



# Coastwatch

UNC SEA GRANT ▪ MARCH 1991

## Who Will Be Tomorrow's Scientists?



# Fewer Choose Science Women and Minorities to Give Science

By Carla B. Burgess

Where would the world be without scientists?

Without someone to lead us in discovery, we'd probably still be rubbing sticks together to make fire and dying from smallpox and polio. We would never have set foot on the moon or sunk to the depths of the ocean floor.

From Isaac Newton to Marie Curie to Albert Einstein, scientists have forged discoveries that saved lives, increased our comfort and broadened our concept of the universe.

Although these heroes of discovery are applauded and admired, fewer people are choosing to dedicate their lives to research. The feet to fill the scientific shoes of tomorrow are running in other career directions at a time when we need them most.

The National Science Foundation predicts a shortfall of 675,000 scientists and engineers in the United States by 2006. Not only will there be fewer researchers in the field, but fewer Ph.D.s to lecture in college classrooms.

When it comes to tackling the major scientific problems looming on the horizon—global warming, restoring rain forests, salvaging water quality, restoring fish stocks—scientists may be in short supply.

Sea Grant invests in our scientific future by awarding graduate fellowships, internships and opportunities to study under the guidance of researchers doing Sea Grant work. But these efforts may be a drop in the proverbial scientific bucket.

The forecast for tomorrow includes a retirement wave among aging scientists and university professors, potentially magnifying the deficit of researchers.

To fill the void, educators and employ-

ers are looking to women and minorities, who have traditionally not pursued careers in biology, oceanography, biotechnology and engineering.

By the end of this century, 85 percent of people entering the job market will be minorities and women.

Demographics suggest that the American population over the next several decades will include a higher proportion of blacks, Hispanics, women and other minorities. In North Carolina, minorities already represent 25 percent of the population.

"A percentage of them need to be represented in the sciences. And we can't improve in the future if they aren't even in the field now," says Sea Grant marine education specialist Lundie Spence.

Over the past 20 years, women's participation in science and engineering has increased so that they now earn 45 percent of the bachelor's degrees and 30 percent of the Ph.D.s in those fields.

But this slow rise has offset a decline in male participation. Also, the number of female science majors has not increased proportionately with the increase of women going to college.

A federal report concludes that this slowdown is happening because women continue to experience higher unemployment, lower pay and fewer promotion opportunities than their male counterparts.

The situation for blacks is even bleaker. They represent 11 percent of the working-age population, but earn only 1 percent of all doctoral degrees in natural sciences and engineering.

Many people are starting to recognize this untapped pool of talent. There are several programs aimed at attracting

these groups.

But saving science will require more than just recruiting people into a program. Students need to be kept there and nurtured until they're placed in a science career.

"Any program to bring in minorities and women has got to be considered a long-term one," says Spence.

That's called "sustainable education," says Walter "Skip" Bollenbacher, a University of North Carolina professor who has developed a model outreach program for the advancement of minorities in science. (See story, page 5)

"There's a problem with the way we're trying to solve problems with science education," says Bollenbacher. "As a society, we always go for the quick fix."

The tendency of social programs to throw money at a problem is temporarily effective at best. "Some people feel they need a more immediate return to their investment," he says.

Bollenbacher's program deals with students and teachers at the high school and college levels. It's an ongoing program to "energize" science education and attract minorities to science careers.

Here are some other programs going on in North Carolina:

**The Duke Young Scholars Program**—Selected female, middle-school students spend five weeks in a summer enrichment program at the Duke University Marine Lab in Beaufort, collecting specimens and doing research.

"This is definitely the time to start encouraging minorities and women to go into science," says Joan Barber, the program's co-director.

Barber, who did full-time research in renal physiology before accepting her

# Careers: Encouraged a Chance

current position, says some young girls she meets think a career in science is so far out of reach.

"Their tone is always as if there's something magical about it," she says.

**The Sloan-North Carolina School of Science and Mathematics Initiative**—Sloan is an ongoing two-year program that targets five rural counties in North Carolina.

The 120 participants are blacks and American Indians who are exposed to enrichment programs and school-based mentor programs, says Joan Barber, who is also the Sloan project director and deputy director of student life at NCSSM.

"I call it raising their horizons," she says of the program's goals. "We give them knowledge about what's available to them and start them off at an early enough age to get them on track."

Ideally, the program will create a pool of NCSSM hopefuls, she says.

**Math-Science Education Network Pre-college Program**—This statewide program tracks minorities and women from sixth through 12th grade in an effort to steer them toward careers in math and science, says North Carolina State University campus coordinator Carolyn Collier.

The program received seed money from Sea Grant for some of its preliminary conferences.

The program includes Saturday classes, a summer scholars curriculum and role-model interaction. About 200 Wake County students are enrolled.

Participants learn math, science and communication skills and an emphasis is placed on cultural awareness.

"We're dealing with developing the whole child," says Collier. ■



Photo by Steve Murray

*If Skip Bollenbacher had a grant to do it, he'd start reforming science education as early as kindergarten.*

*Because to attract anyone—black or white, male or female—to science, there needs to be a change in the way we teach it from day one, says the UNC biology professor.*

*"We have succeeded in eroding the intrinsic interest children have in science," he says. "You grow up loving worms, playing in ponds."*

*But soon the memorize-regurgitate syndrome of learning starts. And by the time most students are in the 10th grade, they're sick of it all, he says.*

*"They need less facts and more meaning," Bollenbacher says. "Students need to be taught at a conceptual level."*

*The universal complaint from young students—"Why do I need to know this?"—is finally being heard loud and clear throughout classrooms.*

*A five-year-old needs to learn science—*

*or any other subject—as it relates to him or her, says Bollenbacher. "We have to train teachers to make things interesting and relevant," he says.*

*"This is one of the new trends in science education—the idea of relevance," says Sea Grant marine education specialist Lundie Spence. "In a 10th grade science class, students may learn 3,000 new words that are never used again."*

*A program funded by the National Science Foundation is aiming to change the way science is taught in the middle-grades, she says.*

*"They're trying to get away from the layer-cake science curriculum," says Spence, explaining that schools have a tendency to serve up physics, biology, chemistry and geology with no regard to how they relate.*

*"The goal is to integrate science from a very applied, personal level," she says.*

*Students need to be scientifically literate, whether they plan to become scientists or not.*

*"The question we're concerned with is—Who can be a good citizen, who can understand science?—whether it has to do with health insurance, wetlands protection or new technology," Spence says.*

*But reform will take time, and the solutions are never a sure thing.*

*"And for all of the experts and educational leaders, it won't work without mothers and fathers taking an interest in their children's education," Spence says. "It doesn't matter what the schools do if there's no support at home." ■*



Lundie Spence

Photo by Allen Weis

# Succeeding in a Man's World

By C.R. Edgerton

A scientist is a frizzy-haired caucasian man in a bleached lab coat hovering over a beaker of bubbling liquid, right?

Wrong, except that most working scientists are caucasian men.

In the last decade, women have made great strides in banking, construction and dozens of other vocations formerly dominated by males.

Not so in research science, where only a few women have broken into the ranks. Some folks are wondering why.

Sea Grant researchers Celia Bonaventura and JoAnn Burkholder have some answers based on their own personal pursuits of science.

"The idea is that females are not encouraged to take risks in our society," says Bonaventura of the Duke University Marine Lab in Beaufort. "And only if a person is willing to take risks can they advance new things and be on the forefront of new ideas."

Both Bonaventura and Burkholder, a botanist at North Carolina State University, are respected scientists. As Sea Grant researchers, they have made important contributions to our knowledge of the marine ecosystem. Along the way, they've encountered barriers because they are female.

For Burkholder, the pressure started at home.

"My mom tried to get me to be a secretary," she says. "But I knew what I wanted to do. When I was 15, I read an article about the nuisance algae that was threatening the Great Lakes. My interest was aroused, and I never looked back. I really wanted to make a difference."

Her father became her mentor. He taught her that being a woman should not stop her from doing what she wanted to do.

"My father is part Indian," she says. "He had a great reverence for the woods and for conservation. I remember him showing me bluebirds when I was four and helping me build a butterfly collection when I was five. Through him, I

developed that same reverence for the outdoors and that has guided me ever since."

But from her first job in science as a junior in college, the fulfillment of her career goals has not been simple.

Her first important research position was "extremely difficult," Burkholder says. "I was harassed by my male counterparts in a lab. I had to ignore it and go with the flow."

But sometimes she would lash out at men who exhibited what she calls a "knee-jerk reaction" to a woman in a research position.

"That was not good for me professionally," she says. "Now I'm trying to be more professional, gentler. I will let them know that it's not the kind of

But her father-in-law's influence alone didn't bring Bonaventura into the scientific limelight. Like Burkholder, she encountered those who believed only men could be scientists.

She says she "never did press the point of being female" to her male counterparts. Instead, she let her work speak for her.

"When people saw I wasn't going to be confrontive, there weren't any problems," she says. "I believed that the negative repercussions of being defensive was not a good way to proceed."

"I counted on my ability to make the science clear in every grant proposal I wrote," she says. "I was not offensive or defensive. I just presented my ideas and insights as science. It worked, and I succeeded."



Celia Bonaventura

thing I will accept, and then I'll go on with my work, which is the most important thing."

Bonaventura's major role model and mentor was her husband's father, an Italian physician who immigrated to America in the 1930s to flee the political repression of Benito Mussolini.

"He was a political rebel with a conviction that individuals do make a difference, whether they're male or female," Bonaventura says. "I was a junior in high school when I first met him, and he influenced me a great deal."

For Bonaventura and Burkholder, the risks have paid off. Both have successful careers and, at the same time, have been able to step away from the microscope to pursue satisfying personal lives.

But many females never get a chance to test scientific inclinations.

For most, the stifling of interest comes in junior high school. Recent studies have shown that male and female students show the same interest in math and science until they begin to take courses that require a certain amount of risk-taking. It is here that females fall by



Photo by C.R. Edgerton

JoAnn Burkholder

the wayside.

"It shows up early in math and science classes," Bonaventura says. "When risk-taking is involved, almost instantly the guys take the lead. The girl feels hesitant about trying something risky."

The answer to the problem can be found in teachers who are willing to instruct girls that there is freedom in taking intellectual as well as social risks.

"Teachers need to be taught not to squash kids, to show them that it's all right to explore and take chances and

make mistakes," Bonaventura says.

Though many teachers don't seem to be practicing that philosophy, there are what Burkholder calls "refreshing pockets" of educators who are encouraging young girls to consider science careers.

"It's going to take some time for society to change enough for the majority of women to feel comfortable with science as a career," she says. "But it's already changing for the better, and I'm encouraged by that." ■

# Program Nurtures Future Minority Scientists

It's tough being a science teacher.

Burnout can happen fast when you're overloaded with classes and frustrated with students who don't seem to care.

And it's not easy being a student of science either, memorizing and regurgitating facts that seem irrelevant.

Add to that the pressure of being a minority who feels "locked out," and the

whole thing can get discouraging.

Walter "Skip" Bollenbacher considered all these things when he began writing a proposal for a grant to promote minority advancement in science careers 2½ years ago.

What resulted is the Program for Minority Advancement in Biomolecular Sciences, designed to "energize" science

By Carla B. Burgess

education so that more minority students will choose careers in research or science education.

"If we have a human resource problem in the mainstream, it's that today's minority is tomorrow's majority population," says Bollenbacher, associate professor of biology at the University of North Carolina at Chapel Hill and the developer of the outreach program.

To take their proper places in the world of science, minorities need to have the self-esteem and the practical experience to succeed, he says. That's one of the goals of the outreach program, still in its infancy.

It is three-tiered in its approach, embracing faculty members and undergraduates at minority universities and science teachers at high schools with large minority enrollments.

It is organized around two courses. "Frontiers in Cell and Molecular Biology" provides information and promotes discussion about cutting edge research. The "Summer Research Challenge Course" is an intensive, hands-on laboratory course.



Photo by C.R. Edgerton

Nancy Mueller (at right) teaches the Frontiers course to undergraduates at North Carolina Central University in Durham.

*Continued on next page*

It's a cyclical program.

First, selected high school science teachers complete the "Frontiers" course through UNC's continuing education program.

"We need to build their morale, to keep them excited about science, up-to-date on it and thinking about it in a different way," says Bollenbacher. "They're scientists too. They just happen to be in science education and not research."

Through the course, the teachers become "revitalized" and carry that enthusiasm back into their classrooms.



Skip Bollenbacher

"They're excited about it; they get the students excited about it. And the students think, 'Hey, it isn't some boring thing with a bunch of beakers and nerdy people,'" says Bollenbacher.

Meanwhile, the program also considers the special needs of university professors. They experience burnout too.

To start with, selected faculty members from participating minority institutions are paired with a UNC-CH research scientist for a summer fellowship.

The program then "buys" those faculty members' time—in effect paying a substitute—so their course loads will be reduced enough to teach the Frontiers seminar at their home institutions.

"They're teaching a course for their undergraduates like the course we're giving the teachers at the high schools," Bollenbacher says.

The undergraduates who do well in the Frontiers course and the participating high school teachers will be students

together during a seven-week research lab, "where they'll do the very experiments they've been reading about," Bollenbacher says.

The Summer Research Challenge will begin with a hands-on study of biology at the coast and end in a research lab on the UNC campus.

"Students really don't get the thrill of discovery anymore—they don't understand the 'why' of learning it all," he says. In the lab, they will get to experience that excitement.

Terrance L. Johnson, director of the



Terrance Johnson

program, says this is where students get to truly feel the workings of science.

"It feels good to go in a lab, run an experiment and the dang thing works," he says.

The classroom portion of the program is unique too. It employs a "liberal arts" approach to science, Johnson says.

In a literature class, students read a novel, then go into the classroom and talk about it—what they understood, what they liked about it, what it means.

That's what students in the Frontiers class do—really discuss the bones of the research papers they read.

"What we're doing is creating an atmosphere of total gratification of studying science," Johnson says.

But for all the excitement and all the challenge it offers, some things about science are "still pretty impersonal," Bollenbacher says.

This is why the program is going to so much trouble to forge relationships—

lasting ones—between potential young minority scientists and their role models.

"For this to work, these teachers and students have got to become friends," he says.

A strong ally can help build self-esteem and confidence.

"The most important thing is that the students know they can accomplish in that field," he says. "This is especially critical with minorities."

Bollenbacher asks for empathy. Imagine you're the only black student in a research lab, he says. You know you're

smart. You know you're as competent as anyone else in the room. But you've been told you're not as good. And you're nervous.

"Can you think well when you're anxious?" Bollenbacher asks. "Of course not. You'll most likely perform below expectations. The process needs to consider that."

It's not about pacifying or making things seem easy. This is a competitive, challenging project that aims to bolster scientific skills and encourage participation with just an extra dose of TLC, he says.

"We're telling them, 'it may very well be a struggle, but you can do it and it's worthwhile,'" Bollenbacher says. ■

*The Program for Minority Advancement in Biomolecular Sciences is funded through a grant from the Howard Hughes Medical Institute, the Z Smith Reynolds Foundation and the Eisenhower Mathematics and Science Program.*



Dear Readers:

We're making some changes in *Coastwatch*. This will be the last issue of *Coastwatch*, the newsletter. The next time it appears in your mailbox, *Coastwatch* will have been transformed into a 16-page magazine.

Why the change?

The newsletter was a limiting format. Sometimes we had to curtail the information we provided because there wasn't enough space. And we were forced to keep our photographs and other graphics small so we could provide maximum information.

We simply had more to show and tell you than we could fit on eight pages.

But now we're going to expand.

We'll devote the first section of the magazine to a single topic. We will have three or four stories in the first eight or nine pages devoted to an issue shaping our coast.

Then we'll have regular departments.

One section will focus on recent Sea Grant research findings, another on the work of our Marine Advisory Service agents and specialists.

Youngsters will have a page of their own where we'll tell stories, introduce activities or relate interesting marine facts. For the older naturalist, we'll also have a section devoted to explaining the flora and fauna that make our coast unique.

We'll still have a section like our present Back Page devoted to news briefs, conference announcements and research updates. There'll be a bookstore department where we'll announce new and seasonal marine publications.

Finally, there'll be a page for you, the reader, to respond to our stories and ask questions.

The expanded format should provide you with more information, and the design will be pleasing to the eye. We'll publish every other month, and you can expect the first issue about June 1.

We're also going to have to implement another change—a subscription fee.

We have held off as long as possible, but the reality of our budget dictates that now we must charge a subscription fee of \$12. That fee was inevitable regardless of whether we publish a newsletter or magazine. The costs are virtually the same.

Sea Grant has received no federal budget increases in more than 10 years. Couple that with inflation, and you get less buying power. Add increased publishing costs and the shortfall in state funds, and you have a publishing budget that no longer allows us to give away more than 21,000 free newsletters.

We'll use the money raised from fees to supplement our federal budget for printing and production.

We hope you'll be willing to subscribe to *Coastwatch* because you believe it's a good value. In fact, we'll send you one free copy of the magazine so that you can decide for yourself.

We appreciate the support you have shown *Coastwatch*. We hope you'll find its new format just as enlightening and entertaining.

Thank you,

Kathy Hart  
Editor

# The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.



**W**hat's the best way to catch a wave?

If it's a "wave" of peeler crabs, why not try a crab pound?

That's what Sea Grant marine agent Bob Hines used last spring and summer to catch the pre-molt crustaceans.

Hines tested the pounds—a trap consisting of a lead net, heart and box—in Orchard Creek in Oriental during June, July and August.

In other parts of the eastern United States, pounds have been effective in catching peelers as they move in "runs" or "waves."

When blue crabs shed their hard outer shell, they remain soft for a brief period of

time. These soft crabs are a delicacy that can bring from \$12 to \$24 a dozen.

"The key to making enough money in shedding crabs is to catch enough peelers," says Hines. Some fishermen won't go to the trouble of culling the potential soft crabs. As a result, millions of peelers are inadvertently sold on the hard crab market.

"The idea with the crab pounds is to find some way to get that supply of peelers so that shedders can justify expanding their operation to derive more profit," says Hines.

To learn more about building and using crab pounds, write Sea Grant for a free copy of "Building and Using Crab Pounds to Catch Peelers." The publication number is UNC-SG-BP-91-01. The address is Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695.

**I**f the town of Nags Head has its way, no one there will be served on Styrofoam or any other polystyrene products.

The town board is asking the legislature for the right to ban the use of polystyrene in prepared meal packaging.

A ban would reduce the amount of plastic litter along the roads and beaches,

says town manager Webb Fuller.

But that's not all. Production of some polystyrene has been linked with the depletion of the earth's ozone layer.

Fuller says the town wants to make a statement about protecting the environment.

"We've had some discussions with local restaurant owners, and they're basically in favor of it," he says. "I think they're willing to adjust."

Fuller said the ban would apply only to prepared meals packaging—such as from restaurants or grocery store delis.

If passed, the legislation would apply to other willing local governments in Dare County, Fuller said. Nags Head may set a precedent for other Tar Heel communities.

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