

Volume 8, Number 2 • 1999 • Published by the Woods Hole Oceanographic Institution

WOODS HOLE

# Currents

**MIT/WHOI Joint Program**



**An Unprecedented Venture  
In Higher Education**

# WOODS HOLE *Currents*

Volume 8, Number 2 • 1999



Tom Kleindinst

Graduation Day in 1990: (left to right) Ken Melville, then Associate Professor at MIT (now Professor at Scripps Institution of Oceanography); Susan Schultz Tapscott '75 (oceanographic engineering); Mike Purdy, then WHOI Senior Scientist (now Director of the National Science Foundation's Division of Ocean Sciences); the late Athelstan Spilhaus, who invented the bathythermograph (or BT) at WHOI and later became "father" of the Sea Grant College program; Terry Joyce '72 (physical oceanography), now Chair of WHOI's Physical Oceanography Department, and George Grice, retired WHOI Associate Director of Scientific Operations.

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George Riley

The historic photos in this issue are largely from Associate Dean Jake Peirson's collection. Our thanks to the photographers, many of whom we could not identify.

#### On the cover:

The MIT/WHOI Joint Program's Class of 1990 gathers in front of Community Hall in Woods Hole: (first row, left to right) Laura Kong, Paula Coble, Peter Franks, Virginia Armbrust and Lisa Urry; (back row, left to right) John Goff, Mark McCaffrey, Richard Signell, Andrew Jessup, and Martin Dougherty. Franks holds the traditional ship's belaying pin—the Joint Program's nautical equivalent for the academic mace used in commencement processions. Photo by Tom Kleindinst



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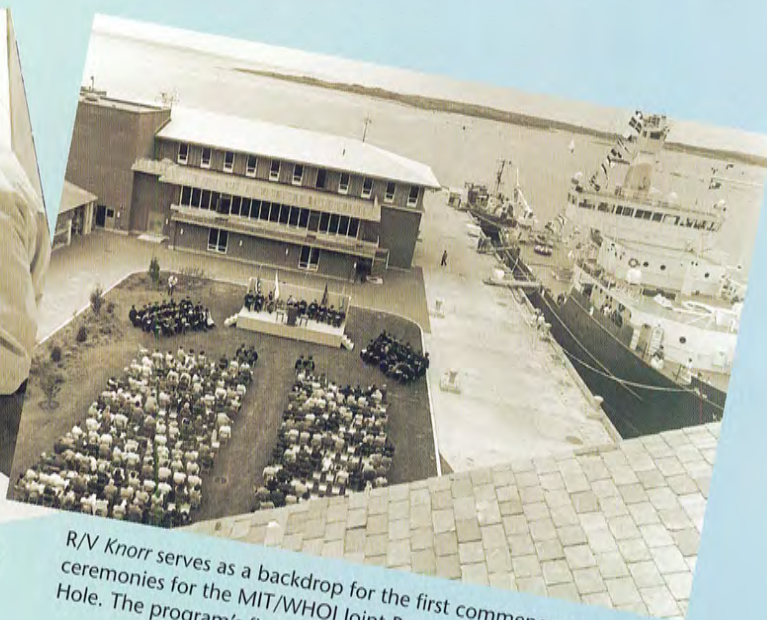
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Melinda Hall '85 (physical oceanography), now a research specialist at WHOI, works with the late Henry Stommel, renowned MIT and WHOI physical oceanographer.



R/V Knorr serves as a backdrop for the first commencement ceremonies for the MIT/WHOI Joint Program in 1970 in Woods Hole. The program's first four graduates are seated in the first row.

# Meant for Each Other

After 31 years, the MIT/WHOI Joint Program is going strong

It was 1968. On university campuses, the Beatles blared from dorm-room stereos, and VW Beetles (the original ones) infested parking lots. The times were a-changing, and they were ripe for bold initiatives.

Few initiatives are as bold as an unorthodox marriage—especially in the halls of academia. So it was a bit of a maverick master stroke when two eminent scientific institutions—the Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution—announced in 1968 that they had joined forces to create a joint program for graduate studies in oceanography.

At first blush (and even thirty years in retrospect), the union seemed made in heaven. MIT was among the foremost American centers of higher education in science and engineering, but it did not offer a full range of ocean sciences and was threatened with becoming literally and figuratively landlocked from an exciting, important and rapidly emerging field of science. WHOI, on the other hand, literally and figuratively faced the sea, launching research ships and ocean expeditions from its active port in Woods Hole. But it had no shore-based provisions for teaching fundamental science courses and spawning new generations of oceanographers to continue seagoing research.

“Woods Hole had a vast laboratory, which was the ocean,” said Howard W. Johnson, who became president of MIT in 1966. “We had the classrooms and the students who were interested in that laboratory. So the connection was natural.”

But if the idea made so much common sense, why hadn't it been done before? The primary reason was that, well, it had never been done before. It was an unprecedented venture in



Aboard R/V Chain, MIT President Howard W. Johnson (left) and WHOI Director Paul Fye sign the historic memorandum of agreement that created the MIT/WHOI Joint Program in Oceanography and Oceanographic Engineering on May 8, 1968. Witnessing the signing in the back row are (left to right): H. Burr Steinbach, WHOI Dean of Graduate Studies, MIT Provost Jerome Wiesner, and Frank Press, head of MIT's Earth Science Department and first MIT Director of the Joint Program.



Chatting, no doubt, about the taxonomy of a newly discovered species are student biological oceanographers (left to right) Cheryl Ann Butman '84, Anne McElroy '85, and Joanne Willey '88. Today they hold positions as, respectively, Senior Scientist at WHOI, Associate Professor at The University of Stony Brook's Marine Sciences Research Center, and Assistant Professor of Biology at Hofstra University.



Ken Buesseler '86 (chemical oceanography) shares his mortarboard on Commencement Day. He is an Associate Scientist at WHOI and executive scientist of the Joint Global Ocean Flux Study's Planning and Data Management Office.

higher education: Two proud, independent institutions joined themselves, as the Memorandum of Agreement between MIT and WHOI said, "in a cooperative arrangement in which each institution... will participate as an equal partner." This was no merger or acquisition, but a marriage—one that is still going strong after thirty-one years.

Like all relationships, the MIT and WHOI partnership didn't occur in a vacuum; forces brought them together. First, a thunderous scientific revolution had just occurred. Between 1966 and 1968, two decades of intense post-World War II oceanographic and geophysical research had culminated in confirmation of the plate tectonics theory, which revealed a fundamentally new framework for understanding the Earth.

Much of that research was led by pioneering geophysicist Maurice Ewing at Columbia University. Ironically, in 1948 MIT had offered Ewing a professorial position and an estate in New Bedford to launch a geophysics and oceanography program. But Columbia countered with its own offer of an estate in New York. Ewing and his fledgling group of graduate students toured both estates, put it to a vote, and decided to stay at Columbia. If they hadn't, MIT may well have turned out to be WHOI's rival, rather than its subsequent spouse. The decision also derailed MIT's ambitions in marine geo-

physics, and, as a result, MIT essentially sat on the sidelines during the plate tectonics revolution. Now it wanted to get into the game.

Heightening that desire was an impending report by the Stratton Commission—comprising academic, governmental, and business leaders, and established by Congress "to give serious and systematic attention to our marine environment and to the potential resources of the oceans."

Named after its chairman, Julius Stratton, the commission was wrapping up two years of deliberations and was poised to recommend sweeping steps "to stimulate marine exploration, science, technology and financial investment on a vastly augmented scale."

Adding urgency and political clout for ocean research was a germinating environmental movement in the country, which would blossom two years later in the first Earth Day and the creation of the US Environmental Protection Agency.

Meanwhile at WHOI, Director Paul Fye also had been keeping a keen eye on these forces and their potential effects on his Institution. Established in 1930,

WHOI originally conducted research primarily in the summer and did not put out to sea in the cold months. But World War II instantly ratcheted up operations and WHOI became an energetic, year-round research center.

**'It was perfectly obvious to (WHOI Director) Fye and others that if nothing were done, the bloodstream of fresh young minds would be diverted from WHOI, and it could become nothing more than a ship station.'**

By the mid-1960s, the field was shifting. Until then, oceanography was concentrated at a handful of institutions, such as WHOI, with the ships to support the research. Now many other institutions, including MIT, became more interested in ocean science.

"Some of us began to see that the young blood and new ideas in oceanography would come through academic institutions," recalled Arnold Arons, the last living member of a WHOI Trustees' Education Committee appointed in 1964 to review WHOI educational activities and deficiencies.

Arons knew firsthand the importance of this transfusion of youthful energy and brain power. As a young Harvard graduate student, he came down to WHOI a few months after the Japanese bombed Pearl Harbor to take part in what soon became the Underwater Explosives Research Laboratory. The group's work clarified



Commencement Day, 1980



Stephanie Pfirman '85 (marine geology and geophysics) and John Beard, summer student fellow, conduct coastal field work in the early 1980s. She is now Chair of the Earth and Environmental Sciences Department at Barnard College.

much of the then little-known physics of underwater explosion phenomena and helped test and optimize various experimental explosive compositions for the Navy's anti-submarine warfare effort.

"It was perfectly obvious to Fye and others that if nothing were done, the bloodstream of fresh young minds would be diverted from WHOI, and it could become nothing more than a ship station," Arons said.

"Fye feared that the Institution's lack of academic offerings would reduce its opportunities for growth. He also understood that WHOI was not equipped to do the work alone. We didn't have the structure and time to do introductory courses. So he began to think in terms of joint operations with academic institutions."

Fye's model for a new educational program was Rockefeller University, a graduate university that was affiliated with nearby hospitals in New York City, said Robert Morse, who joined WHOI in 1971 and served as third dean of the young MIT/WHOI Joint Program from 1973 to 1979. Just prior to that, Morse was president of Case Institute of Technology and had helped engineer a momentous, but more traditional, academic merger with Western Reserve University to create Case Western Reserve. Unlike those academic institutions, WHOI sought to gain educational advantages without giving up its independence.

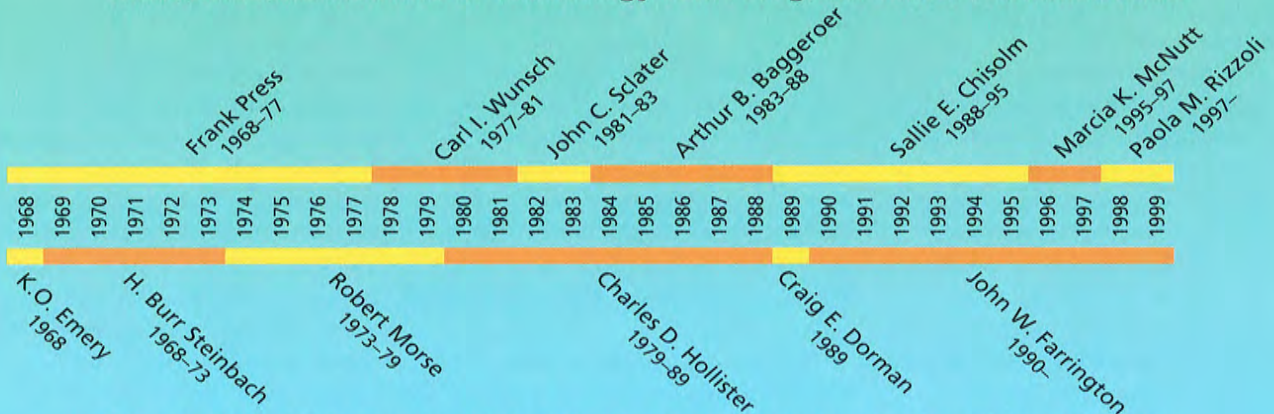
So WHOI went a-courting, first to two obvious potential partners, both 65 miles away in Cambridge. "We hoped to set up

a connection with Harvard, through biology, but they weren't interested," Arons said. "MIT was ambivalent; there was both desire and opposition."

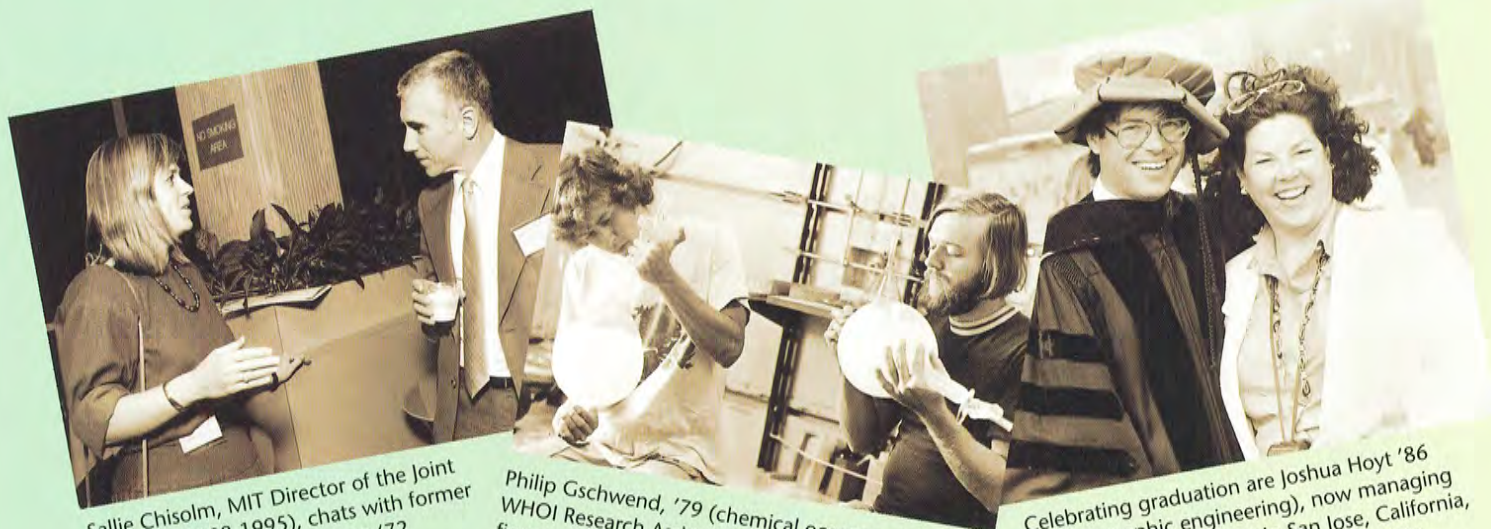
Imagine a proud and able sea captain returning to shore after years of freedom and adventure on the high seas, and then imagine an urbane, aristocratic young woman, well-ensconced in her family mansion. Now imagine these protagonists contemplating marriage. They may have had much to offer each other, but they came from such different worlds, with different rules, and they both feared having to make unsavory compromises. And then there were all the objections from the families.

"At Woods Hole, the Joint Program

### Massachusetts Institute of Technology Joint Program Senior Administration



### Woods Hole Oceanographic Institution Joint Program Senior Administration



Sallie Chisolm, MIT Director of the Joint Program (1988-1995), chats with former WHOI Director Craig Dorman '72 (physical oceanography).

Philip Gschwend, '79 (chemical oceanography) and WHOI Research Assistant Rick Borbonniere (right) figure out who will wash and who will dry aboard R/V Knorr in 1973. Gschwend is one of four students who earned their Ph.D. solely from WHOI. He is now a Professor at MIT.

Celebrating graduation are Joshua Hoyt '86 (oceanographic engineering), now managing director of ZIBA Designs in San Jose, California, and Anna Maria Peirson, wife of longtime WHOI Associate Dean and Registrar Jake Peirson and friend to many JP students.

wasn't universally accepted," said Charley Hollister, who succeeded Morse and served as WHOI dean of the Joint Program from 1979 to 1989. (Hollister died in a hiking accident Aug. 23. See page 19.) "Some of the staff had come here to get away from students," he said. They preferred to conduct their research without the burdens of teaching and advising students or the constraints imposed by academic bureaucracy, committees, and rules.

MIT faculty members had their own qualms, Morse said. For starters, the idea of *sharing* its prestigious degree with another institution was new

and not something to be entered into lightly, he said. In addition, some academic curmudgeons deemed the young science of oceanography a playground for yachtsmen or a bastard science unworthy of the same degree given to students of more classical fields like physics, biology, and chemistry. To stem the hemming and hawing and bring MIT and WHOI to the altar required the strong intervention of two visionary matchmakers.

The first was Frank Press, who had recently been lured back East from the

California Institute of Technology to head MIT's Earth Science Department. Press was a seismologist, but he earned his degree and began his career under Ewing at Columbia. In fact, he was among the cadre of graduate students who had come close to moving with Ewing to MIT in 1948. Press, who had

made several cruises aboard research ships including WHOI's *Atlantis*, knew the value of oceanographic science. He made no secret of his view "that an integrated approach to the earth sciences, including the oceans and land, was the way to proceed."

And at WHOI, Fye was rounding up support for the partnership among trustees and gathering funds from private donors to ensure that WHOI could hold up its end financially. J. Seward Johnson gave two gifts totaling \$8 million, and Mr. and Mrs. W. Van Alan Clark donated another \$5.25 million to launch the new education program.

With this dowry promised and a nuptial agreement hammered out, WHOI and MIT were formally wed on May 8, 1968, at a signing ceremony aboard

WHOI's research vessel *Chain*. The Memorandum of Agreement signed by Howard W. Johnson and Fye made patently clear that, in this marriage, the partners would maintain separate residences and checkbooks: "...each institution retains full autonomy in appointment of faculty and staff, awarding of degrees, and in all other matters involving that institution alone," the memorandum said.

At the same time, the document declared a respectful full-fledged commitment to make all decisions affecting the program "through mutual consultation" and "with the common consent of both institutions," and it established a vehicle for doing that: "a joint education committee with equal representation from each institution." Each institution contributed a co-leader. Press became the first MIT Director of the Joint Program, retaining the position over the program's first decade. K.O. Emery became the first WHOI Dean of Graduate Studies for six months until H. Burr Steinbach assumed the position from 1968 to 1973.

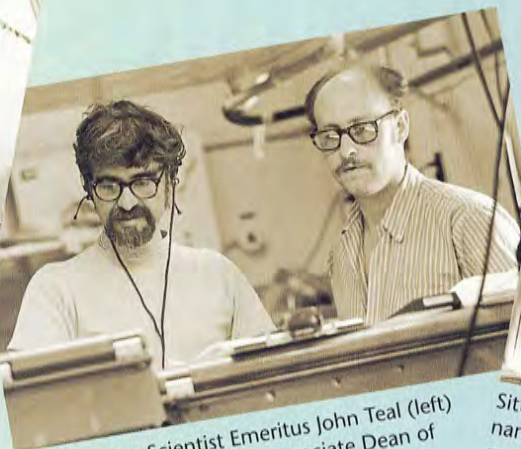
"The truly unique thing about this program is that every decision—from the time students are admitted to the time they get their degrees—is made by joint faculty committees whose members have to come to a consensus," said A. Lawrence "Jake" Peirson III, who has been associated with the program from its beginning, retiring in 1996 as WHOI

**"The Joint Program is the top graduate program—or arguably one of the two top programs—in marine science in the world. The more than 500 alumni and alumnae include many of the scientific leaders of oceanography."**

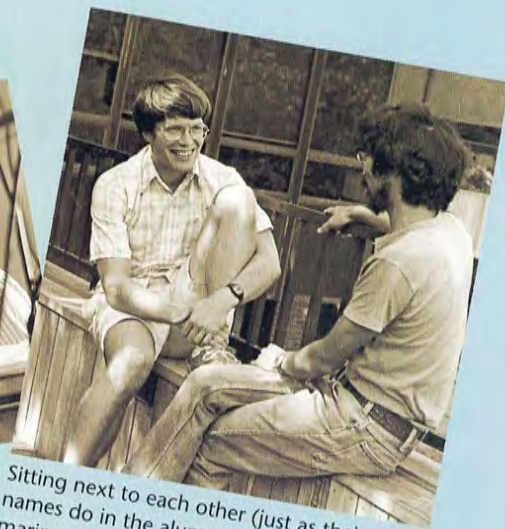
—External Review Committee, 1998



Nick Staresinic '78 (biological oceanography) is a now mariculture consultant at EcoMar Mariculture in Galveston, Texas.



WHOI Senior Scientist Emeritus John Teal (left) and John Farrington, now Associate Dean of Graduate Studies, are hard at work aboard R/V Knorr circa 1973. The two served as advisors to many JP students.



Sitting next to each other (just as their names do in the alumnae/i directory) are marine geology and geophysics students Stephen Swift '86 (left), now a Research Specialist at WHOI, and Kozo Takahashi '82, now Professor at Hokkaido Tokai University.

Associate Dean and Registrar.

Collaboratively, WHOI and MIT faculty oversee every facet of the program—including admitting students, establishing curriculum requirements, assessing academic performances, and conducting thesis defenses.

“Students have to be acceptable to both institutions and feel welcome at both institutions,” Peirson said.

**D**uring the honeymoon period, however, a large percentage of the scientific staff at WHOI didn’t exactly welcome students with open arms. They remained suspicious about having to assume teaching responsibilities and harbored resentment that the Joint Program had been imposed on them.

The endowment funds were critical. The program would never have succeeded without them, Morse said, because “they allowed us to provide fellowships to students, particularly in their first one or two years, without being burdens to research projects.”

Critics could not complain that institutional funds earmarked for them were being diverted to support students. And since teaching was voluntary, they could not complain that the program was eating up their time.

But then a curious thing happened. “Four or five years later, some of those people who criticized the program had turned around and were teaching

courses,” Peirson said.

Soon, “a lot of the people who had been unhappy retired,” said Carl Wunsch, an MIT faculty member from the beginning of the program, who succeeded Press as MIT Joint Program Director. “As WHOI hired new faculty, it used the existence of the Joint Program as a carrot.”

Today, though some WHOI scientists prefer to devote their entire time to research, many of them enthusiastically advise students and teach classes. Students permeate WHOI labs and ships. They take classes taught by faculty of both institutions, on both campuses—or sometimes presented on both campuses simultaneously via teleconferencing. A shuttle bus provides transportation between campuses, making it easier for students to take advantage of each of them.

**M**arriages, as we all know, don’t always work out. So it’s nice to find one that is thriving. “After 31 years, we have become aware that our strength lies in being joined,” said Paola Rizzoli, the current MIT Joint Program Director.

MIT and WHOI both not only got what they originally wanted out of the relationship, but they also received a bonus: “In my experience, I don’t think any other graduate oceanography program got students of such high quality,” said Morse, “and it isn’t clear that either MIT or WHOI could have gotten those students themselves.”

In 1998, an External Review Committee composed of elite scientists and educators from other institutions assessed the program and concluded:

“The Joint Program is the top graduate program—or arguably one of the two top programs—in marine science in the world. It consistently draws the most outstanding applicants from both the US and abroad, and the program has managed to recruit a consistently high fraction of those admitted. The students encountered by the Review Committee were articulate and highly motivated. The variety of areas of research and training that they represented was laudatory, as was the quality of their research. The more than 500 alumni and alumnae include many of the scientific leaders of oceanography.”

A total of 576 graduates have earned joint degrees from MIT and WHOI. (An additional four have earned Ph.D. degrees from WHOI alone.) They have flourished in academia and oceanography, but their contributions and career paths are surprisingly diverse.

On the pages that follow, and in the next issue of *Woods Hole Currents*, we invite you to meet some of the fruitful children of this innovative marriage between two proud, independent, scientifically top-notch institutions.

—Laurence Lippsett

# Doubly Blessed

## First graduate felt synergy and symbiosis of two campuses

Frank Bohlen became the MIT/WHOI Joint Program's first official graduate much the way the two institutions came together—naturally and inevitably.

Bohlen's family had a house on Fishers Island in Long Island Sound, and he spent a lot of time sailing, fishing, and working on and around the water. He was an inveterate tinkerer, the sort of boy who built go-carts and got a ham radio license. So not surprisingly, he majored in electrical engineering at Notre Dame and earned money during summers working as a deck hand on yachts. Bohlen returned from a two-year hitch in the Navy in 1962, a time when aeronautics firms were furiously hiring electrical engineers. "I had an interest in playing with rockets," he said, "and I also had an offer to teach high school."

He was pondering his options when he ran into a friend who was about to visit his brother, a WHOI technician. Bohlen went along for the ride. Amid introductions, Bohlen mentioned that he was an engineer.

"A few days later, my friend's brother said, 'Do you want to go to sea Tuesday?' Well, I had just come back from two years at sea," Bohlen said, pausing now, as he probably did then, for a just few seconds. "I said, 'Sure. Where are we going?'"

It was a quick out-and-back to the North Atlantic on R/V *Chain*, but sometimes it doesn't take a rocket scientist to figure out you don't really want to be a rocket scientist. "It was a confluence of things: love of the sea, the opportunity to be inventive, to do experiments...."

Bohlen signed on as a technician at WHOI. "I loved the work," he said. "I was never happier than at sea doing experimental work."

After a few years and several cruises, the next logical step was graduate school at MIT. But that didn't mean leaving WHOI.

"Working at WHOI was a natural outgrowth of your research at MIT because all the ships and many advisors were at WHOI," he said. "We didn't recognize any barriers between the institutions."

There were few boundaries between disciplines and approaches, too, and Bohlen found himself working with scientists who designed experiments, built



Now a full Professor at the University of Connecticut, Frank Bohlen earned his Joint Program degree in physical oceanography. His specialty is the transport of fine-grained sediments.

instruments, and synthesized data.

"The teaching staff and the technical staff at MIT and WHOI were superb," he said. "We were blessed to be able to work with a great diversity of people, working on different problems with different approaches, so there was a great deal of synergy and symbiosis."

When Bohlen finished his graduate work in 1969, he was given the choice of getting his degree from MIT or from the MIT/WHOI Joint Program, which had been officially established a few months before. He made the natural choice: "I felt I was 'joint' physically and psychologically," Bohlen joked, and he became the program's first official graduate at its first commencement ceremonies in 1970. He earned his Ph.D. degree in physical oceanography, and his specialty was the transport of fine-grained sediments.

His timing was propitious. The University of Connecticut had just established its Marine Sciences Institute and Bohlen joined the faculty. Soon after, the Environmental Protection Agency was created amid heightened concerns about water quality, especially around urbanized areas such as Long Island Sound. Every time people dredged a harbor, installed an underwater gas pipe, used waterways for disposal, or fixed a bridge, they stirred up sediments and controversy. The sedi-



Frank Bohlen (at lectern) receives the first Joint Program degree at commencement ceremonies in 1970. From left to right are WHOI Director Paul Fye, MIT President Howard Johnson, Julius Stratton (seated), chairman of a Congressional commission that in 1969 recommended sweeping steps to bolster ocean research, and WHOI Dean H. Burr Steinbach.



## MIT/WHOI Joint Program

ments clouded waterways, threatened to suffocate shellfish beds, and resuspended contaminants, such as metals, PCBs, and dioxin, which are taken in by sediments.

"In the 1970s, 15 of the 19 historical disposal areas for dredged materials in Long Island Sound were closed," Bohlen said. "Without dredging, you can't get submarines up the Thames River to the US sub base in Groton or tankers into New Haven to bring oil for home heating or electrical power generation."

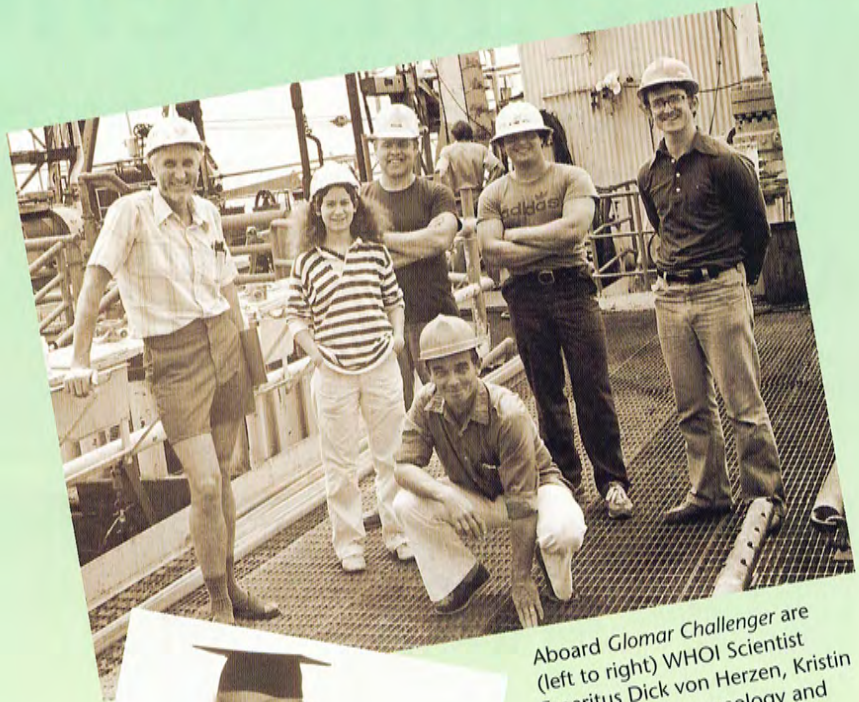
Suddenly, a seemingly esoteric subject such as fine-grained sediment transport became hugely practical. Bohlen has had no shortage of work, and all facets of his WHOI training have come in handy. He has combined field and laboratory investigations, developed instruments to collect data, and used that data to create numerical models to understand the complex processes by which sediments move into and around the water column.

While continuing to teach at UConn, now as a full Professor, he has conducted basic research and studies for a range of interested parties, including the EPA, the National Oceanic and Atmospheric Administration, and the US Army Corps of Engineers; the Iroquois Gas Transmission Co., which laid a gas pipeline across the Sound; oil companies that dispose of fine-grained muds used to lubricate their drills; and towns concerned about their local shellfish beds and beach erosion.

"These situations create a lot of tension among environmentalists, businesses, regulatory agencies, even political bodies, resulting in decisions that often are not based on the best science," Bohlen said. "Our job is to reconcile perceptions with reality, to find optimum strategies to prevent or remediate environmental problems."

He is still doing all the things he has always loved: teaching, building instruments, conducting experiments, and staying close to the sea. He still sails passionately, participating in long-distance sailing races and taking transatlantic voyages. His career path has allowed him to combine business with pleasure. Not too many sailors come into Woods Hole's Great Harbor to use the oceanographic library.

—By Laurence Lippsett



Aboard *Glomar Challenger* are (left to right) WHOI Scientist Emeritus Dick von Herzen, Kristin Rohr '83 (marine geology and geophysics), now a scientist at the Pacific Geoscience Center in British Columbia, WHOI Senior Engineer Butch Grant, WHOI Information Systems Associate Steve Gegg, and WHOI Senior Scientist Ralph Stephen. In front is retired WHOI Research Associate Earl Young.



John Farrington, WHOI Associate Director of Education and Dean of Graduate Studies, addresses the 1990 commencement participants in Woods Hole.



Getting her feet wet in a salt marsh above, Kathryn Burns '75 (biological oceanography), is now down under, working as a scientist at the Australian Institute of Marine Science.

# 'Joint' Ventures

**One builds robots to work in hazardous places.  
The other works to help industries think 'green.'**

Armed with fresh coffee from the Pie in the Sky restaurant in Woods Hole, Hagen Schempf was driving his rusty, geriatric Fiat when he was jolted one summer day in 1985. The jolt didn't come from the coffee.

"I'm about to make this turn and I see

but lived abroad for much of his childhood, always wanted to do something "à la Cousteau," something combining the oceans and engineering. But such a combination was not offered in Germany, so he enrolled in Stevens Institute of Technology in New Jersey, where he majored

do anything, to be associated with anything related with the program."

Later, Schempf worked on the remotely operated vehicle *Jason*. He developed improved control technology for the manipulator system used to pick up artifacts and samples from the ocean floor. For his dissertation research, he built and tested a novel tendon-driven design. During his tenure at WHOI, he took part in expeditions that found and explored *Titanic* and *Bismarck* in the North Atlantic and several Roman shipwrecks in the Mediterranean.

Conway-Schempf had studied natural science as an undergraduate at Trinity College in Dublin. She scuba dived a lot around the Irish coast, which focused her interest on marine organisms. After graduating in 1984, she visited the United States, went sailing on Cape Cod and came to Woods Hole. She said she felt awestruck in the presence of the "gods of the marine world." One of WHOI's ships was in, and she was thrilled by the whole scene.

"Just seeing all of the activities and the scientists carrying their tools and equipment back and forth, I was just



Since he graduated in 1990 with an oceanographic engineering degree, Hagen Schempf has developed robotic equipment to perform tasks in hazardous environments. The robot above, HOUDINI, cleans up hazardous nuclear and petrochemical storage tanks.

this woman walking," Schempf said. "OK, so she's got blond hair, but she's carrying this army bag. It's one of those things that was very well-used in Europe in the '70s and '80s. They're basically made of very strong jute, very strongly woven cloth material, even coarser than canvas. And I said, 'Ooh, she can't be from here. She can't be from the US. She's got to be foreign. I've got to find out who she is.'"

Before long, Schempf—an engineering student in the MIT/WHOI Joint Program—found out. She was Noellette Conway, a new biology student, who eventually became Noellette Conway-Schempf—adding a new dimension to the term "Joint Program." For each of them, the path to WHOI was somewhat serendipitous.

Schempf, who was born in Germany

in mechanical engineering with a specialty in ocean engineering.

When Schempf's professors urged him to go to graduate school, the Joint Program suited his interests perfectly. When he arrived at WHOI, the first research group he visited was the Deep Submergence Laboratory and he instantly wanted to get on board, though his first job wasn't very glamorous.

"I was the slave air-conditioning man," Schempf said. "That means I made and installed the air conditioners on the trailers that contained all the electronics. I was just there to



As an MIT/WHOI graduate student, Schempf (middle, white shirt) worked in the Deep Submergence Laboratory. He helped improve control technology for the manipulator system used by the deep-sea robot *Jason* to grasp samples and perform tasks on the seafloor.

absolutely amazed,” Conway-Schempf said. “I had never seen anything like the scale of research that was going on, all related to the marine world. And I really was just gulping down the air thinking, ‘Oh, maybe the guy who invented *Alvin* had inhaled one of these molecules, and now I am, too.’”

She picked up an application for the Joint Program, was accepted, and returned in 1985 with the jute bag and a wardrobe that reflected her thriving cosmopolitan Dublin, but that stood out in a small New England village.

“When I came to Woods Hole, I can honestly say I looked like some sort of a weird punk rocker, though by Irish standards I could have worked in a bank, and I was looking respectable,” she said.

Conway-Schempf initially worked in WHOI biologist Fred Grassle’s lab, an experience that allowed her to settle in gently and get to know Woods Hole’s surroundings and ways of doing things. For her thesis advisor, she selected Judy McDowell, now Associate Dean of the Joint Program, who had done a lot of research on the effects of pollution on marine organisms. The research focused on a shallow-water clam, *Solemya velum*. The clam lacks a digestive system, but it is provided with nutrients by symbiotic sulfur-oxidizing bacteria—similar to the microbes that form the base of the food chains at deep-sea vents. Conway-Schempf used the clam as a model for vent fauna.

“To study animals at deep-sea hydrothermal vents, you have to go down in a submersible and you maybe get one or two animals—three, four if you’re lucky,” she said. “And by the time you bring them up to the surface, they’re kind of a bit mushed and not quite their jolly old selves. So it’s hard to do experiments.”

The clam Conway-Schempf worked



Conway-Schempf is a faculty member of Carnegie Mellon University’s Green Design Initiative, which works with businesses to develop environmentally conscious products and manufacturing processes. She also enjoys talking about science with students, especially young women.

on lives off the northeast US coast, usually in only a few inches of water. Collecting it was very easy, she said. “You’d just look at your watch, and say, ‘It’s low tide, time to go get some organisms.’”

After the two graduated from the Joint Program in 1990, Schempf took an engineering research position at

search, but by 1992 she felt she might have better options in administration, so she enrolled in an MBA program at Carnegie Mellon. For her, the training formalized what is normally an ad-hoc process for most scientists.

“It was learning about managing, strategy, program development, and all of that stuff, which I wouldn’t have learned in a formal way as a bench scientist,” Conway-Schempf said. “If you think of it, most bench scientists eventually become administrators in charge of a lab, but they have to pick everything up by osmosis or just sort of make it up as they go along.”

Conway-Schempf’s decision to earn an MBA proved prescient. In 1992, Carnegie Mellon decided to start the Green Design Initiative (GDI), a campus-wide interdisciplinary program that works with businesses to develop environmentally conscious products and manufacturing processes. The GDI explores ways, for example, to reduce hazardous emissions, toxic materials, and inefficient energy usage and to lower costs by recycling scarce resources and using fewer raw materials. Green Design also offers educational programs for undergraduate and graduate students and for business executives.

The university had one key personnel requirement: someone with both a Ph.D. in science or engineering, who would be regarded as a peer among the faculty, and with an MBA, who could administer the program and who would be perceived by



Noellette Conway-Schempf ‘90 and fellow Joint Program graduate student Paul Snelgrove ‘93 examine the shallow-water clam, *Solemya velum*, the focus of Conway-Schempf’s research at WHOI.

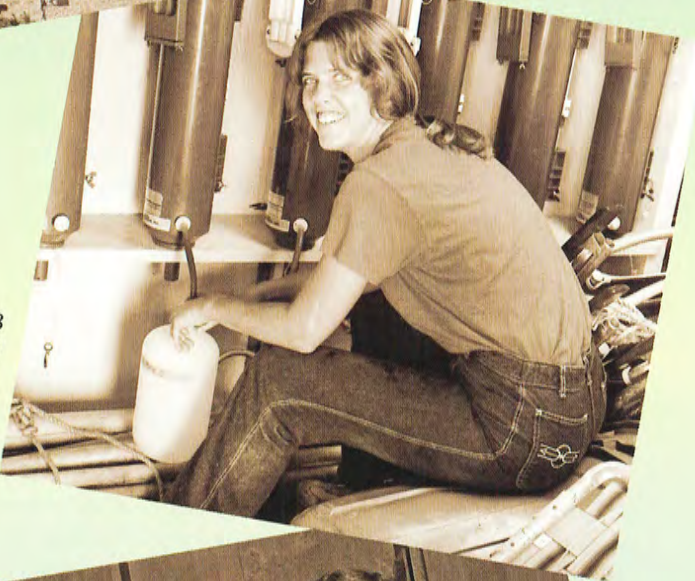
Carnegie Mellon University in Pittsburgh, and Conway-Schempf was offered a postdoc at the University of Pittsburgh, where she worked on a cancer-research project using sea urchins as models for cell development. She enjoyed the re-

# MIT/WHOI Joint Program



Graduation ceremonies, 1980

Elisabeth Gray '88  
(biological  
oceanography),  
is now a lecturer  
at Ohio State  
University.



Longtime WHOI Registrar and Associate Dean Jake Peirson (left) and Bob Morse, WHOI Dean from 1973 to 1979, helped mold the Joint Program in its early years.

## Hagen Schempf & Noellette Conway-Schempf...

the business community as a person who understood its needs.

For both Carnegie Mellon and Conway-Schempf, the fit was perfect.

She joined the GDI faculty, where, among other projects, she has developed environmental management software and strategies to recycle electric motors and old personal computers. Companies taking advantage of the GDI's expertise include Hewlett-Packard, IBM, General Motors, Hughes Electronics, Alcoa, and Union Carbide.

Meanwhile, Schempf had been invited to join Carnegie Mellon's Robotics Institute, which specializes in designing robots that perform tasks in hazardous environments. One of the institute's first products, a remotely controlled robot designed to do cleanup work at the Three Mile Island nuclear power plant, immediately solidified its reputation. Institute engineers also designed Dante, a walking robot that performs sampling and measurement activities in volcanic environments.

Since then, Schempf has developed robots for hazardous site inspections and cleanups in Department of Energy facilities, space exploration robots for NASA, robots to move materials for the horticultural industry, and reconnaissance and remotely operated systems for the military. One of his more recent projects is a robot that removes asbestos-containing insulation from pipes.

Combining their skills, Schempf and Conway-Schempf in December 1995 launched their own company, AUTOMATIKA Inc., to develop, among other things, robotic inspection and monitoring systems and parcel handling and stacking systems for clients such as Adidas and Codelco (a Chilean mining company). And somehow into that active lifestyle, now living in a Pittsburgh suburb ("minivan central," as Conway-Schempf calls it), they also keep up with their three children.

"One was good," said Schempf. "Two was a lot more work. Three is just, 'OK, we're in zone defense now. There is no more man-to-man coverage.'"

All in all, it's been an exciting joint venture.

—By David M. Lawrence

# Taking the Navy Deep

Rear Admiral Paul Sullivan spent 29 years taking US Navy sailors deep under water, out of sight and out of touch in a global military cat-and-mouse game. Then he fulfilled a new mission, one for which he was trained more than two decades ago.

In the early 1970s, the Navy sent Sullivan, a graduate of the US Naval Academy, to the MIT/WHOI Joint Program as part of an effort to “get naval officers better equipped to talk as peers with members of the scientific community.” The goals, Sullivan said, were to develop naval officers who understood ocean science, to create and maintain a mutually beneficial dialogue between the Navy and civilian scientists, and to share data and equipment when possible to advance both military and basic research goals in the oceans. He earned an engineer’s degree in ocean engineering in 1975.

The MIT/WHOI program “was a great introduction to how difficult, unpredictable—but fun—the ocean can be as a work environment,” Sullivan said. And his work at WHOI on upgrading the submersible *Alvin* gave him an “introduction to the challenging world of deep submergence.”

Over three decades, Sullivan pursued his first love, the camaraderie and challenges of submarine life, and he rose through the ranks of the Navy’s submarine fleet. By the late 1980s, he was elevated to commanding officer of *USS Birmingham* (SSN 695) and later *USS Florida* (SSBN 728).

“As the commanding officer, I was a mentor, overseeing a crew and a complex machine,” Sullivan said. “You’re out there in the middle of the ocean, without

a lot of contact with the rest of Navy, no less the world. So you have to depend on your fellow crew members as a team. As a commander, you have to rely on your ability to think through a problem.

“Teamwork is the hallmark of a good submarine crew,” he said. “To operate a submarine, you have to depend on each other.” That team approach earned Sullivan nominations for numerous

leadership and combat readiness awards.

Along the way, he also spent time in Washington, DC, earning a master’s

degree in national security strategy from National Defense University, then serving on the Joint Staff. Later, he was commander of Submarine Group Nine, supporting all Trident missile submarine crews in the Pacific.

In April 1998, Sullivan was tasked with promoting another type of teamwork—between scientists and sailors. He was appointed director of the Deep Submergence Branch, overseeing the

deeper than the submarines he once commanded, including *NR-1*, a small nuclear sub that can maneuver on the seafloor, and remotely operated vehicles (ROVs), either tethered or autonomous. The Navy has an abiding interest in understanding its extensive, exacting, and unpredictable theater of operation: the ocean. Navy deep-ocean research ranges from exploring US and foreign wrecks on the seafloor to research on the evolution and health of the planet. “There is so much history and so much knowledge of the planet lying on the bottom of the ocean,” Sullivan said.

“The deep ocean is a tough environment to work in,” he said. “We are trying to push the technology” through miniaturization, computerization, and higher-resolution sonar systems. “We are working on the cutting edge, trying to learn to do this work more economically. Any time you have humans in a sub, it gets expensive. Much of the future is on the surface—that is, with the humans on the surface, manipulating equipment thousands of feet under water.”

Sullivan’s work in Deep Submergence reconnected him with WHOI Scientist Emeritus Robert Ballard on the recent search for the *USS Yorktown*, lost off Midway Island during World War II. And it had him working occasionally with his MIT/WHOI classmate John Krieder, vice president and general manager of the Advanced Technologies

Group of Oceanering International Inc., a private company that provides technical support and deep-diving ROVs to the Navy for salvage and deep-ocean search and submarine rescue operations.

Two decades after he graduated from WHOI, Sullivan has become the consummate citizen-soldier-scientist.

—By Mike Carlowicz

**“There is so much history and so much knowledge of the planet lying on the bottom of the ocean.”**



After a distinguished career commanding Navy submarines, Rear Admiral Paul Sullivan '75 embarked on a new career in 1998 as director of the Navy's Deep Submergence Branch.

Navy’s efforts to map currents, survey ocean bathymetry, and conduct search-and-rescue missions for sailors and sunken craft. Working with other federal agencies, commercial companies, and research institutions such as WHOI, Sullivan kept the Navy equipped to work in the deep ocean.

Sullivan oversaw craft that dive miles

# Biogeochemical sleuth

## Following a trail of chemical clues through the ocean

Susan Henrichs has picked a tough puzzle to solve. She tracks organic compounds in the biggest, fiercest, most inscrutable ecosystem on Earth—the oceans. And she tries to piece together these small, sparse chemical clues to reconstruct the vast, complex, cyclical food chain that is the engine of life in the oceans.

The cycle starts with plants harnessing sunlight, carbon dioxide, nutrients, and water to produce the organic building blocks they need to grow, said Henrichs, a 1980 MIT/WHOI Joint Program graduate and now a Professor of marine science at the University of Alaska's Institute of Marine Sciences.

"The plants are consumed by animals," she said, "and when the animals are eaten or die, some organic building blocks are released to the water to be used again by plants. Bacteria and other organisms break down the organic substances, recycling them in a process similar to that which occurs when leaves and grass decompose in a compost pile. However, a small fraction of the organic substances survives and sinks to the seafloor to accumulate, layer by layer over thousands of years, in muds at the bottom."

Tracking the fate of organic substances in the ocean is a key to unraveling this complicated biogeochemical cycle and to understanding the ocean's productivity, Henrichs said. Some organic substances, produced only by specific plant or animal groups, act as "biomarkers" to track specific marine life way into the past.

"The record is imperfect, though, because bacteria are generally so effective at destroying organic matter," she said. "Only about one in a million molecules originally making up the cells of marine organisms survives to end up in sediments, and, even there,

**'It is sort of like trying to read a history book with five, or even nine, out of every ten words blacked out.'**

for millions of years, helps us to read the record better."

Henrichs is using the biomarker approach to learn why polluting hydrocarbons from petroleum remain in sedi-



Susan Henrichs '80 removes sediment samples from a box corer aboard R/V *Wecoma* in the southeast Bering Sea on one of the few sunny days of a cruise that endured storms with wind gusts up to 70 knots.

bacteria are constantly breaking down molecules and changing what we find. It is sort of like trying to read a history book with five, or even nine, out of every

ten words blacked out. Knowing more about the decomposition process, and why some organic substances escape and are preserved

ments long after they have disappeared from the water above. She also leads several programs investigating productivity in the Bering Sea and the decline of fisheries there.

Henrichs divides her time nearly evenly between research and teaching—both graduate-level courses and an introductory oceanography course for freshman and sophomore non-science majors.

"I find the latter enjoyable, though challenging, because it is difficult to interest some of these students in scientific issues," Henrichs said.

A native of Anchorage, Henrichs was exposed to the sea early on, enjoying

## MIT/WHOI Joint Program

fishing, beachcombing, and clamming along the Alaskan coast. A high school teacher had sparked an interest in ocean science, but she entered the University of Washington to study chemistry—until a fateful chemistry lab held in the basement of an older campus building.

"The ventilation was poor, it was about 110 degrees in the room, and we were using benzene, a smelly and rather toxic organic solvent, in our experiment," she said. "During that lab I decided I did not want to be an organic chemist under those conditions."

The next day she was an oceanography major, and upon graduation she traveled to the East Coast for the first time to study in the Joint Program.

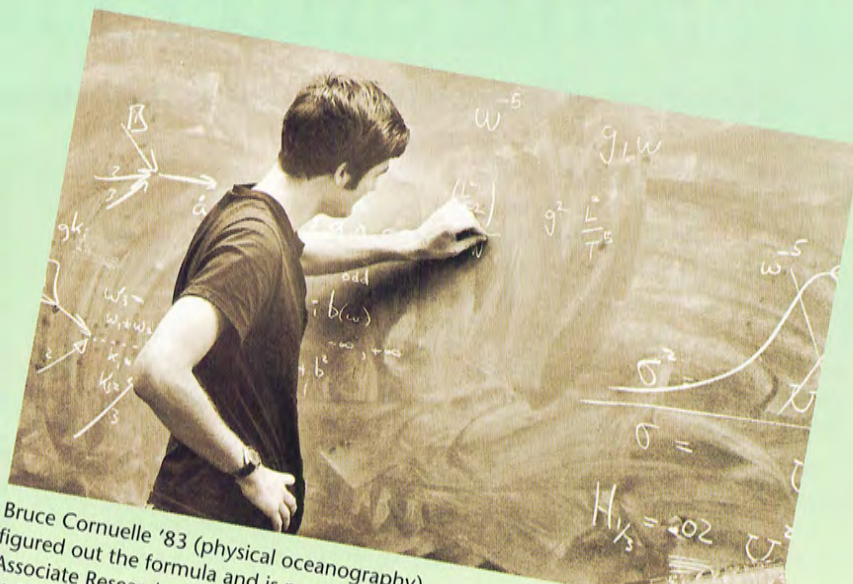
"WHOI had a very active research group in marine organic chemistry at the time," Henrichs said. "There was a huge variety of outstanding research going on." She was intellectually stimulated by WHOI scientists who spanned all academic generations—from older pioneers in the field and young professors to post-docs, visiting scientists, and even her own classmates. "There are few other oceanographic institutions where you could go to a seminar given by a leading researcher, either local or visiting, several times per week," she said.

The Joint Program requirement that students develop their own research "was a great experience and excellent preparation for the real world," she said. She received support all down the line—from her advisor, John Farrington, who "helped a great deal with both the broad aspects of research design and data interpretation and the practical aspects of getting supplies, ship time, and other resources," from Assistant Scientist Cindy Lee, and from "an excellent technical staff, who made it easy to do a lot of things in the lab that are very difficult, I found later, without such support."

After the Joint Program and a postdoc at Scripps Institution of Oceanography in California, Henrichs returned home to Alaska, completing a cycle reminiscent of the one she has been studying.

"Most days I enjoy my work," she said, "especially the fun of finding a piece in the larger puzzles I am trying to solve, or explaining something difficult to students, so that they finally understand."

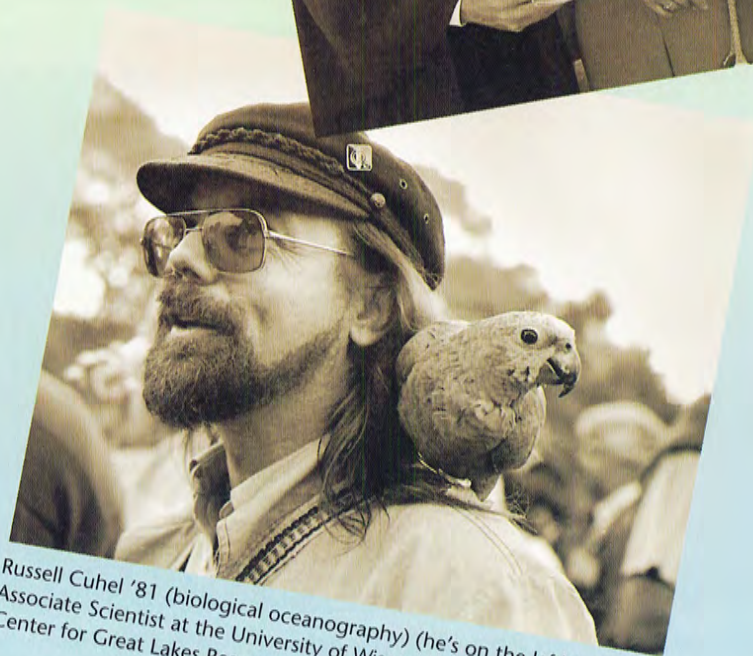
—By David M. Lawrence



Bruce Cornuelle '83 (physical oceanography) figured out the formula and is now an Associate Research Oceanographer at Scripps Institution of Oceanography.



Ken Green '80 (marine geology and geophysics) shows off his diploma. He currently works at Exxon Production Research Company in Houston.



Russell Cuhel '81 (biological oceanography) (he's on the left) is an Associate Scientist at the University of Wisconsin's Center for Great Lakes Research.

# Safe and Effective

## Making sure common household products won't harm the environment

People wash and clean their homes every day in every community in the world. The commercial products they use in these ubiquitous domestic activities contain a wide variety of chemicals that go down drains, into sewers or septic tanks, and then can find their way into the natural environment. From her laboratory at Procter & Gamble's Sharon Woods Technical Center in Cincinnati, Pamela J. Kloepper-Sams keeps a vigilant eye on the fate and the effects of chemicals in her company's laundry and cleaning products, assessing their potential toxicity to animals and plants.

Kloepper-Sams, who received her doctorate in biological oceanography in 1989 from the MIT/WHOI Joint Program, heads an interdisciplinary team of scientists responsible for worldwide environmental safety for Procter & Gamble's Fabric and Home Care Division. Known for its name-brand personal care and household products, the company does business in more than 140 countries.

Chemicals in these products could get into the environment easily and in large amounts, Kloepper-Sams pointed out. "After consumers use it, what happens to

a substance? How can we make sure that the typical form of disposal is proper for the product? How can we improve the product?"

Her team develops methods for assessing environmental risks of products, ensuring their safety and regulatory compliance. "If a product has an (environmental) issue, we have to catch it early," she said.

**'If a product has an (environmental) issue, we have to catch it early.'**

Kloepper-Sams first developed a passion for marine biology after a fourth-grade project on living under the ocean. As an undergraduate biology major at the University of California, Irvine, she was exposed to the new molecular approaches that were emerging in biology during the 1970s. She spent her junior and senior years at the University of Göttingen in Germany, where she learned genetic techniques as a research assistant at the Max Planck Institute for Experimental Medicine and where she met Henning Kloepper, a German undergraduate majoring in literature and history. They married in 1981.



Today, Kloepper-Sams heads a team of scientists responsible for worldwide environmental safety for Procter & Gamble products. Wearing her favorite sweatshirt, she enjoys a day in the park with her children, Brian and Sarah.

But her interest in the marine environment steered her toward oceanography, and the couple came to the US in 1983 when Kloepper-Sams began graduate school at WHOI. Her interest in understanding how genes work led her to work with John Stegeman in the Biology Department. Stegeman and his students were studying how marine animals responded at the molecular level to pollutants in the ocean.

Research in Stegeman's lab focuses on a group of enzymes found in fish that break down foreign chemicals and transform them into other substances. They are members of a family of proteins called cytochrome P-450, so named because they absorb light at a peak wavelength of 450 nanometers. Because certain contaminants induce production of these enzymes, this process serves as a "biomarker," an explicit indicator that the fish have been exposed to these foreign substances.

Kloepper-Sams conducted her thesis research on the molecular processes that



Pamela Kloepper-Sams '89 collects fish samples for her research as a Joint Program student in the late 1980s.



## MIT/WHOI Joint Program

regulate cytochrome P-450E (now known as P-4501A) induction in *Fundulus*, an estuarine fish. She helped develop methods for using antibodies to detect amounts of proteins present, and she conducted the first studies of the rates at which the genes that trigger protein production are turned on and off, Stegeman said.

"We faculty learn an enormous amount from the JP students, and their energy keeps us going," he added. "She certainly made a lasting contribution to this lab, and the work we do today still is influenced by what Pam learned 'at the bench' here. She was unusually good in helping others and no doubt still is."

The first of Kloepper-Sams's two children was born in 1989, the year she received her doctorate. While she was nursing, she recalled, she saw an ad for a job as a scientist at Procter & Gamble that offered an opportunity to establish an environmental biomarker laboratory. She turned down a university post-doctoral position to go into industry.

Her first major project at Procter & Gamble was a multidisciplinary suite of measurements to assess the impact of effluent from a pulp mill in northern Canada on fish communities in receiving waters. These included studies of P-450 induction, hormone levels and chemical residues in fish, and fish population fecundity and dynamics. Following that work, she transferred to Brussels, Belgium, to address environmental issues for P&G's European businesses. She was promoted to her present position in 1996, and management rather than research takes up most of her time now.

Kloepper-Sams is building a collaborative group of researchers who have a mixture of backgrounds in environmental sciences and whose work is applied directly to the development of new products. "We catch problems and assist in designing new molecules from the perspective of environmental safety," she said. "The opportunity to work with global colleagues to develop better methods to predict and assess the environmental fate and effects of chemicals is especially rewarding. It's a different type of influence—making sure that a major company, which sets standards for other companies, does it right."

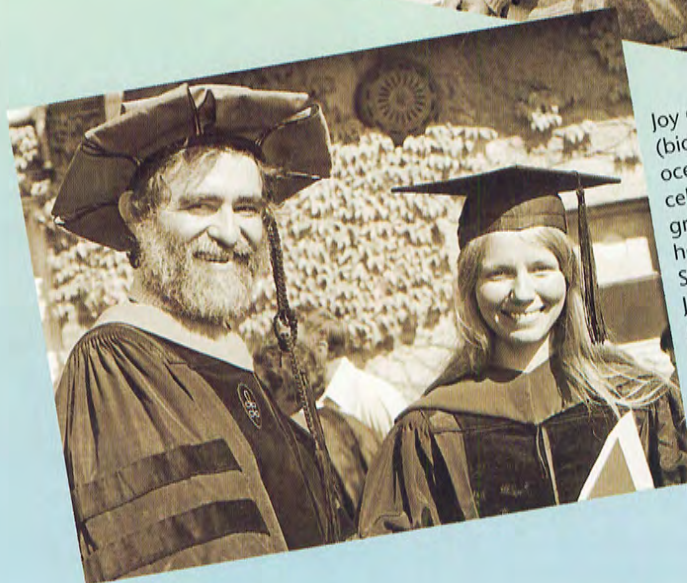
—By Margaret C. Bowles



At dedication ceremonies for the opening of the Student Center in Clark South in 1990, Sarah Green '92 (chemical oceanography) (in the foreground, left) chats with Martha Tarafa, then Executive Assistant to Bob Gagosian. Green is now an Assistant Professor at Michigan Technological University.



Ray Schmitt (left) and John Toole '80 (physical oceanography) are now both Senior Scientists at WHOI.



Joy Geiselman '80 (biological oceanography) celebrates her graduation with her advisor, WHOI Scientist Emeritus John Teal. She is now Assistant Director of the US Geological Survey's Alaska Biological Science Center.



## New Senior Scientist Chair Honors Bob Morse

**B**ob Morse had already left a legacy at WHOI. As the third dean of the MIT/WHOI Joint Program, he guided the nascent program through a period of significant growth between 1973 and 1979. Now he leaves another: The Robert W. Morse Senior Scientist Chair at WHOI has been established in his honor with funds from the Frederick Gardner Cottrell Foundation in Tucson, Arizona.

The permanently endowed chair will be awarded to a scientist for extraordinary accomplishments in marine scientific research and education. Funds for the chair provide an invaluable boost for its recipient to work on projects for which traditional grant support is unlikely or to explore new ideas or research directions inspired by the availability of new technology.

Morse came to WHOI in 1971, culminating a distinguished career as a physicist and educator. Following his graduation from Bowdoin College in 1943, he was a naval officer until 1946. He earned his Ph.D. in physics from Brown University, where he held several faculty positions between 1949 and 1966, including Professor of Physics, Physics Department Chair, and Dean of the College. His research interests included underwater acoustics, low-temperature and solid-state physics, and science policy.

He was named Assistant Secretary of the Navy for Research and Development in 1964, serving until 1966, when he was named President of Case Institute of Technology in Cleveland, Ohio. A year later, Case merged with Western Reserve University and he became President of Case Western Reserve University until 1971, when he became Director of Research at WHOI. He served as Associate Director and Dean of Graduate Studies from 1973 to 1979, and as Director of

Marine Policy and Ocean Management for several years. He retired from WHOI in June 1983 and was named Scientist Emeritus. He lives in North Falmouth.

Morse also served for many years as a



WHOI Scientist Emeritus Bob Morse (left) congratulates Hal Caswell, first holder of the newly established Robert W. Morse Senior Scientist Chair at WHOI.

director of Research Corporation, an organization originally endowed by the Cottrell Foundation that awards research grants to individuals and nonprofit institutions. He was also a founding Director

of the new Research Corporation Technologies, an independent technology management company that supports commercial development of innovations from universities and research institutions worldwide through seed investments, partnerships and management, licensing, and other services.

"Research Corporation Technologies wanted to make an award through the Cottrell Foundation to a research institution or university in my honor, and I chose WHOI," Morse said. "It is a very special institution with a unique obligation to promote ocean sciences research for this country. WHOI is a can-do organization with solid accomplishments, where the staff works extremely hard to get a lot done with the resources at hand, and it uses its funding resources wisely. I'm flattered at this honor and very pleased WHOI scientists will benefit from it for years to come."

Hal Caswell, a leading mathematical ecologist at WHOI who has developed widely used modeling techniques to study population dynamics, was named the first holder of the Morse Chair.



US Secretary of the Navy Richard Danzig (left) visits WHOI in the spring, touring facilities and receiving reports from WHOI scientists. Above, WHOI Principal Engineer Al Bradley briefs the secretary on ABE, the Autonomous Benthic Explorer developed by WHOI.



# Charles Davis Hollister

## *A life as big as all outdoors*

**F**riends and colleagues called him “the cowboy oceanographer”—not simply because his ways were sometimes unorthodox, but because his passion, energy, daring, and vision—even his smile—seemed to be as big as the ranch he grew up on, the seafloor that he explored, and the mountains that he climbed.

Charles Davis Hollister, Senior Scientist at WHOI, former Dean of the MIT/WHOI Joint Graduate Program, and Vice President of the Corporation, died Aug. 23 in a hiking accident while on vacation with his family in Wyoming. He was 63.

“Charley had a love for life and enjoyed it to the fullest,” WHOI Director Bob Gagosian said of his longtime colleague and close friend. “He was not afraid to take risks in whatever he pursued, knowing the rewards success would bring and the lessons failure would teach.

“As a scientist he pioneered the field of deep-sea sediment dynamics and challenged our thinking about the role of the oceans in the management of hazardous wastes,” Gagosian continued. “As Dean of the Graduate Program for a decade he inspired a generation of students to enjoy research and exploration—hopefully half as much as he did.

In recent years as Vice President of the Corporation, Charley was intent on helping us raise funds to secure the future of Woods Hole Oceanographic Institution, and he opened many doors we would never have found. His good nature, love of people, passion for life, and dedication to this Institution and to the entire field of oceanography will be deeply missed.”

Hollister grew up on his family’s ranch in Santa Barbara, California, which once covered 40,000 acres and was one of the largest cattle ranches in the state, and never lost his love for the outdoors. He was an avid horseman, hunter, fly fisherman, and skier.

He received his B.S. degree from Oregon State University and his Ph.D. degree in geology in 1967 from Columbia University. His advisor was the pioneering seafloor explorer and mapper Bruce Heezen, with whom Hollister wrote *The Face of the Deep*. Published in 1971, it was the first illustrated natural history of a seafloor that until then was “virgin and unseen” and “existed mostly in the imagination,” as they wrote.

Joining WHOI in 1967, Hollister continued his lifelong interest in the deep. He was among the first oceanographers to document that large areas of the seafloor—long thought to be tranquil—are swept by strong currents, or benthic storms. At the same time, he found that many areas beneath the seafloor were well-suited for

disposing hazardous waste, and he launched an uphill effort to promote this as a viable and safe alternative. He also helped develop a giant piston coring system, dubbed “Super Straw,” that pushed the boundaries of seafloor sampling and took a 100-foot-long core, containing the longest continuous record, 65 million years, of ocean basin history. Over his career, he sailed on some 27 research cruises, 21 as chief scientist, and spent months doing research aboard nuclear submarines in several oceans.

Hollister’s explorations took him to the heights as well as the depths. In his youth, he climbed Mount Rainier, the Cascades, and the Sierras, and in 1962 he participated in the first ascent of the southeast side of Mount McKinley—a month-long expedition that was featured in *Look* magazine and *The New York Times*. He was a member of a mountaineering expedition that made the first ascents of Antarctica’s highest mountains, including its highest peak, Vinson Massif. The team earned the John Oliver La Gorce Medal from the National Geographic Society. Later, he climbed peaks in Europe and Asia, including the Himalayas, and served as President of the American Alpine Club.

“Ocean research is a lot like climbing a new route to the top of a mountain,” he once said. “Every time you go out to sea there’s something new. I enjoy that aspect of both—the unpredictability of the mountains and the bottom of the sea. Besides, neither place is very crowded.”

## Two Memorial Funds Created to Honor Hollister

WHOI has established two endowed funds in memory of Charley Hollister, Senior Scientist, Dean Emeritus, and Vice President of the WHOI Corporation.

With a generous \$1 million gift, Honorary Trustee Gratia R. Montgomery launched the Charles D. Hollister Endowed Fund for Support of Innovative Research. It will provide significant grants to tenured scientific staff to broaden and deepen ongoing research, to stimulate interchange with other academic areas, to provide leadership for new national or international programs, or to pursue new research directions.

“Charley felt very strongly about providing research funds for innovative and risky ventures, which the federal govern-

ment was too conservative to support,” said WHOI Director Bob Gagosian. “This will be a wonderful tribute to his dream.”

The Charles D. Hollister Graduate Student Fellowship Fund will support students entering the MIT/WHOI Joint Program. It will give them flexibility to complete required course work and to choose thesis topics—before having to commit significant time to work on grants and contracts with advisors.

“Charley was Dean for ten years and just loved to watch students grow and become first-rate oceanographers,” Gagosian said.

For more information about these funds, please call Jane Neumann at (508) 289-4895.



George Riley

Boston Museum of Science visitors enjoy the lobby promotion for "Extreme Deep."



## WHOI Collaborates on Museum Exhibit

A new museum exhibit on the deep sea—highlighting many of Woods Hole Oceanographic Institution's discoveries and exploration vehicles—made its national debut Sept. 9 at the Museum of Science in Boston. The exhibit—"Extreme Deep: Mission to the Abyss"—is scheduled to travel to science centers and museums nationwide over the next five years.

The exhibit introduces visitors to the

tools and technology used to explore the deep sea, including WHOI's three-person submersible *Alvin*, its remotely operated vehicle *Jason*, and its Autonomous Benthic Explorer *ABE*.

"Extreme Deep" also examines explorations of shipwrecks, as well as life in the depths—starting with spectacular images of beautiful, ethereal jellies that inhabit the water column and culminating in a life-size, three-dimensional replica of the exotic life that dwells around seafloor hydrothermal vents.

"Extreme Deep" was developed by BBH Exhibits Inc., of San Antonio, in collaboration with WHOI. It is sponsored nationally by John Hancock Financial Services and the Discovery Channel, and locally by Benthos Inc., a Falmouth

maker of oceanographic equipment.

"This exhibit is a wonderful opportunity for WHOI to share the excitement of exploration and the importance of the oceans to our future," said WHOI Director Bob Gagosian. "As a world-class center for oceanographic and engineering research, we are proud to show some of the technology we have developed and the science we undertake to understand how our planet works. The deep sea is largely unexplored, and much remains to be discovered. We hope young people will share our enthusiasm for exploration and take a new interest in learning about the oceans."

The exhibit will remain in Boston through Jan. 7, 2000, when it moves on to the Children's Museum of Indianapolis.



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