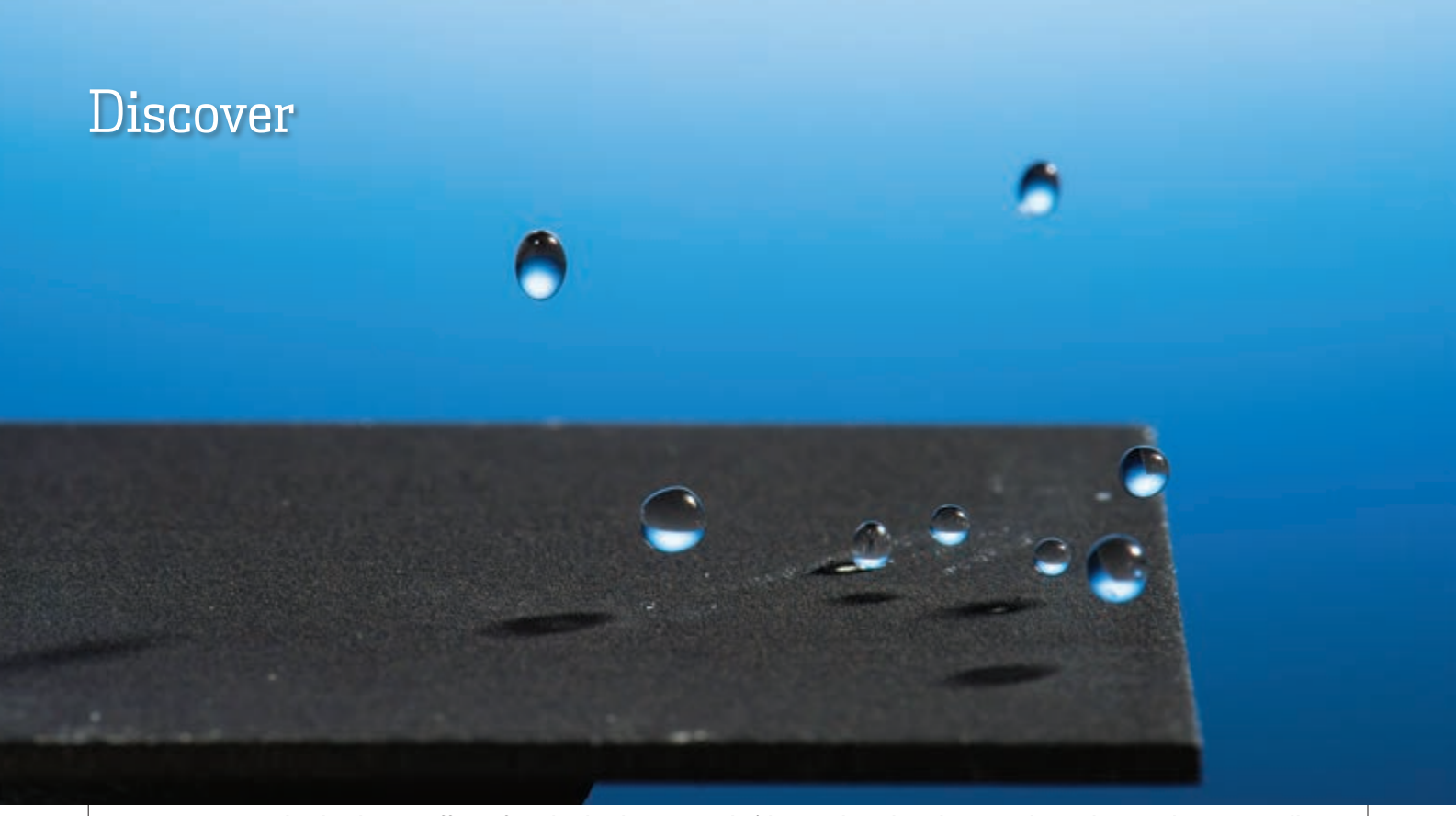

BOUNCING: Water droplets bounce off a surface that has been treated with a new laser-based process that makes metals water-repellent.

Optical Scientists Create Highly Water-Repellent Metals

Institute of Optics scientists have used lasers to transform metals into extremely water-repellent, or hydrophobic, materials without the need for temporary coatings.

Super-hydrophobic materials are desirable for a number of applications, such as rust prevention, anti-icing, and sanitation. But most current hydrophobic materials rely on chemical coatings.

In a paper published in the *Journal of Applied Physics*, Chunlei Guo, professor of optics, and Anatoliy Vorobyev, senior scientist with Guo's group, describe a laser-patterning technique that creates an intricate pattern of micro-and nanoscale structures to give the metals their new properties. The work builds on earlier research by the team that used a similar technique to turn metals black.

"The material is so strongly water-repellent, the water actually gets bounced off," says Guo. "Then it lands on the surface again, gets bounced off again, and then it will just roll off from the surface."

The work has piqued the interest of the Bill and Melinda Gates Foundation, which has supported the research, for its potential applications in collecting rain water and creating cleaner, healthier latrines in developing countries. —Leonor Sierra

Neutrinos Can Deliver 'Glancing Blows'

In what they call a "weird little corner" of the already weird world of neutrinos, physicists have found evidence that the tiny particles might be involved in a surprising reaction.

Neutrinos are famous for almost never interacting with other matter. For example, 10 trillion neutrinos pass through your hand every second, and fewer than one actually interacts with any of the atoms that make up your hand. However, when neutrinos do interact with another particle, it happens at very close distances and involves a high-momentum transfer of energy.

A new paper published in *Physical Review Letters* shows that neutrinos sometimes can also interact with a nucleus but leave it basically untouched—inflicting no more than a "glancing blow"—resulting in a particle being created out of a vacuum.

Kevin McFarland, professor of physics, is a scientific co-spokesperson with an international collaboration that carries out neutrino-scattering experiments at Fermilab, near Chicago. McFarland, who also heads the Rochester team that was primarily responsible for the analysis of the results, compares neutrino interactions to firing a bullet at a bubble, only to find that the bubble was left intact.

"The bubble—a carbon nucleus in the experiment—deflects the neutrino 'bullet' by creating a particle from the vacuum," McFarland says. "This effectively shields the bubble from getting blasted apart and instead the bullet only delivers a gentle bump to the bubble."

Producing an entirely new particle—in this case a charged pion—requires much more energy than it would take to blast the nucleus apart, which is why the physicists are surprised that the reaction happens as often as it does.

"The production of pions from this reaction had not been observed consistently in other experiments," McFarland says. By using a new technique, the team measured how much momentum and energy was transferred to the carbon nucleus—showing that the nucleus remained undisturbed—and the distribution of the pions that were created.

—Leonor Sierra and Peter Iglinski

ADAM FENSTER

Is the U.S. Slipping in Medical Research?

Once the undisputed center of global innovation in medicine, the United States is steadily losing ground to Asia and Europe—and will, if trends continue, relinquish its leadership in the coming decade.

That's the conclusion of an analysis in the *Journal of the American Medical Association*, coauthored by Ray Dorsey, the David M. Levy Professor in Neurology.

The study tracked medical research activity from 1994 to 2014 in the United States, Europe, Asia, Canada, and Australia, compiling data on funding by public and private sources, the creation of intellectual property, and the size of the medical and scientific workforce.

U.S. spending on medical research grew at an average annual rate of 6 percent between 1994 and 2004, according to the report. The pace fell sharply in the following decade, when the annual rate of growth decreased to 0.6 percent, falling behind the pace of inflation. With the exception of the temporary increases brought about by federal stimulus spending in 2009 and 2010, the last five years have seen a decrease in research funding when adjusted for inflation. Overall, medical research and development funding has declined in real terms by 13 percent since 2004.

The report highlights a move away from investing in early-stage research. The authors point out that new knowledge often takes from 15 to 25 years to go from a discovery in the lab to a clinical application in people. With the private sector moving more resources to late-stage research, that leaves the shrinking resources provided by the federal government and often very small companies as the primary sources of funding for early-stage, high-risk research.

—Mark Michaud

Discovery May Explain Why We Gain Weight

Rochester researchers believe they're on track to solve the mystery of weight gain. They've discovered that a protein, called Thy1, has a fundamental role in controlling whether a primitive cell decides to become a fat cell—making the protein a possible therapeutic target, according to a study published online in the *FASEB Journal*.

The research brings a new biological angle to a problem that's often viewed as behavioral, says lead author Richard Phipps, who holds the Wright Family Research Professorship in the Department of Environmental Medicine.

The protein was discovered 40 years ago and has been studied in other contexts, but its molecular function has never been known. Phipps's laboratory showed for the first time that when fat cells are developing they lose Thy1, suggesting that obesity could be treated by restoring the protein.

The researchers are also working to develop an anti-obesity drug and have applied for an international patent to protect the invention.

—Leslie Orr

POINTS OF VIEW: Early 20th-century postcards and other images shed light on Japan's modernization and pop culture.

Digital Humanities Project Turns Lens on Prewar Japan

A new interactive archive and research project called "Re-envisioning Japan: Japan as Destination in 20th-Century Visual and Material Culture" is now online.

Created by Joanne Bernardi, associate professor of Japanese, and developed with the help of the Digital Humanities Center, the project uses images and objects to investigate representations of Japan and its place in the world in the first half of the 20th century.

Bernardi—who first visited Japan as an undergraduate with prize money she won in a national photography competition—has documented views of the country and its modernization with hundreds of early 20th-century postcards, films, brochures, advertisements, and other objects now on display in the online archive.

"What a lot of people have in their minds about prewar Japan is rising fascism," Bernardi says. "And yes, there was that. But there was also a very vibrant popular culture."

The archive can be visited at http://humanities.lib.rochester.edu/rej.

—Bob Marcotte

COURTESY OF "RE-ENVISIONING JAPAN"