

IMPACT

RESEARCH AT THE UNIVERSITY OF MARYLAND

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As I begin my tenure as Vice President for Research, the University of Maryland has just wrapped up its 150th Anniversary celebration. I find this fitting, in that we can simultaneously honor our century-and-a-half of service as a public research institution, while we also look forward to a very bright future.

And we have great expectations for our future. Within the next year, we will unveil a Biosciences Research Building that includes a new institute focused on host-pathogen interaction. We will also continue to expand our research partnerships with the federal government and strengthen our affiliations with private industry. Look for future issues of *Impact* for updates on these important initiatives.

In this issue, we look at how our strong relationships with NASA and NOAA have resulted in a unique, interdisciplinary research center that closely examines how the Earth's four major systems—land, atmosphere, oceans and living things—interact with each other. With new evidence pointing toward global climate changes that could have a significant impact on how we live, this research is especially relevant.

I encourage you to visit our Web site at www.umresearch.umd.edu for a more detailed look at all of our ongoing scientific projects. And I welcome your comments and suggestions on how we can further the research mission of the University of Maryland.

Mel Bernstein
Vice President for Research

Forecasting severe weather

is just one aspect of important research in the atmospheric and oceanic sciences. To better understand weather patterns and other climatic conditions, Maryland researchers are taking a high-tech interdisciplinary approach to earth science prediction. **Look inside for the story ...**



researchTRENDS

As one of the nation's premier public research universities, we are committed to scientific discovery that has a positive impact on our lives and our communities. Here are some of the recently funded projects we are working on:

VACCINE RESEARCH

University researchers received \$4.1 million from the National Institutes of Health to continue research on a vaccine that, in early NIH trials, successfully immunized monkeys against SARS and human parainfluenza viruses. Future research will study other viruses for which vaccines are currently not available, including avian influenza H5N1.

QUANTUM PHYSICS

The university, in collaboration with NIST and the National Security Agency, has formed the Joint Quantum Institute, designed to advance quantum physics research and decipher the secrets of nature at the submicroscopic scale. The institute will have an annual budget of about \$6 million and a staff of about 20 scientists, half from the university and half from NIST.

SPACE SCIENCE

The university has joined with the University of Maryland, Baltimore County, and the Universities Space Research Association to establish the Center for Research and Exploration in Space Science and Technology, or CRESST. With \$7.5 million per year in NASA funding, CRESST will initially focus on the study of neutron stars, black holes and extremely hot gas throughout the universe.

BIO-NANO

The university's Clark School of Engineering will receive more than \$1 million from the Robert W. Deutsch Foundation for bioengineering research on the nanoscale. Maryland engineers are developing new "biochip" technologies that can lead to new drugs to treat bacterial infections.



research **PROFILES**

For a closer look at faculty research in the Earth System Science Interdisciplinary Center, go to www.umresearch.umd.edu.



RUTH DeFRIES

This professor of geography wants to quantify the changing use of land around the world and its consequences.



RAGHU MURTUGUDDE

This associate professor of atmospheric and oceanic science studies the interactions between climate and living creatures, such as phytoplankton.



ZHANQING LI

This professor of atmospheric and oceanic science investigates how aerosols in the atmosphere affect climate both locally and globally.

Understanding Earth's Changes

While there is a broad consensus in the scientific community that global climate change is currently under way, there are times when political overtones overlap with scientific data, clouding the picture on this important issue.

“We’ve turned the corner in the United States regarding an acceptance that the Earth’s climate is changing,” says Antonio Busalacchi, professor of atmospheric and oceanic science and director of the Earth System Science Interdisciplinary Center, or ESSIC, at the University of Maryland. What’s important now, says Busalacchi, is determining how *fast* climate change is occurring, and what part of it is due to human influence.

Monitoring and predicting global climate change is just one aspect of the ongoing research at ESSIC, an interdisciplinary research center that involves the departments of Atmospheric and Oceanic Science, Geography and Geology. Maryland faculty—augmented by a large staff of senior research scientists, visiting scientists and post docs—are joined by other earth scientists from nearby NASA-Goddard, as well as researchers from the National Oceanic and Atmospheric Administration, or NOAA.

Combining data from more than a dozen NASA satellites circling the Earth with other sensors located on land or in ocean buoys, researchers at ESSIC are examining how four separate systems that greatly affect the Earth—oceans, atmosphere, land surface and human influence on each of these—interact as one system.

“Clearly, there are natural cycles—El Niños, the North Atlantic Oscillation or the monsoons, for example—that arise as a result of the coupling of the ocean and the atmosphere and the land surface,” says Busalacchi. “These intrinsic cycles in the Earth’s systems don’t exist in any one part of the Earth by themselves, and only happen when they come together. This is what we are particularly interested in.”

Other examples might be

changes in the Earth’s ozone layer due to emissions from internal combustion

engines or industrial pollution. ESSIC scientists have tracked the downstream transport of aerosol particles released in Asia all the way across the Pacific to the mainland United States. Research in ESSIC is also examining the Earth’s carbon cycle, trying to compare natural occurrences to changes brought on by large-scale deforestation projects.

“One thing we have come to appreciate is that the Earth is always changing,” says Busalacchi. “And while we continuously promote the advancement of scientific knowledge, it is our duty as a public research university—together with NASA and NOAA—to determine if these changes present a danger to our welfare and the planet’s sustainability.”

New Advances in Earth Science Prediction

A key reason that Maryland scientists have a much better perspective of the Earth’s systems is the use of sophisticated satellites (including the NOAA weather satellite shown at left) developed at NASA-Goddard, a major federal research facility located less than five miles from the university. Maryland faculty have used NASA satellite data for decades as a means of developing new concepts for weather prediction, but a new generation of space vehicles launched beginning in the mid-1990s brought a much-deeper relationship between Maryland faculty and earth scientists at NASA-Goddard.

“This new class of satellites has allowed us to start developing a predictive capability for the environment as a whole,” says ESSIC’s



Antonio Busalacchi

(cont. on back)

Busalacchi, who was recruited from NASA-Goddard six years ago to lead the interdisciplinary earth science center at Maryland. Now, in addition to weather prediction, researchers are collecting satellite data that measure water vapor content in the atmosphere, ozone levels, sea-ice concentrations, sea level, infrared radiation emitted from the Earth's surface,

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chlorophyll in the ocean, as well as rainfall and the amount of vegetation in specific areas.

What this means, says Busalacchi, is that Maryland faculty are working side-by-side with earth scientists at NASA and NOAA to monitor and better predict conditions like water quality, disease vectors, agriculture crop forecasts, carbon cycles and marine ecosystems on a worldwide scale.

“The data from these new satellite missions

have given us predictive capabilities that were inconceivable as recently as 10 years ago,” says Franco Einaudi, director of the Earth Sciences Division at NASA-Goddard. Einaudi foresees further research with Maryland faculty in ESSIC on critical topics of weather and climate.

Cutting-edge research is just one benefit of government/academic partnerships like ESSIC, Einaudi adds. “These joint institutes offer young scientists an edge,” he says, offering them unique opportunities to write proposals, teach courses, and further their own research.

Busalacchi sees this relationship expanding even further. With the greater Washington, D.C., area having the largest collection of earth scientists anywhere (from NASA, NOAA, area universities and private corporations), Busalacchi sees, in the near future, the development of an advanced institute for the study of environmental prediction.

“We’re just scratching the surface in research of the Earth’s systems that we can accurately predict,” he says. “And accurate prediction is vital both for improving the quality of life we have now, and in making decisions that will help mitigate negative changes in the future.” — *Tom Ventsias*

Impact is published four times a year by the Office of the Vice President for Research and is mailed to members of the mid-Atlantic research community and others who have an interest in the latest research at the University of Maryland.

Your comments and feedback are welcome; please email your comments to impact@umd.edu or fax them to Anne Geronimo, executive editor, at 301.314.9569.

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researchSPOTLIGHT



The NOAA Center for Weather and Climate Prediction, scheduled for occupancy in summer of 2008, is currently under construction at M Square, the University of Maryland Research Park. This new facility is expected to bring 800 federal employees involved with climate and weather-related research to College Park. University researchers from ESSIC are expected to occupy another new building at M Square adjacent to the NOAA facility, further strengthening the research relationships

in earth science prediction between Maryland faculty and NOAA.

“We are expecting great things to happen with these new collaborations with the academic community—specifically the University of Maryland—to improve weather and climate forecasts,” says Louis Uccellini, director of NOAA’s National Center for Environmental Prediction. For a closer look at M Square, go to www.msquare.umd.edu; to view more of the ongoing research in ESSIC, go to www.essic.umd.edu.



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