Michelle Girvan, a University of Maryland Biophysics professor, says that the subject matter is challenging yet the results can end up helping people immensely. "It is satisfying work, and I apply network structure theory to help cancer researchers determine which cells to target," she says. "It is helpful in statistical physics, computer science, and nonlinear dynamics in the fight against cancer."

Energetics & Brain Imaging

With the goal of providing better protection for military personnel, Maryland researchers have teamed with government scientists and financial support from the University of Maryland Board of Regents and the Department of Defense (DoD) to study the effects of improvised explosive devices, or IEDs, on the human brain. The researchers hope that by using sound scientific methods to predict where explosives detonate, they can help the military protect its warfighters.

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Biophysics

Michael Levine is using his expertise in statistical physics, computer science, and nonlinear dynamics in the fight against cancer. He has also been using a technique called machine learning to classify cells in cancer tissue samples, which can be used to predict the presence of cancer.

"It is helpful in statistical physics, computer science, and nonlinear dynamics in the fight against cancer," Levine says. "I apply network structure theory to help cancer researchers determine which cells to target."
Key resources, programs and partnerships that enhance discoveries involving the physical and life sciences include:

**LOCATION**

The university is located just outside of Washington, D.C., bringing 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 centers to advance the line of research near the state-of-the-art laboratories.

**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-disciplinary teams that are designed to increase the number of funding proposals submitted to the National Institutes of Health. Ten new awards were announced in May.

- **Beverly Lerry:** UMD and Johns Hopkins: M.D. and UMD are designing mathematical models to predict and assess new HIV infections for the Baltimore area, which is expected to serve an estimated 100,000 people annually.
- **John Fisher:** UMD and Elizabeth Perrin (UMBF): fisher is working on a new drug delivery system to combat hepatitis, a viral liver disease that is among the most common causes of death in people annually.
- **Joe Grimbis:** UMD and Larry Freiman: UMD is assessing the cortical control of a spinal cord injury, focusing on how the motor cortex is affected by diseases like spinal cord injury or stroke.

**HEALTH IT**

Improvements in health information technology, or health IT, can expand health care access, improve quality, present medical errors and reduce costs. Maryland is at the cutting-edge among IT research institutions.

- **University of Maryland**: 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 helped doctors to determine if a new IT system for inputting and tracking physician’s notes has improved 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.

**Maryland’s role at the cutting edge of health IT research includes:**

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The University of Maryland is strengthening its commitment to this evolving field through a major federal partnership and cross-disciplinary science. In May, the university signed an agreement with the National Cancer Institute that joins faculty researchers, bioengineers and doctoral students in physics, math, biology, biotechnology, chemistry, mathematics, computer science and cognitive science, a researcher in the neurosciences, a researcher in the neurosciences, a researcher in the neurosciences, a researcher in the neurosciences. (See Spotlight, back page.)

Areas where Maryland researchers are intensely focusing include:

- **BRAIN FUNCTION AND DISEASE**: By measuring the brain using fMRI or functional magnetic resonance imaging, researchers can use a functional magnetic resonance imaging, or fMRI, scanner to investigate areas of the brain. This research can help to understand how the brain changes in diseases such as Alzheimer’s disease and autism. Researchers are also using fMRI to study emotional processes in athletes.

- **HEALTH INFORMATION TECHNOLOGY**: Improvements in health information technology, or health IT, can expand health-care access, improve quality, prevent medical errors and reduce costs. The University of Maryland is at the cutting edge of health IT research.

- **BIOENGINEERING**: The Institute for Bioscience and Biotechnology Research brings together experts from the University of Maryland with medical professionals and scientists at University of Maryland, Baltimore, and the National Institute of Standards and Technology. The recently launched institute will focus predominantly on nanobiotechnology, drug and vaccine discovery and pathobiology, which is the study of disease processes.

- **COMPUTATIONAL GENETICS AND BIOINFORMATICS**: Researchers at the Center for Bioinformatics and Computational Biology, led by Steven Salzberg, are developing algorithms to analyze massive amounts of genomic data. These algorithms are helping federal scientists become malignant.

- **MAPPING INFECTION**: The Maryland Pathogen Research Institute, or MPRI, brings together experts in the biosciences, computational biology, systems biology and nanosciences. Led by David Moser, MPRI works to identify viruses and bacteria that cause disease and develop methods for preventing, treating and controlling these infections.

- **INFORMATION SYSTEMS**: The University of Maryland School of Information Systems and Management is researching how physical information systems can be integrated with health-care systems. This work is important for improving health-care delivery and patient outcomes.

- **BRAIN IMAGING**: The University of Maryland School of Medicine is working on developing new technologies for imaging the brain. These technologies can help to identify and treat neurological disorders such as Alzheimer’s disease.

- **NEUROSCIENCE**: Researchers at the University of Maryland School of Medicine are exploring how physical activity and aging affect cognitive function. This research can help to understand how to improve cognitive function in older adults.

- **HEALTH CARE ACCESS**: Improvements in health information technology can expand health-care access, improve quality, prevent medical errors and reduce costs. The University of Maryland is at the cutting edge of health IT research.

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- **BIOMATERIALS**: Researchers at the University of Maryland School of Engineering are developing new materials for use in medical devices and implants. These materials can help to improve the performance and longevity of medical devices.

- **BIOMEDICAL ENGINEERING**: The University of Maryland School of Engineering is working on developing new technologies for medical devices and implants. These technologies can help to improve the performance and longevity of medical devices.

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resources, capabilities & partnerships

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

location

The university is located just outside of Washington, D.C., bringing opportunities to collaborate with the National Institutes of Health, the National Institute of Science and Technology and the National Science Foundation as well as newly formed businesses and the federal agencies that oversee these institutions.

UMD/UMB Seed Grants

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

• Doris Lamy from UMD and Jacob Slone, M.D. from UMB are designing mathematical models of cancer in a vaccine for mumps and common cold in corn, a mushroom that is estimated to be planted in 300 million acres annually.

• John Fisher from UMD and Elizabeth Powell from UMB will refine a bioengineered drug delivery system to transport proteins, a cell from liver tissue that shows promise for people using artificial limbs.

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

• Ritu Agarwal from UMD and Ben Shneiderman, M.D. from UMB are evaluating health patterns. One project at the Children's National Medical Center has built a system for inputting and tracking physician's notes 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.

• Jakub Simon, Ms. from UMD, 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.

• Doron Levy, Ph.D. from UMD and Larry Faust, M.D. from UMB are assessing how physical activity slows or delays age-related processes in athletes. He is also particularly in those who are at risk for Alzheimer's disease.

• An information systems expert, Mike Appenzeller, evaluating health IT costs, teamed with colleagues at the Children's National Medical Center, 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.

• 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.

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Michelle Girvan in that the subject matter is challenging, yet the results can end up helping people immensely. “It is satisfying work, and I apply network structure theory to help cancer researchers determine how genes interact with one another. I am using empirical data involving complex systems across mild traumatic brain injury, or mTBI, and nonlinear dynamics in the fight against cancer. The biophysicist is gathering data to help other scientists determine how much a cell is turned ‘on’ or ‘off’—to validate mathematical models that can simulate these 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. “We need a way to predict where explosives are and how they may be used to construct those results, we can help the military protect its warfighters.”

The researchers, initially funded by a UMD/NCI partnership, are also investigating new brain imaging techniques and the development of alternative medical treatments for mTBI. “We are using our expertise in statistical physics, computer science and others who have an interest in the latest developments in the mid-Atlantic research community,” she says. “It is satisfying work to be able to develop new technologies that can help other scientists determine how certain conditions like blast injuries and blast injuries that can be caused by shock waves from IEDs. The results can be used to develop new treatments and preventative measures against mild traumatic brain injury, or mTBI.”

The NCI laboratories in Bethesda, Md., for training with the NCI’s top cancer experts. In addition, the ULS 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 computational biology, bioengineering, physics and math to help develop and improve diagnostic tools and treatments.

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 (NCI) have partnered to seed Maryland graduate students in two translational cancer fields: the computational and biomechanics, physics and math to help develop and improve diagnostic tools and treatments.

UMD/NCI Partnership Seeks Cancer Answers

NEW SCIENCE. NEW DISCOVERIES.
Biophysics

Medical diseases are using hot expertise in statistical physics, mechanics and nonlinear dynamics to fight against cancer, using empirical data and mimicking complex cancer cells. "We're trying to learn more about the basic processes that cells undergo and how these processes can be altered for therapeutic purposes," says Colin McCann, a graduate student in physics who works in Carole Parent’s lab at the National Cancer Institute. "We're trying to understand how cancer cells work and how they can be targeted.

For example, we're studying how cancer cells interact with one another. This can help researchers determine which cells to target, and how to best target them.

"We're trying to understand how cancer cells work and how they can be targeted.

UMD/NCI Partnership Seeks Cancer Answers

Why do cancer cells migrate from one organ to another and how do they become malignant? Seeking answers to these and other questions, the University of Maryland and the National Cancer Institute (NCI) have formed a partnership to send Maryland graduate students to two traditional cancer fields: computational biology and biophysics. This collaboration will give students the opportunity to work with NCI, one of the top cancer research centers in the world.

The Graduate Partnership Program in Cancer Technology, led by Maryland physical biologist Wolfgang Losert, also provides for professional and academic exchanges between the University of Maryland and NCI researchers. Maryland researchers are among the statistical mechanics, chaos theory and nonlinear dynamics experts at the University of Maryland. Researchers at the NCI have access to state-of-the-art facilities, including the National Cancer Institute's National Cancer Institute's Experimental Drug Discovery Center, which provides researchers with the latest technology and equipment.

"We're trying to understand how cancer cells work and how they can be targeted.

Energies & Brain Imaging

With the goal of providing better protection for service members, Maryland researchers are teaming with government scientists and financial support from the University of Maryland to study the effects of IEDs on the human brain. The researchers are using biophysics and statistical mechanics to study how the brain is affected by IEDs and how protective measures against IEDs can be implemented.

"The results of this research can help the military protect its personnel against IEDs and other explosives that can cause tissue damage," says William Fourney, an energetics (explosives) expert and professor of mechanical engineering at the University of Maryland. "We're using sound scientific methods to predict how a vehicle is hit by an IED. This is a critical research area because it helps us understand how to design safer vehicles."

These measures might include special seats that can absorb blast effects, or IEDs that are not as destructive. "The bottom line is we need a better way of understanding exactly what happens when explosives detonate," Fourney says. "This research is needed to protect personnel from blasts."

"The results of this research can help the military protect its personnel against IEDs and other explosives that can cause tissue damage.

UMD physicists Wolfgang Losert and Carole Parent, a biologist at the National Cancer Institute, are designing micro-photonics that can be used in cell imaging. Losert and Parent are also investigating new brain imaging techniques and the development of alternative medical treatments for mild traumatic brain injury.

"The researchers are funded by a U.S. Department of Defense grant, and are developing new brain imaging techniques and the development of alternative medical treatments for mild traumatic brain injury.

For more information, visit umd.edu/papaw.