 2002

SCIENTIFIC ACHIEVEMENTS The design, construction, and calibration of two mass spectrometer systems in the Fluids and Volatiles Laboratory at Scripps.

FIELD: Earth Sciences

NOTABLE ACCOMPLISHMENTS Recently participated in an expedition in Indonesia to gather gas and fluid samples from active volcanoes. Spent several weeks with a team of hydrologists studying groundwater resources in the Kalahari Desert of southern Africa.

IN HIS OWN WORDS "At Scripps I've learned about the processes driving the hydrological cycle. Following graduation, I hope to employ the analytical techniques I've learned here, and plan to focus on water policy issues facing communities in semiarid regions. Ultimately, I'd like to have the opportunity to share my knowledge and become an instructor for the next generation of scientists."



Above, The early institution trained a number of women zoologists, including Myrtle Johnson (above), seated in La Jolla's Little Green Laboratory, circa 1907.

Tanya Atwater



HOME: Santa Barbara, CA

CURRENTLY Professor of Geophysics and Geology, University of California, Santa Barbara.

GRADUATION YEAR: 1972

FIELD: Oceanography

AS A SCRIPPS STUDENT In an era when women were routinely barred from going to sea, she participated in the first expedition to take a close-up look at a seafloor spreading center. This resulted in her first published paper, a lead article in the prestigious journal *Science*.

SCIENTIFIC ACHIEVEMENTS Led Scripps's first all-woman cruise, *Aphrodite*, in 1968. One of the first female scientists to contribute to the theory of plate tectonics.

NOTABLE ACCOMPLISHMENTS As a geoscience educator, helping students get to know, understand, and respect the planet. Currently experimenting with ways to use the power of electronic multimedia to enhance geologic visualization and understanding.

IN HER OWN WORDS "I think I spend half my time just talking and listening to people from many fields, searching for how it might all fit together. When something does fall into place, there is that mental explosion and the wondrous excitement. I think the human brain must love order."



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their classes at Berkeley. Ritter would assign each student a particular marine specimen to study. The student was required to collect the animal or plant from the ocean or bay, examine it under a microscope, and later draw it to demonstrate his or her understanding of its anatomy. Classroom discourse as a teaching method was rare, although students often attended the presentations that Ritter and others made to local residents.

In 1907, Edna Watson became the first student to obtain a doctoral degree in zoology based on work at the remote marine laboratory. The first student to be awarded a doctoral degree in oceanography at Scripps was Ansel B. Keys in 1930, during the tenure of the second director, Thomas Wayland Vaughan.

Vaughan added oceanographic studies to the biology curriculum and established a graduate program to help students master the complexities of the interdisciplinary field of



Left, William Ritter (standing, third from left) with colleagues and students during the 1904 summer session at the Hotel del Coronado boathouse. **Below,** Kenneth Emery, a student in marine geology, in 1938 with the "Queen Mary," which was used to transport instruments and samples to the end of the Scripps pier.



oceanography. He also formalized the admission process and developed prerequisites for the courses. There were three students at the institution at this time.

THE SVERDRUP CURRICULUM

Upon Vaughan's retirement in 1936, Norwegian scientist Harald U. Sverdrup was recruited as the

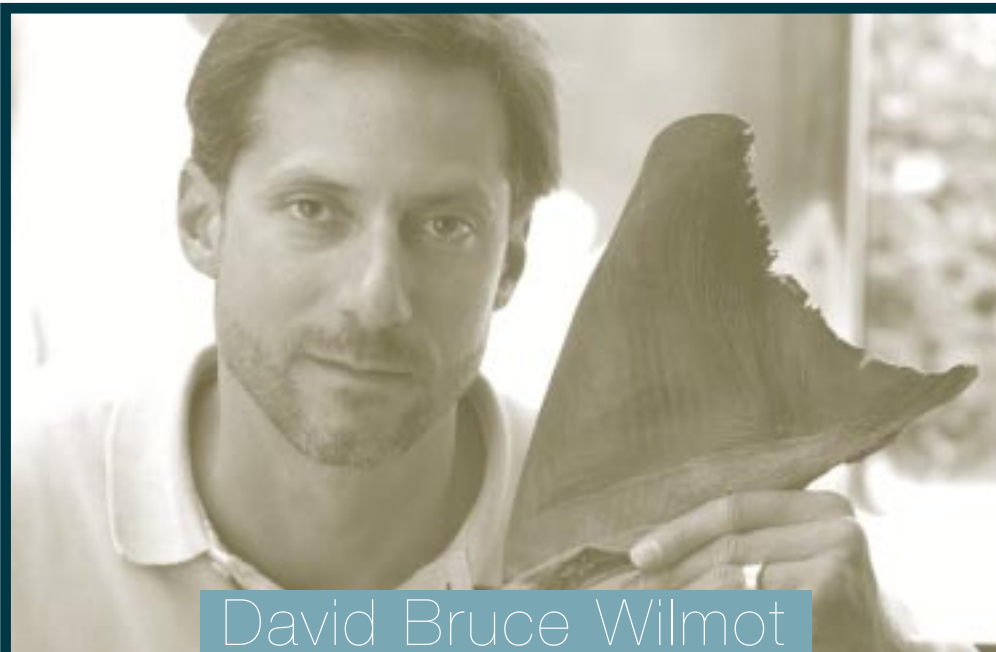


Above, Geoscientist Miriam Kastner lectures new students in the 1990s.

institution's third director. Hired for his reputation as the world's most accomplished physical oceanographer, Sverdrup recognized the shortcomings of the teaching program at Scripps. To raise the academic standards to be on par with other University of California departments, he assembled a group of faculty members to help redefine the curriculum, standardize the coursework, and develop classes.

Sverdrup required all students to complete core courses in physical oceanography, marine chemistry, biological oceanography, and marine geology before pursuing their specialized subdisciplines. This teaching format, the "Sverdrup curriculum," became the model for graduate education in oceanography at many institutions in the United States and Europe.

"Although the concept of the interrelatedness of all science was introduced by Ritter," recalled physical oceanographer and Scripps Professor Emeritus Douglas



David Bruce Wilmot

HOME: Santa Cruz, CA

GRADUATION YEAR: 1999

FIELD: Marine Biology

CURRENTLY Director, Ocean Wildlife Campaign, a coalition of six conservation organizations working to improve the conservation and management of giant ocean fish: sharks, tunas, and billfishes.

AS A SCRIPPS STUDENT Studied the symbiotic relationship between sulfur bacteria and their animal hosts. Participated in more than 20 research cruises including expeditions to hydrothermal vents and a dive in the deep-sea submersible *Alvin*. Along with fellow students Don Croll and Craig Cary, successfully instituted a ban on polystyrene foam in drinking cups at Scripps and UCSD.

SCIENTIFIC ACHIEVEMENTS Learned to integrate science and ocean policy while working for the National Research Council of the National Academy of Sciences. Testified before Congress on marine conservation issues. Worked with colleagues to achieve conservation goals for the ocean's giant fishes. Returned to Scripps to complete his doctoral degree after an extended absence.

NOTABLE ACCOMPLISHMENTS Continues to work with the Ocean Wildlife Campaign as the director to promote conservation initiatives for giant ocean fishes. Teaches his family about the wonders of the sea and the need to protect it.

IN HIS OWN WORDS "Near the end of my dissertation research, I still needed more mollusks to complete critical experiments. Time was tight, and a ship and some free labor were needed. After a couple of calls and meetings, R/V *Robert Gordon Sproul* was secured for my expedition, and several fellow students generously volunteered to help me collect animals. Less than a week after my dilemma developed, I returned to Scripps with enough specimens to complete my research. While Scripps has high expectations for achievement, I found that the professors, students, and administration provided an environment where exciting and special things happened."



Left, Marine zoologist Richard Rosenblatt conducting a student cruise as part of his course in the biology of fishes.

Below, Zoologist Betty Kampa Boden was one of the few women to earn a Ph.D. at Scripps during the 1940s.

Inman, who was one of Sverdrup's first students, "it was Sverdrup who pulled the modern discipline of oceanography together."

While developing a syllabus with Scripps chemical oceanographer Richard H. Fleming and marine biologist Martin W. Johnson for a much-needed general oceanography class, Sverdrup began compiling a comprehensive book on ocean sciences. Published in 1942, *The Oceans: Their Physics, Chemistry, and General Biology* grew to more than 1,000 pages, although originally planned to be only 400 pages.

Known as the bible of oceanography, it became an invaluable resource in marine science studies and was a major achievement for both Sverdrup and the institution. *The Oceans* was so exhaustive in its detail of the ocean environment that the U.S. Navy considered it classified information until the end of World War II.

OCEANOGRAPHY COMES OF AGE

As World War II gripped the nation, the entire institution dedicated itself to the war effort. Most of the faculty members and graduate students enlisted in the military or participated in subsurface warfare research in the laboratories at Point Loma, near Scripps. Despite the decrease in faculty and students, the campus was alive with activity. Researchers who remained at Scripps trained U.S. Navy and Army personnel in swell and surf forecasting. In turn, these military meteorologists predicted surf conditions in numerous theaters of war in Europe, the Pacific, and North Africa, thus helping to ensure the Allies's victory and demonstrating the need for trained oceanographers. Oceanography, in effect, had come of age.



Marcia McNutt

HOME: Salinas, CA

CURRENTLY President and CEO, Monterey Bay Aquarium Research Institute.

GRADUATION YEAR: 1978

AS A SCRIPPS STUDENT Studied geophysics. Attended demolition school with U.S. Navy SEALs and used this training to help researchers obtain sound-refraction data in studies of marine seismology. Sailed the "seven seas" and survived an equator-crossing initiation with hair intact. Starred in the avant-garde motorcycle movie *Women on Wheels* and succeeded in destroying the only print.

FIELD: Earth Sciences

SCIENTIFIC ACHIEVEMENTS Spent 15 years on the faculty at Massachusetts Institute of Technology. Extensively studied the history of volcanism in French Polynesia using data she collected on nearly two dozen oceanographic expeditions. Won Macelwane Award from the American Geophysical Union.

NOTABLE ACCOMPLISHMENTS Currently president of the American Geophysical Union; elected fellow of the American Academy of Arts and Sciences. Raised three daughters with husband Ian Young, a ship's captain.

IN HER OWN WORDS "Scripps in general—and the Institute for Geophysics and Planetary Physics in particular—provided a friendly and inviting environment where the excitement of discovery was infectious and expectations for achievement were lofty. Scripps professors Robert Parker and Freeman Gilbert invested their time to build in me the confidence that a college kid from the Midwest could become a real scientist."



Christina Massell

HOME: Spring, TX	RESEARCH AT SCRIPPS Mapping the seafloor to study deformation of the oceanic lithosphere near subduction zones.
GRADUATION YEAR: 2002	SCIENTIFIC ACHIEVEMENTS Spent more than 135 days at sea on ships and went down in the deep-diving submersible <i>Alvin</i> ; mapped more than 850,000 kilometers (530,000 miles) of seafloor—twice the size of the state of California.
FIELD: Earth Sciences	NOTABLE ACCOMPLISHMENTS Investigating the deep sea, venturing into the unknown, and discovering the unexpected.
	IN HER OWN WORDS "My time at Scripps has been invaluable, and my experience has reached far beyond the science I've learned in the classroom or at sea. I've interacted with researchers who have revolutionized atmosphere and ocean sciences. I've personally seen the impact that a single motivated individual can have on the world in which we live. I am looking forward to pursuing my interest in science policy and education."

Following the war, enrollment of graduate students increased substantially at Scripps. Forty-one students registered in 1947. Contributing to this growth, some of the military officers who had received wartime training at Scripps, as well as new students who were at sea during the war, came to the institution to study the emerging field of oceanography. New courses were developed, and expanded classrooms and laboratories were planned to accommodate this surge of students and increased research capabilities.

GROWING UP IN THE '60S

The 1950s were a time of unprecedented growth at Scripps, and the University of California Board of Regents considered plans for a general university campus in San Diego. Roger Revelle, Scripps's



Above, *Neuroscientist Walter Heiligenberg with students in the Scripps Neurobiology Unit, circa 1980.*

director at the time, vigorously pursued establishment of a San Diego campus for a variety of reasons.

First, some Scripps students were performing at unacceptable levels in basic science courses. He recognized that with access to physics, biology, and chemistry courses at the proposed university, Scripps students could improve their oceanographic studies at the institution. Second, Revelle conceded

that in order for Scripps to reach its full potential as both a research and graduate education institution, it had to be more closely tied to a university campus. Third, Revelle realized that making Scripps a university graduate school, as opposed to simply a teaching department, would make it easier for students to submit doctoral paperwork, which at the time was processed through UCLA.

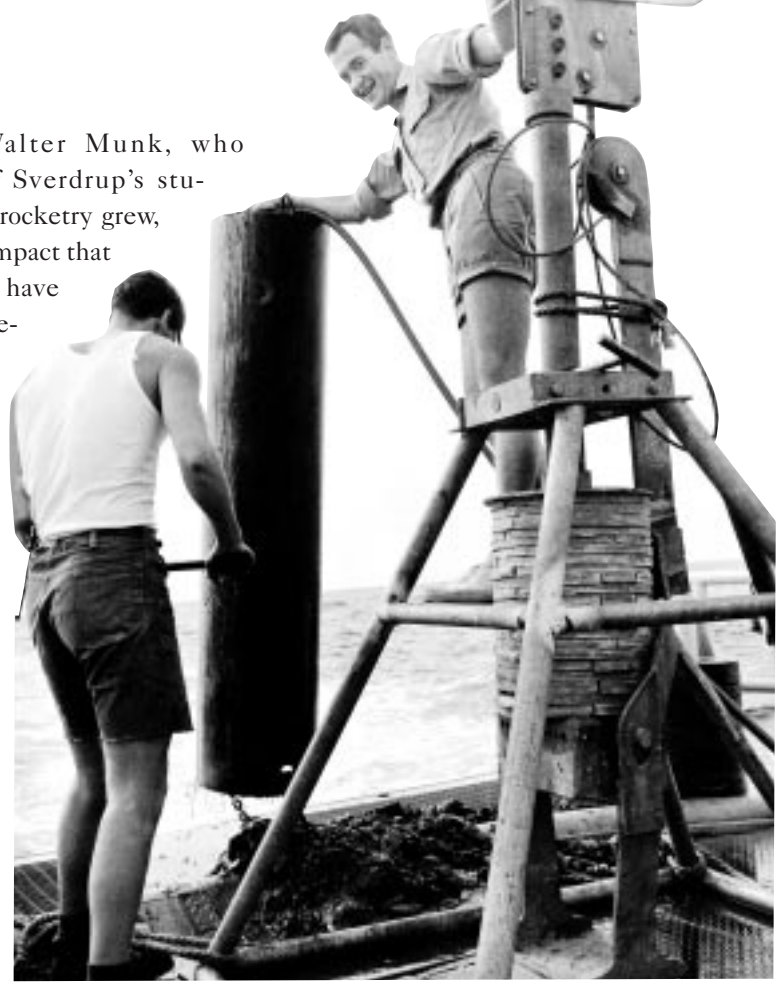
"Scripps was isolated because of its distance from UCLA," recalled marine zoologist and Scripps Professor Emeritus Richard Rosenblatt. "I don't know how much the institution would have grown, particularly in terms of biological and earth sciences, if it weren't for the establishment of UCSD."

In 1960, the regents established a San Diego campus of the University of California on the

north mesa of the Scripps property. That same year, university officials also approved creation of a La Jolla branch of the Institute of Geophysics at Scripps, later known as the Institute for Geophysics and Planetary Physics (IGPP). The establishment of IGPP was the result of the unrelenting efforts of

Scripps geophysicist Walter Munk, who had also been one of Sverdrup's students. As the study of rocketry grew, Munk recognized the impact that space exploration would have on geophysics and planetary physics and the need for a stimulating environment for graduate and post-doctoral research in these fields. He was joined in these efforts by the next director of Scripps, William A. Nierenberg.

At the end of the 1960s, earth sciences was added to the marine biology and oceanography degrees offered at Scripps. In turn, these three academic areas were orga-



Above, Alina Szmant (standing) was a Scripps member of the all-woman Tektite team of aquanauts during the early 1970s. **Top right,** During a Revelle-era student cruise in the 1960s, Wolf Berger (back turned) and a student examine seafloor dredgings.

Bonnie Becker

HOME: Roslyn, NY

GRADUATION YEAR: 2004

FIELD: Marine Biology

RESEARCH AT SCRIPPS Analyzing the trace chemistry of mussel shells, which serves as a map for the locations in which the mussels develop as microscopic larvae. This knowledge helps researchers determine parent populations and protect sources for future generations in marine reserves.

SCIENTIFIC ACHIEVEMENTS Successfully introduced laboratory-raised mussel larvae into the ocean in larval "homes." Is using the chemical signatures of these ocean-raised mussels as a reference for better scientific understanding of larvae in the wild.

NOTABLE ACCOMPLISHMENTS Working as a marine biologist for San Diego's Cabrillo National Monument at Point Loma, south of Scripps. Uses this post to make a positive contribution to marine conservation in the region. Received Bob Davey Memorial Scholarship from the Sierra Club.

IN HER OWN WORDS "What I most enjoy at Scripps is the diversity of knowledge represented here. To be effective in marine conservation, one needs to be well rounded. I hope to bring my interdisciplinary training to bear on the challenges our oceans face in the future."





Wolfgang H. Berger

HOME: Solana Beach, CA

CURRENTLY Professor of Oceanography, Scripps Institution; director, California Space Institute, University of California.

GRADUATION YEAR: 1968

FIELD: Oceanography

AS A SCRIPPS STUDENT Studied deep-sea sedimentation. Trawled deep and surface waters of the California Current for plankton. Studied foraminifera, plankton ecology, carbonate sedimentation, and their relationships to ocean circulation. Learned to be nice to marine technicians because they make things work. Adopted trademark turtle-neck to ward off colds and avoid neckties.

SCIENTIFIC ACHIEVEMENTS Scripps faculty member since 1971, focusing on paleoceanography. Received the Bigelow Medal from Woods Hole Oceanographic Institution, the Maurice Ewing Medal from the American Geophysical Union and the U.S. Navy, and the Balzan Prize from the International Balzan Foundation. Cochief scientist on two legs of the interinstitutional Ocean Drilling Program. Elected to the European Academy of Sciences.

NOTABLE ACCOMPLISHMENTS Studying theoretical relationship between tides and climate as well as tides and ocean productivity. Participating in public outreach programs at Scripps by educating the public about Earth's fragility and the need to protect the environment.

IN HIS OWN WORDS "Basically, Scripps has been my home since I arrived in 1963. I've been privileged to interact with many of the great scientists who led oceanography in the postwar era. I've participated in one of the most exciting phases of exploring the planet—that of deep-sea drilling—which converted blank areas larger than the continents into geologic maps. It has been an incredible ride."

nized as six curricular programs: biological oceanography, marine biology, marine chemistry, physical oceanography, marine geology, and geophysics. This curriculum change helped the institution meet the growing research needs of government and industry.

Despite this broadened range of research areas, students and faculty interested in the applied physics of the ocean were not supported by a curricular group. Nierenberg recognized the need for such a program and created the Applied Ocean Sciences curriculum, in cooperation with the Aerospace and Mechanical Engineering Sciences Department at UCSD. Instrument develop-

ment is an important part of this research program.

COMMITMENT TO EDUCATION

Historically, Scripps directors have concerned themselves with improving the curriculum and the education of students, only after the research needs of the institution have been addressed. However, when Edward A. Frieman assumed the directorship in 1986, he aimed to strengthen the entire institution by making education and research of equal importance. In 1995, Frieman's efforts to



Geochemistry student Ray Weiss during one of the Geosecs expeditions in the 1960s.

raise the educational bar were recognized when the National Research Council ranked Scripps first in faculty quality among all graduate oceanography programs in the United States.

Frieman also recognized that the needs of society and the envi-



John A. Knauss

HOME: Spring, TX

CURRENTLY Retired director of the National Oceanic and Atmospheric Administration.

GRADUATION YEAR: 1959

FIELD: Earth Sciences

AS A SCRIPPS STUDENT Spent a great deal of time at sea. Doctoral thesis was based on a two-ship expedition he led during the International Geophysical Year (July 1957-December 1958), making the first extensive observations of the Pacific Equatorial Undercurrent. With fellow student Art Maxwell, created the Albatross Award of the American Miscellaneous Society.

SCIENTIFIC ACHIEVEMENTS Built a wide range of marine programs at the University of Rhode Island. Instrumental in the launch of the Sea Grant College Program. Made original proposal leading to coastal-zone management legislation while a member of the Stratton Commission in 1968-69.

NOTABLE ACCOMPLISHMENTS Founding dean of the Graduate School of Oceanography, University of Rhode Island. Recently completed term as president of the American Geophysical Union. Received the Scripps Excellence in Professional Achievement Alumni Award.

IN HIS OWN WORDS

"Like nearly all of my generation, I became an oceanographer almost by chance. The field was expanding rapidly after World War II, and I was fortunate both at Scripps and at Rhode Island to be part of that growth. When I first arrived at Scripps, Roger Revelle was director and I served as his administrative assistant. Much of whatever success I have had in my career I owe to that experience."




Above, Biological oceanographer David Checkley on a student cruise in the late 1990s.

ronment were changing in the latter half of the twentieth century. As evidence of global climate change continued to mount, he created a climate sciences curriculum group, which began accepting students in the fall of 1996. There were now eight curricular groups through which a student might pursue a doctoral degree at Scripps.

As current director of Scripps, Charles F. Kennel places great importance on attracting exceptional graduate students and talented faculty members to the institution. Sixty students were admitted in the summer and fall of 2001, the single largest class in the institution's history, increasing total enrollment for the 2001–2002 academic year to 191 students.

The educational program at Scripps

continues to grow in other areas as well, including undergraduate education in the earth and environmental sciences through joint programs with UCSD departments, and increased emphasis on educational outreach to San Diego schools through the Birch Aquarium at Scripps.

As Scripps celebrates its centennial, today's young scientists carry on the spirit of scientific inquiry that brought William Ritter and his zoology students to the shores of the Pacific Ocean, the same spirit that led to some of the most significant scientific achievements in the twentieth century. 

For more information on graduate study at Scripps, visit www.siograddept.ucsd.edu.