

# Bulletin of the

## CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING



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### UConn Scientist Plays Key Role in International Marine Census

On a recent warm October afternoon, I sat in newly constructed conference room, awash with sunlight, backed by a magnificent view of the Long Island Sound, and listened to Ann Bucklin describe her work as the Director of Marine Sciences at the University of Connecticut. Dr. Bucklin has been serving in this role since the fall of 2005. Prior to her tenure at the University of Connecticut, Dr. Bucklin was a professor of zoology at the University of New Hampshire. Dr. Bucklin's research is focused on marine zooplankton, especially their genetic composition. She is now leading the Census of Marine Zooplankton—an ocean realm field project of the Census of Marine Life (CoML)—which will complete a global survey of zooplankton biodiversity by 2010. Her research is part of an international census that began in 2000 and has as its purpose to develop a comprehensive understanding of marine life in terms of what species exist, where they reside and what their populations are. This research is funded largely by the Sloan Foundation, which has as its core mission a celebration of “curiosity-driven research.”



*Dr. Ann Bucklin is Director of Marine Sciences at UConn*

#### Q: Why zooplankton?

A: The true answer about “why zooplankton” is that I was trained in graduate school to be an invertebrate zoologist. Zooplankton are largely invertebrates, and they are just beautiful. To fully appreciate the beauty, you have to see them alive. Not all zooplankton are transparent. Some are really highly colored. They have outrageous morphology to stay afloat, to drift with the currents, to avoid predators. They're highly diverse and just incredible.

(Bucklin, page 2)

### News from the National Academies

The following is excerpted from press releases of the National Academies and from Infocus Magazine ([www.infocusmagazine.org](http://www.infocusmagazine.org)), a news resource of the National Academies.

#### ◆ Consumers Need Better Guidance for Seafood Choices

A new report by the National Academies' Institute of Medicine reviews the scientific evidence on the benefits and risks of consuming seafood and finds that due to the “fragmented” and confusing nature of the information made available to them, consumers often have misperceptions about both the nutritional value and the health risks associated with fish and shellfish. The report recommends that federal agencies partner with state, local and private groups to develop new, more coherent information tools, testing them with consumers to ensure that they work.

(National Academies, page 8)

### CT Science Center Update: Children's Gallery, Construction

The Connecticut Science Center and Pitney Bowes are working together to create an exciting children's gallery that will be a playground of interactive science exhibits for the Center's youngest visitors. The Pitney Bowes Literacy and Education Fund Children's Gallery will feature an interactive display designed in collaboration with Hartford-based photographer and artist Walter Wick, who's famous “I Spy” and “Can you see?” books are treasured by children around the world. The gallery will also include a water play area, a soundscape and a children's reading nook, co-programmed by the Hartford Public Library.

With this generous gift, the Center will develop a broad array of educational offerings, including classroom-based and kit-based programs, after-school programs, professional development and specialized programs for teachers and students in Charter  
(Center, page 7)

### Banucci Awarded CT Medal of Technology

The 2006 Connecticut Medal of Technology was awarded to Gene Banucci, founder and Chairman of the Board of Danbury-based ATMI, Inc., at the Alliance for Connecticut Technology Award Dinner at the Connecticut Convention Center in Hartford on October 19, 2006. The award, modeled after the national Medal of Technology, was established by the Connecticut General Assembly and is administered by the Board of Governors for Higher Education. It is the state's highest award for technological achievement in fields crucial to economic competitiveness.

Banucci co-founded ATMI in 1986 and has led the manufacturing company ever since. Today, the company employs more than 750 people worldwide. ATMI went public in 1993, and has grown to over \$300 million in annualized revenues with a market capitalization exceeding \$1 billion. The key technological advance made by ATMI is a revolutionary method of safely storing hazardous gases as solids so they can be safely transported and efficiently used in semiconductor manufacturing. The resulting product, called SDS<sup>®</sup> (Safe Delivery System), is now used in nearly every semiconductor plant in the world. Semiconductor associations have called it “one of the greatest safety, environmental and productivity innovations in the history of the industry.”

Banucci holds a PhD in chemistry, and began his career at General Electric, where his work earned 21 patents. In 1981, he was named Director of Discovery Research at American Cyanamid Company in Stamford and in 1986, he founded ATMI. A founding member of the Connecticut Technology Council, he actively promotes the state's technology-based companies.



*Gene Banucci*

The reason why I can stay in business is because zooplankton are very important to the ecology of the marine environment. Our ocean ecosystems would not function without zooplankton. They are the intermediaries between commercially-harvested fish and the phytoplankton that are a source of productivity in the ocean. There is a huge need to predict fisheries production and the answer lies in part with understanding the dynamics of zooplankton.

**Q: What method of research are you currently using?**

A: Zooplankton is collected today much as it was by the *HMS Challenger* expedition in the 1870s. That is, in nets. Today the sampling systems are much more complicated because they are electronically controlled and calibrated to regulate the volume of water and measure the concentration of animals. These systems collect information about the physical and chemical parameters of the ocean. Present day nets are essentially fancier nets with many more bells and whistles.

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**Q: Do you see changes within the species that have genetic capabilities different from zooplankton a hundred years ago?**

A: Because of preservation techniques that destroy DNA, we aren't yet able to compare zooplankton today with those that lived a hundred years ago. We see short-term changes in populations that we can detect with gene sequencing. We know that marine animal populations are responding dramatically to changes in the environment. We see shifts in species abundances. For example, in the Antarctic, a species related to jellyfish is much more abundant than it used to be, displacing the krill that are the foundation of that ecosystem. We see more frequent jellyfish blooms in this part of the world. And a red tide—a harmful algal bloom—spread along much of the coast of New England a few years ago. Such biological events are changing in intensity and frequency. We're not quite sure what is causing these changes, but it's very likely due to climate.

**Q: What predictions can you make about what you expect to learn from your study?**

A: The Holy Grail in marine genetics is to understand how the environment changes the genetic makeup of organisms and populations. Complicated questions are answered by looking at rates and patterns of gene expression—that is, the transcription of DNA into proteins. Gene expression can tell us if the organism is hungry, well fed, or experiencing stress, heat or cold by looking at which genes are "turned on." We are now looking for indicators of environmental impacts on animals from chemical pollution, hypoxia, and nutrient enrichment, for example. These studies will yield bio-indicators that can help us understand the health of the Long Island Sound ecosystem.

**Q: What are your goals?**

A: I came here last year as department head, and I have a five-year term of service. My preference is that all goes well and I will be appointed for another five-year term. The consolation prize, which is not too bad either, is that I would continue as a tenured full professor in the department. My first goal is to develop a sense of common purpose among the faculty, based upon genuine understanding what they want to do, what they value, and what they think is most important. That is what my first year was about. Luckily, this coincided with a university-wide strategic planning process. My second year is all about implementation. Five years out, I hope the department will remain competitive in big oceanographic programs, some of which are just gaining steam now. I want to see the department maintain and grow their share of coastal ocean observation and biodiversity initiatives. I wish the department to play a significant role in the big questions of the day for oceanography. That means strategic positioning, hiring faculty who will allow us to compete, and getting the word out about all the things that the department does. My role is to support these initiatives, encourage the department to set a course, and help them achieve their goals. I will consider my goals met if we are more than we already are now: an effective center of coastal oceanographic research and graduate education.

**Q: How do you communicate your work to the people of Connecticut?**

A: The best and easiest way to get information to the public is through the newspapers. We enjoy good relationships with the *Hartford Courant*, the *New Haven Register* and the *New London Day*. We are producing a slate of communications materials, including an annual report, brochures, and newsletters that talk about who we are and what we do. We keep a list of addresses of friends and supporters. We are making an organized attempt

(Bucklin, page 7)

to find our alumni—especially PhD and Masters students—and get them back in touch.

**Q: What impact do you expect your work to have on the state of Connecticut?**

A: I think the university has a responsibility to serve the citizens of the state directly by educating their children. This is a very straightforward service we provide, and we do an innovative and successful job. From there it gets a little less straightforward. Another one of our responsibilities is simply to be wonderful at what we do and to continue to bring recognition for research excellence to the university. The reputation of universities like UConn rests on our research expertise and our ability to attract top-notch graduate and undergraduate students. Building a research enterprise that is successful, well-funded, and highly regarded is one of the charges that I take seriously.

**Q: What do you think your research will yield that will be important to people whose livelihood depends on the health of Long Island Sound?**

A: Zooplankton are excellent indicators of whether the ecosystem is healthy. When species numbers decline, and when the number of individuals of those species decline, that's an early warning of problems that will reach throughout the ecosystem—including the commercial fisheries. We need to understand what determines zooplankton survival, productivity, and species diversity. If we can record these characteristics over time, we will be able to see changes occurring in the world's oceans. For example, in our part of the northwest Atlantic, we have noticed significant drops in zooplankton species and populations that are associated with changes in fisheries. Ocean ecosystems cannot be dissected species by species. We need to understand the entire system in order eventually to be able to predict it.

**Q: How will your research be useful in terms of policy?**

A: My research is part of the big picture that contributes to an understanding of ocean ecosystems. This is already a foundation of ocean policy. The national legislation that governs fisheries management is called the Magnuson-Stevens Fishery Conservation and Management Act and it is up for reauthorization. The new version of that bill calls out the need for ecosystem based management. It is ready to be enacted to ensure that the United States manages fisheries based on ecosystems, not on single species. So the day is already upon us when the zooplankton studies are going to be taken into consideration for fisheries management.

The department has a research focus on the Long Island Sound ecosystem—more so than any other higher education institution. We collect real-time data to measure the impacts of low oxygen concentrations, and we participated in studies of the 1990s lobster die off. The department has always responded enthusiastically and competitively to real-world problems in coastal ocean environments, especially the one on our doorstep!

**Q: How has your research helped industries that operate on the Sound?**

A: As a group, the department is contributing to improved awareness of how the Sound ecosystem works—both naturally and how it accommodates the activities of man. A number of faculty of the department are involved in a study which seeks to place people in the Sound ecosystem and understand how we can behave most adaptively to maintain a healthy ecosystem. The department also does quite a bit with maritime industries in southeastern Connecticut. I found it surprising that Connecticut has more maritime industries, not located on the coast or in the southeast exclusively,

than any other New England state. We welcome them as partners and seek to learn what they need and how we can help them.

**Q: Has your research yielded results that indicate very specific conservation measures that should be immediately put into effect?**

A: There was a recent cruise to the abyssal regions of the Sargasso Sea in the North Atlantic, sampling almost two miles down. We know already that we have polluted waters that deep with plastic and organic pollutants. There is no part of the global ocean that man has not impacted, largely negatively. The top predators have changed: sharks are rare, whales are endangered, and commercial fish are depleted. My goal is to report on the species that exist today, as a baseline for the future. We're seeing shifts in species' geographic ranges and abundances. It is not inconceivable that zooplankton can be at risk for extinction. The real goal of the census of marine zooplankton is global coverage by 2010. Remarkably, working with twenty colleagues from sixteen different countries, all of whom are leading major field efforts throughout their regions, we are going to come pretty close to reaching our goal.

**Q: Is it a hard sell to convince the public and politicians that this is important research that warrants immediate attention?**

A: Marine biodiversity is one of those topics where the public at large does not have a sense of urgency. However, many oceanographers do have a sense of urgency, because we know how dramatically we are changing ocean ecosystems. We are hopeful for major infusions of ocean research funding, but politicians and Congress have so many pressing and scary threats to consider. That is where private funding comes into play. The Sloan Foundation in particular has visionary program managers who can understand the contribution that programs like ours can make for the future. I'm extremely glad to be a part of a program that is able to focus on a horizon that only seems far away. Unless we act now, the opportunity for such studies will not be available in the future.

**Q: Is there anything that has surprised you?**

A: This is the first time I have been a department head. I have found the faculty to be committed to self-governance, very hard working, and quite collegial. I was extremely relieved because I know of departments that have a difficult time making decisions, setting a course, and just doing the simple things a department must do. I enjoy my job and look forward to implementing the shared vision that I discovered among the faculty. I think we have an excellent chance of making this shared vision come true. —  
**Wendy Millstein is a freelance science writer based in Simsbury.**

## Center (continued from page 1)

schools. These programs will serve to enhance and reinforce the science education that will be offered at the Science Center. Where possible, funding will be made available to underwrite the cost of class trips to the Center for schools in low-income communities. With the announcement of the \$1 million donation from Pitney Bowes, the Center has reached 95% of its campaign goal, with under \$10 million still to raise.

This winter, the Connecticut Science Center plans to finalize construction of its three-level parking garage, which will also serve as the base of the building. In August, the Center began pouring concrete for the first floor of the parking garage and is now in the process of completing the ramp to the third level. You can view real-time video of the construction of the project and see plans for the Pitney Bowes Literacy and Education Fund Children's Gallery, as well as other information about the Center, online at [www.CTScienceCenter.org](http://www.CTScienceCenter.org).