Great Grains: New AGNR Faculty Focus on Food for Maryland and the World

A crop of newly hired faculty in the Department of Plant Science and Landscape Architecture is strengthening the University of Maryland’s mission to ensure a steady supply of an important nutritional staple by overcoming disease and environmental challenges to grain crops.

Three new assistant professors—Yiping Qi, Nidhi Rawat and Vijay Tiwari—are applying genomic research in their innovative approaches to wheat and other Maryland cash crops.

“If we are to meet the demands of feeding the global population in the 21st century, new disease-, drought- and heat-resistant wheat cultivars must be developed. However, the large and complex genome of wheat makes the development of these cultivars extremely difficult and time-consuming,” says Angus Murphy, professor and department chair.

“The University of Maryland has assembled a team to enhance the ability to rapidly accelerate wheat breeding and genetic manipulation to meet this global need.”

Qi is making an impact in an exciting emerging area of biological science, in which researchers make targeted changes in the genomes of plants and other organisms.

“Genome editing is about to revolutionize biological research, medicine and agriculture,” he says.

Qi developed an upgrade to Cas9, a gene editing technology that Science magazine named “2015 Breakthrough of the Year,” by replacing the Cas9 gene editing protein with the Crispr protein. Previous groups have demonstrated gene-editing frequencies generally below 50 percent. Qi’s approach—using self-cleaning ribosomes to facilitate precise processing of the mechanism that mediates DNA targeting—resulted in 100 percent targeted mutations in tests. That translates to faster, easier plant breeding for research, he says.

“Breeding a new wheat variety takes easily a decade, but now you can cut it to maybe just a couple of years,” he says.

Rawat’s groundbreaking research targets a fungal disease, Fusarium Head Blight, that plagues the soft red variety of winter wheat common to Maryland, as well as grains worldwide.

The disease not only reduces the yield but degrades the quality of the wheat, and results in contamination with the evocatively named “vomitoxin”—strictly limited in wheat for human and animal consumption.

Supported by U.S. Department of Agriculture funding, she identified a gene, Fhbi1, that limits the disease’s spread, a discovery published in Nature Genetics. “It is a new type of resistance, and now we are exploring how the gene actually confers resistance to wheat plants against the fungus,” she says.

The fungus targets many other plants as well, so beating it will safeguard a broad spectrum of crops, Rawat says.

LESS LAND, MORE GRAIN

Tiwari is focusing on integrated genetic approaches to breeding wheat and other grains with built-in resistance to environmental challenges and biological diseases.

That, he says, will help address a central challenge for researchers and farmers: expanding crop yields.

“The population keeps growing, and we are not going to change the geography—which means less land for cropping,” Tiwari says. “What this means is that in the coming years, we have to increase crop yields almost two-fold to provide the same amount of food for everyone.”

NIH-FUNDED CENTER FOCUSES ON COMPLEX TISSUE ENGINEERING

State-of-the-art medicine can regenerate relatively simple body parts like bone or cartilage. But when it comes to complicated combinations of different kinds of tissue, state of the art is stumped.

A new $6.25 million grant will help establish the Center for Engineering Complex Tissues (CECT), a National Institutes of Health-funded Biomedical Technology Resource Center (BTRC) based at UMD to focus on advanced tissue engineering.

“Rather than just looking at bony tissues, for instance, it would be looking at vascularized bone tissue, or innervated bone tissue, or interfaces between bone and tendon and ligament,” says John Fisher, the Fischell Family Distinguished Professor and chair of the Fischell Department of Bioengineering.

Fisher will lead the center, collaborating with researchers at Rice University and the Wake Forest Institute for Regenerative Medicine, and with Dr. Curt Civin, director of the Center for Stem Cell Biology & Regenerative Medicine at the University of Maryland School of Medicine in Baltimore. It is part of the MPowering the State partnership designed to harness the complementary strengths and resources of UMD and the University of Maryland, Baltimore.

“The concept of a BTRC is that anyone from anywhere in the world can contact us and we would assist them, or they could come work in our labs,” Fisher says. “It’s truly a center that could be of use for the entire community.”

NEW TIER 1 GRANTS LAY GROUNDWORK FOR RESEARCH

The Division of Research recently announced winners of 2017 Tier 1 grants—awards of up to $50,000 to help UMD faculty and research scientists pursue sponsored research, or to support scholarship leading to a major publication.

Edward Bernat, assistant professor of psychology, is working to fund a new EEG neuromaging lab at a 120-bed Washington, D.C., residential rehabilitation center, for the project “Substance Use and Health Disparities: Assessing Brain Systems Underlying Treatment Response and Etiology.”

Taryn Devereux, Women in Agriculture program coordinator for the Department of Agriculture and Resource Economics, is working on a project in Baltimore and Lusaka, Zambia, called “HarvestLink: Connecting Farmers to Markets.”

Antony Jose, assistant professor of cell biology and molecular genetics, will examine whether changes in gene expression are passed down through generations in a study entitled “Effect of Chemicals on Transgenerational Gene Silencing.”

Jennifer Barclay, assistant professor of playwriting and performance, will work with the Woolly Mammoth Theatre Company to create a collaborative model for play development in a project entitled “Essence Work: A New Approach for New Plays.”

Susan Passmore, project director at the Maryland Center for Health Equity, will assess the impact of text messages on the health of disadvantaged groups in the study “Can Tailored Text Messages Reduce Cardiometabolic Risk Among Health Disparity Populations?”

Jessica Vitak, an assistant professor in the College of Information Studies (iSchool), will conduct a study entitled “Tracking Teenagers’ Evolving Technology Use During High School: Optimizing the Balance Between Information Privacy and Disclosure Across Rapidly Evolving Norms.”

Tier 1 grant application deadlines are in June and December. For information, visit qa.umd.edu/ facultyincentive.
HESP RESEARCHERS AIM FOR CLARITY WITH NIH GRANTS ON COCHLEAR IMPLANTS

WE'VE ALL SEEN THE HEARTWARMING VIDEOS OF YOUNG CHILDREN HEARING THEIR PARENTS' VOICES for the first time after receiving a cochlear implant. For people who've lost their hearing or were born without it, the outcome of the surgery can seem miraculous. But the technology isn't perfect, and speech can sound garbled. Now researchers in the Department of Hearing and Speech Sciences (HESP), supported by several recent multiyear research project (or R01) grants from the National Institutes of Health, are pursuing new methods to improve understanding, as well as examining how to best tune the implants for older patients.

"Part of what we're doing is helping people understand speech amid background noise, because we live in a noisy world," says MATT GOUPELL, an associate professor who specializes in psychological acoustics. "You have a really hard time going out to a noisy restaurant with your friends if you can't talk with them."

One of Goupell's projects, conducted with researchers Josh Bernstein and Olga Stakhovskaya at Walter Reed National Military Medical Center, focuses on misaligned frequency information across the two ears. A second examines how subtle loudness differences between sounds picked up by implants in each ear affect localization abilities. The goal is to perfect signal processing for easiest speech understanding.

Another NIH grant is funding a project, "Temporal Processing and Speech Understanding in Older Cochlear Implant Users," that Goupell is conducting with HESP faculty SAMIRA ANDERSON, SANDRA GORDON-SALANT and MIRANDA CLEARY.