RESEARCH ISSUE 2017

WESTERN MICHIGAN UNIVERSITY

W Magazine

Rising Stars in Research

CONTENTS

Executive Editor
Cheryl P. Roland

Managing Editors
Diana Berkshire Hearit
Paula M. Davis

Contributing Editorial Staff
Zinta Aistars
Jeanne Baron, M.A. '89
Molly Goaley
Rex Hall Jr.
Chris Killian, B.A. '01
Mark Schwerin, B.A. '79

Art Director
Kim C. Nelson

Graphic Designers
Madeleine Fojtik, M.A. '12
Debbi Kreps, B.S. '88
Shelli Osterhout

Production Staff
Sue A. Beougher, B.A. '88
Bradley Horstman

Contributing Photographers
Mike Lanka
Brian Powers
Dr. Andre Venter

Questions or Comments?
Contact Paula M. Davis at paula.davis@wmich.edu

Frequency
The *Western Michigan University Magazine* is published quarterly. It is owned by Western Michigan University, 1903 W. Michigan Ave., Kalamazoo, MI 49008-5433.

RISING STARS IN RESEARCH

The stories in "Rising Stars in Research" share a common thread. Each person displays a curiosity rooted in a passion to understand. Knowledge for knowledge sake, however, is not the driving force. Rather, the drive to explore and ask questions is to find answers that add value to the world.

This year, for instance, three professors—the most in any single year at WMU—have garnered a coveted National Science Foundation CAREER award, a top prize for early career scientists.

Those who earn the award and accompanying grant, "have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization," according to the agency.

For the individual faculty members and the University as a whole, the recognition is a high honor.

But more than that, these scientists—Drs. Wendy S. Beane, Elena Litvinova and Fahad Saeed—are generating new knowledge and real-world solutions to advance such areas as human health, nuclear physics, computing science and medicine.

And alongside the University's researchers—CAREER award recipients and others—is the next generation of ascending scientists, following in the footsteps of their mentors, learning new skills and figuring out how to use their own gifts in ways that also address some of society's most critical needs.

A handful of WMU talents are profiled on the following pages, but they represent so many others who share an innate need to explore, understand and contribute.

Uncovering an **'exciting world of discovery'**

A recipient of a National Science Foundation CAREER award—the agency's most prestigious prize for junior faculty—Dr. Wendy S. Beane is gratified that her award's associated $800,000 grant will support her study of the extraordinary regenerative abilities of certain organisms.

But equally important for the assistant professor of biological sciences are the research opportunities she will offer students.

Her own career is directly tied to an unexpectedly focus-shifting experience with scientific discovery in college.

In her last semester of undergraduate study, Beane needed one final required course to earn a bachelor's degree in English. It was a science course. And she was dreading it.

Shifting to science

"I had biology, chemistry and physics in high school and, unlike my English class, they were excruciating experiences. As a point of comparison, my English teachers were not weary like my science instructors were," she says.

But that dreaded college science course turned out to be pivotal. In it, she discovered that science was fascinating, even exhilarating. And she was hooked.

"In the same way that English excited me to do research into a piece of literature and place it within the societal context, science in the physical lab excited me," she recalls. "All kinds of questions surfaced for me that I am still seeking to answer."

Instead of pursuing a graduate degree in English, Beane took additional biology courses. She continued to advance and eventually earned a second bachelor's degree in biomedical sciences.

"The engaged professors and exciting discoveries in the lab are what hooked me," she says. "That's why this CAREER award is so important to me. I can continue my research in the lab while engaging with my students, showing them the exciting world of discovery."

The Beane lab

In Beane's research laboratory, one of the many projects underway is understanding why some organisms, like planarian flatworms, are able to regenerate the brain and nervous system, while humans cannot.

"We can cut a planarian flatworm below the head and above their tale and it will quickly grow a new head and body," Beane says.

"We are studying how these worms are able to regenerate, growing new tissues and cells. Importantly, despite their differences, humans and planarians both possess central nervous systems and have numerous genes in common."

However, unlike humans, who have limited abilities to regenerate and regrow tissues, planarians can not only regenerate, but adapt new tissues to the size and shape needed.

"It is all patterning," Beane says. "We want to understand why they can regenerate proportionally in hopes this will help us understand other species and human regeneration."

What it all means to Beane

For a pre-tenured faculty member like Beane, this NSF CAREER award is significant as it empowers a faculty member to focus on his or her research agenda with a secure source of funding.

"What this award does is it gives me one large grant that goes on for a long time," Beane says. "I have more security, more time to build my reputation, to build my research, and to get things done. It gives me a leg up in my career, research-wise."

The National Science Foundation CAREER award is unique in that it is a long-term, five-year grant. Typically, grants last three years. The CAREER award allows early career faculty to focus on building their reputation and adding to the body of research in their field.

A significant component of this award gives Beane resources that enable her to engage in meaningful educational outreach. NSF reviewers are looking for grant submissions from faculty who engage students in research.

"What this award does is it gives me one large grant that goes on for a long time," Beane says. "I have more security, more time to build my reputation, to build my research, and to get things done. It gives me a leg up in my career, research-wise."

—Beane

Before submitting her grant proposal for the NSF CAREER award, Beane ran a pilot study in a school system in Gobles, Michigan, a small town near Kalamazoo.

The pilot study included lectures, advising high school students on career options for biology majors and a practicum/lab component. In the practicum, students conducted experiments. Because Beane already was working on outreach, her proven record of involving students in research made her grant application all the more attractive.

"The lab is where the focus of engaging the students occurred," Beane says.

"In collaboration with our undergraduate biology advisor and the Gobles public school instructor, we brought in some worms and let the 85 students do experiments. After we left, the instructor kept working with the students to observe the results. They made hypotheses and waited to see what transpired."

The students loved the hands-on discovery. In fact, one of the students so loved working in the lab she decided to attend WMU to major in science. Today, she is working in Beane's lab as an undergraduate. ■

Learn more about Beane's research and how she has engaged students in that work on page 14.

An eye for regeneration

Researcher's innovation aids scientists studying a flatworm's special ability

Saad

Ever since scientists discovered the extraordinary ability of planarian flatworms to regenerate missing tissue, there has been a demand for new assays into how these animals could be used to identify potential therapies for human healing.

Now, a team of WMU researchers is providing the foundational groundwork that will help scientists take the next step in exploring the specimen's regenerative potential.

Two Lee Honors College students teamed up with Dr. Wendy S. Beane, assistant professor of biological sciences, to develop a new surgical procedure for removing the eyes of planarian flatworms and studying the mechanics of how the organs regrow.

The student duo—recent graduate Jacob Morton and sophomore Marwa Saad—wrote a peer-reviewed manuscript describing the technique, which was published in the *Journal of Visualized Experiments.* The article is also the basis of a professional video that teaches the procedure through demonstration.

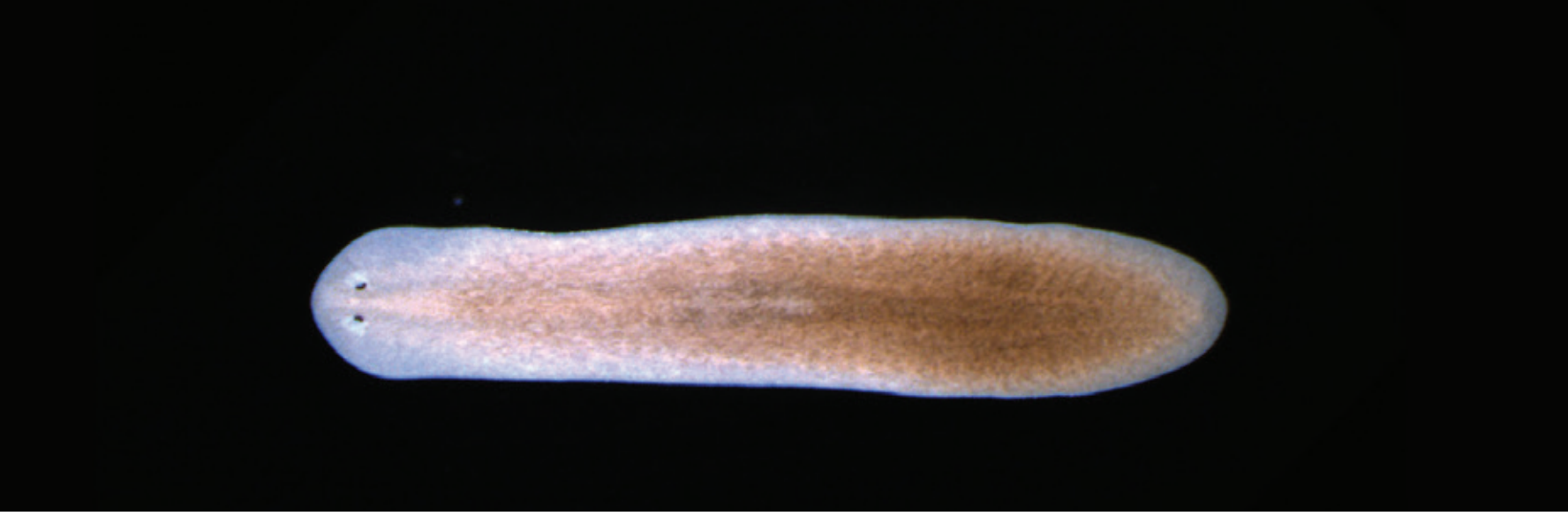
> "New techniques such as this can help scientists study the relevant tissues in the most controlled way possible."
>
> —Morton

Link to human genes

What does this research mean for humans? Planarians are known to possess genes and a nervous system remarkably similar to our own. By studying how these features react as the worms regenerate missing body parts, scientists might move one step closer in learning to grow human tissue and cells.

And these discoveries could lead to extraordinary medical advances—regrowth of an amputated limb, creating insulin-producing cells for people with diabetes or completely restoring nervous system function after a spinal cord injury. The WMU study examines eye regeneration in particular, and allows for a closer look at the mechanisms involved in visual system regrowth.

"Eye injuries and eye disease are a big health and economic problem," Beane says. "We wanted to study the genes and signals that are involved in planarian eye regeneration because they have the ability to recreate the entire eye, not just individual tissues like the retina or lens. To do that effectively, we needed a technique to remove just the eye while leaving the underlying brain and other tissues intact."



An unprecedented technique

In the past, eye regeneration has been studied primarily in the context of decapitating the flatworms.

"The process is incredible because the whole head regrows, including the brain, but it makes it difficult to tease out the mechanisms that are eye specific," Beane says.

In an unprecedented technique using insulin needles intended for diabetic cats, Beane and her students scoop out the flatworm's optic cup, leaving the brain and other tissues behind. They can then examine the regrowth activity related solely to the eye.

"New techniques such as this can help scientists study the relevant tissues in the most controlled way possible," Morton explains.

> "We wanted to study the genes and signals that are involved in planarian eye regeneration because they have the ability to recreate the entire eye, not just individual tissues like the retina or lens."
>
> —Beane

Virtual instruction

Filming of the instructional video took place at Haenicke Hall in February, with Morton and Saad in the spotlight. Beane says that recording the procedure makes the research much more accessible and eliminates the expense of travel for interested scientists.

"The video aims to increase the reproducibility of the research by physically demonstrating the technique," she says. "In other words, when a written description isn't enough, the video can take scientists step by step through the process. In the past, those who wanted to learn ablation procedures had to find someone willing to teach them, travel to a lab and watch them do it. The nice thing about this article and video is that people can get training without the expense of tracking down an expert."

In addition to being at the forefront of their research, Morton and Saad are getting the unique experience of being teachers and published journal article authors as undergraduates.

Saad, who came to WMU from Egypt on a full academic scholarship, says the process was "very exciting and important" for her. She plans to pursue a doctorate with the goal of being a researcher in the biomedical field.

Morton begins his medical education at the WMU Homer Stryker M.D. School of Medicine in August. He says having a successful undergraduate research experience will help prepare him for the work required in medical school. ■