IMPACT
RESEARCH AT THE UNIVERSITY OF MARYLAND
Vol. 5 No. 2 | Fall 2010

NEW SCIENCE. NEW DISCOVERIES.

MARYLAND RESEARCH CONVERGES AT THE INTERSECTION OF THE PHYSICAL AND LIFE SCIENCES

CROSSING SCIENTIFIC PATHS

The boundaries that have traditionally separated the physical and the life sciences are rapidly blurring, encouraging research that intersects the laws governing particles, atoms and molecules with the immense diversity of living things. The University of Maryland is strengthening its commitment to this evolving field through a major federal partnership and cross-disciplinary scientific investigation in high-impact areas like cancer, Alzheimer's disease and public safety.

In May, the university signed an agreement with the National Cancer Institute that joins faculty researchers and doctoral students in physics, math, computational biology, computer science and bioengineering with federal cell biologists and other cancer specialists. (See Spotlight, back page.)

"We intend to use the NCI partnership as a model to identify promising opportunities for similar efforts, particularly where the research has an impact on our lives," says **Norma Allewell**, an expert in biochemistry and biophysics who leads the university's Division of Research.

Areas where Maryland researchers are crossing scientific boundaries to have an impact include:

BRAIN IMAGING

A $2 million National Science Foundation grant to **Nathan Fox**, a researcher in the neuroscience and cognitive science program and distinguished university professor of human development, has launched the Maryland Neuroimaging Center. There, starting next fall, faculty and student researchers and outside collaborators can use a functional magnetic resonance imaging, or fMRI, machine to investigate areas of human cognitive functioning and affective development.

PATHOGEN RESEARCH

The Maryland Pathogen Research Institute, or MPR brings together experts i biosciences, computatio sciences, engineering a nanosciences. Led by **Moser** (above), MPRI diagnose, treat and the spread of path

COMPUTATIONAL BIOLOGY

Using sophisticated algorithms to analyze massive amounts of genomic data, researchers in the Center for Bioinformatics and Computational Biology, led by **Steven Salzberg**, are helping federal scientists pinpoint genetic markers that might predict why certain cells become malignant.

PHYSICAL ACTIVITY AND AGING

Bradley Hatfield, in kinesiology, is researching how physical activity slows or delays age-related change in the brain, particularly in those who are genetically susceptible to Alzheimer's disease. He is also using fMRI to study emotional regulation and decision-making processes in athletes.

NA

The
an
b

BIOENGINEERING

The Fischell Department of Bioengineering, led by **William Bentley** (left), features state-of-the art laboratories to compliment research and development in areas like nanoscale drug delivery, bio-materials, bio-microsystems and biomechanics.

resources, capabilities
& PARTNERSHIPS

Key resources, programs and partnerships that enhance discoveries involving the physical and life sciences include:

LOCATION

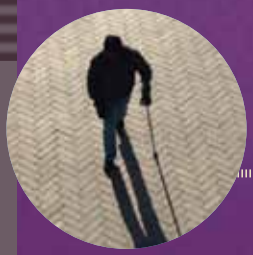
The university's location just outside of Washington, D.C., brings opportunities to collaborate with the National Institutes of Health, the National Institute of Standards and Technology and the National Science Foundation as well as nearby research hospitals and the rich array of startups near the state's I–270 biotech corridor.

UMD/UMB SEED GRANTS

A competitive seed grant program between the University of Maryland and the University of Maryland, Baltimore provides startup funds to cross-institutional teams that are designed to increase the number of funding proposals submitted to the National Institutes of Health. This year's winning proposals included:

- **Doron Levy** from UMD and **Jakub Simon**, M.D. from UMB are designing mathematical models that can assist in a vaccine for the *Shigella* bacterium, which kills an estimated 1 million people annually.

- **John Fisher** from UMD and **Elizabeth Powell** from UMB will refine a bioengineered drug delivery system to transport hepatocytes, a cell from liver tissue that shows promise against pediatric epilepsy or autism.



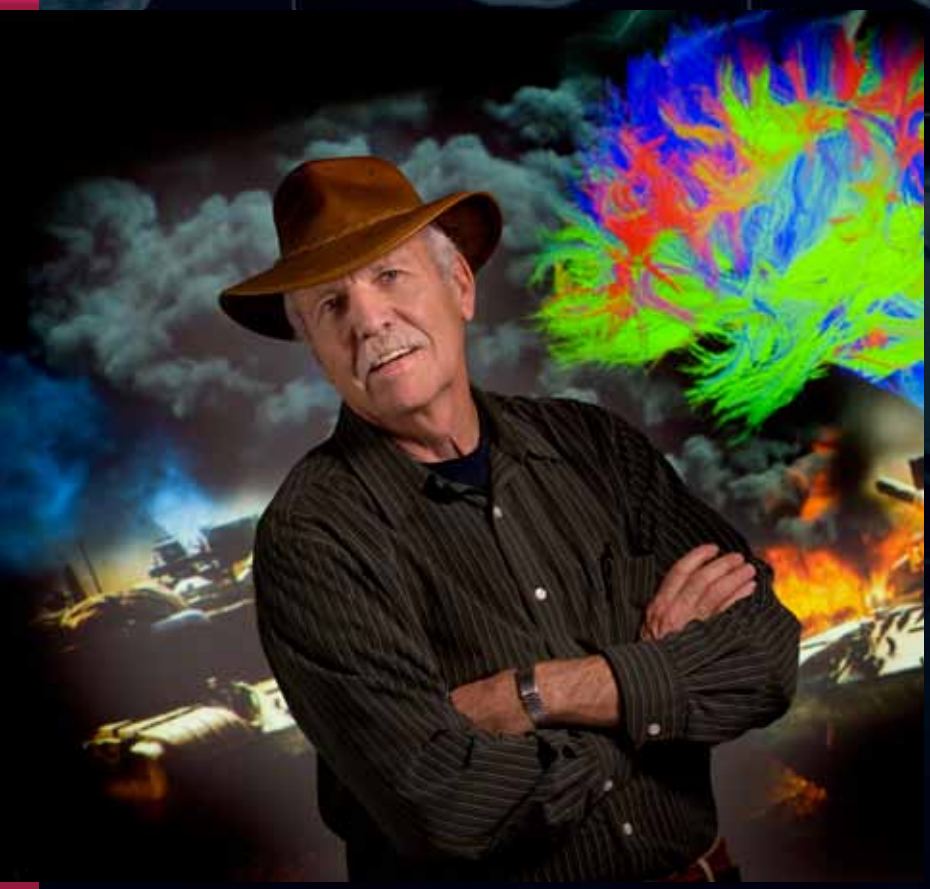
- **Jose Contreras-Vidal** from UMD and **Larry Forester** from UMB are assessing the cortical control of gait, or how we move when walking, for people using artificial limbs. M

HEALTH IT

Improvements in health information technology, or health IT, can expand health-care access, improve quality, prevent medical errors and reduce costs. Maryland's role at the cutting edge of health IT research includes:

- computer visualization pioneer **Ben Shneiderman**, working with colleagues in the university's Institute for Advanced Computer Studies to design Lifelines2, a computer interface that gives physicians an overview of the patient's history—up to 100 years or 10,000 medical events—and lets doctors pull up groups of patient histories to see any emerging health patterns.

- information systems expert **Ritu Agarwal** evaluating health IT costs versus benefits. One project at the Children's National Medical Center will help determine if a new IT system for inputting and tracking physician's notes has affected the way attending physicians and consultants do their rounds, especially doctors who are attending to patients with complex illnesses and injuries. M



Energetics & Brain Imaging

With the goal of providing better protection for military personnel, Maryland researchers have teamed with government scientists and medical professionals at the University of Maryland School of Medicine to study the effects of improvised explosive devices, or IEDs, on the human brain.

William Fourney, an energetics (explosives) expert in the A. James Clark School of Engineering, is gathering data for the Navy to refine computer simulations that could lead to preventative measures against mild traumatic brain injury, or mTBI, caused by the shock waves from IEDs.

These measures might include special seats that deflect blast acceleration effects if a vehicle is hit by an IED. "The bottom line is we need a better way of understanding exactly what happens when explosives detonate," Fourney says. "And by using sound scientific methods to predict those results, we can help the military protect its warfighters."

The researchers, initially funded by a UMD/UMB seed grant, are also investigating new brain imaging techniques and the development of alternative medical treatments for mTBI.

Biophysics

Michelle Girvan is using her expertise in statistical physics, computer science and nonlinear dynamics in the fight against cancer. The biophysicist is using empirical data involving complex networks of gene expressions—how much a cell is turned "on" or "off"— to validate mathematical models that can help other scientists determine how cells interact with one another. "I apply network structure theory to help cancer researchers determine which cells to target," she says. "It is satisfying work, in that the subject matter is challenging, yet the results can end up helping people immensely."

UNIVERSITY OF MARYLAND
Office of the Vice President for Research
2133 Lee Building
University of Maryland
College Park, MD 20742-5121

NONPROFIT ORG
US POSTAGE PAID
PERMIT No. 10
COLLEGE PARK, MD

RESEARCH & EDUCATION
spotlight

Physics doctoral student Colin McCann (above) is one of the first Maryland graduate students to train at the National Cancer Institute. McCann works with two advisers: NCI cell biologist Carole Parent (background, left), and UMD physicist Wolfgang Losert (background, right).

Impact is published 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 e-mail your comments to *vpr@umd.edu* or fax them to Anne Geronimo, executive editor, at 301.314.9569.

If for any reason you would not like to receive this publication, contact us using the same information above.

PUBLISHER
Norma Allewell
Interim Vice President for Research

EXECUTIVE EDITOR
Anne Geronimo
Director for Research Development

MANAGING EDITOR
Tom Ventsias

CREATIVE DIRECTOR AND PHOTOGRAPHER
John T. Consoli

ART DIRECTOR
Jeanette J. Nelson

UMD/NCI Partnership Seeks Cancer Answers

Why do cancer cells migrate from one organ to another? And how do certain cells become malignant?

Seeking answers to questions like these, the University of Maryland and the National Cancer Institute, or NCI, have joined forces to send Maryland graduate students in less-traditional cancer fields like computational biology, bioengineering, physics and math to the NCI laboratories in Bethesda, Md., for training with the NCI's top cancer experts.

The Graduate Partnership Program in Cancer Technology, led by Maryland physicist **Wolfgang Losert**, also provides for professional and academic exchanges between university faculty and NCI researchers.

Maryland researchers in areas like statistical mechanics, chaos theory and nonlinear dynamics will brainstorm with NCI cell biologists on new diagnostic tools and treatments.

Faculty will also lend expertise in bioengineering and nanotechnology, using the university's sophisticated nanofabrication laboratories to expand knowledge in areas like targeted drug delivery and micro-photonics that can be used in cell imaging.

To learn more about how the application of cutting-edge physical and mathematical tools—both experimental and theoretical—is expected to contribute to an understanding of biological systems in health and disease, and help develop and improve diagnostics, prevention and treatment methodologies, visit **www.cancer.umd.edu.**