

# Building on SUCCESS:

EPSCoR Track II Award Accelerates Research Competitiveness

A \$6 million, four-year research project to explore using sunlight to generate fuel and improve food production will be led by Nathan Hammer, associate professor of chemistry and biochemistry at the University of Mississippi.

The award is sponsored by the National Science Foundation's Experimental Program to Stimulate Competitive Research, or EPSCoR, and will be a collaboration between researchers at UM, Mississippi State University, Tulane University and the University of Alabama. Hammer is principal investigator of the project, titled "Feeding and Powering the World – Capturing Sunlight to Split Water and Generate Fertilizer and Fuels."

The scientific goals being pursued in the project are manifold. One goal is to establish technologies that can extract hydrogen from water using sunlight. Another is to establish technologies that can turn carbon dioxide into useful fuels.

A third goal is to create new materials that can make sunlight split nitrogen, a process that could advance the way fertilizers are made. The Haber-Bosch process, pioneered in 1910, is an industrial process for producing ammonia from nitrogen and



**HAMMER**

hydrogen that revolutionized agriculture by allowing the mass production of fertilizer, quadrupling crop productivity. However, this process is highly energy-intensive and requires nonrenewable resources. The ability to split nitrogen with sunlight would allow fertilizer to be produced sustainably.

UM collaborators include Jared Delcamp, assistant professor of chemistry and biochemistry, and Lori Wolff, director of the Dr. Maxine Harper Center for Educational Research and Evaluation. The project will fund postdoctoral fellows, graduate students, undergraduates and high school students.

"This grant increases our regional visibility and demonstrates that we are a sophisticated chemistry department with a growing graduate research enterprise," said Chuck Hussey, chair and professor of chemistry and biochemistry. "It also provides funds for the purchase of much-needed equipment and enables us to support a larger number of graduate research assistants and postdoctoral students."



Hammer's research awards have sponsored the placement of more than 50 undergraduate and graduate students in his research lab.

The award builds on a series of successes for Hammer, who received an NSF CAREER award in 2010 and is the principal investigator on an NSF Research Experiences for Undergraduates award that sponsors a Chemistry Summer Research Program. That award, initially granted in 2012, has been competitively renewed (1460568) through 2018 and increased to fund 10 additional student researchers per year. He was also senior personnel on an NSF EPSCoR Research Infrastructure Improvement Track-1 Grant (EPS-0903787), a collaboration among the state's four research universities administratively managed by Mississippi State University, and co-PI on a previous NSF award.

Hammer's NSF CAREER and EPSCoR Research Infrastructure Improvement Track-1 Grant have sponsored the placement of more than 50 undergraduate and graduate students in his research lab. In addition to helping advance Hammer's research work, the lab experience allows students to gain hands-on training that is essential for them to gain entry into advanced degree programs.

Undergraduates working in Hammer's lab have gained valuable experience, including traveling to national and international conferences and co-authoring research publications. Nine different undergraduate students appear as co-authors, including six as first author. Two of his former undergraduate students have received

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CHUCK HUSSEY



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Goldwater Scholarships, and both received NSF pre-doctoral fellowships at their graduate schools.

Besides the educational opportunities students gain through his research grants, Hammer encourages professional service, which he believes also benefits students. Hammer is chair of the local section of the American Chemical Society. The section received the society's 2015 ChemLuminary award for "Best Activity or Program in a Local Section Stimulating Membership Involvement" for developing a yearlong book club in which members received three titles and discussed their scientific and historic significance.

Additionally, Hammer's creation of an ACS honors banquet for students has helped spotlight success, encouraging students to strive for honors through their commitment to academics and research participation. In turn, students fuel the research enterprise as an essential part of the department's research capacity.

"I like to give students opportunities where if they can succeed, they will succeed," Hammer said. "The key is giving them opportunities."

Hammer is also principal investigator on an NSF Major Research Instrumentation grant that has been recommended for funding by the NSF. The grant will allow Hammer to purchase a new high-resolution Raman Spectrometer. The spectrometer will be housed in Coulter Hall, where renovations have greatly expanded the footprint of Hammer's lab. The Raman Spectrometer will directly benefit at least nine UM research faculty members.

Hammer credits his success in earning major awards to the knowledge he has gained through years of experience in the grant-writing process, the support of his department and the Office of Research and Sponsored Programs, and a philosophy toward his career that balances all three of the areas associated with professional advancement in academia: teaching, research and service.

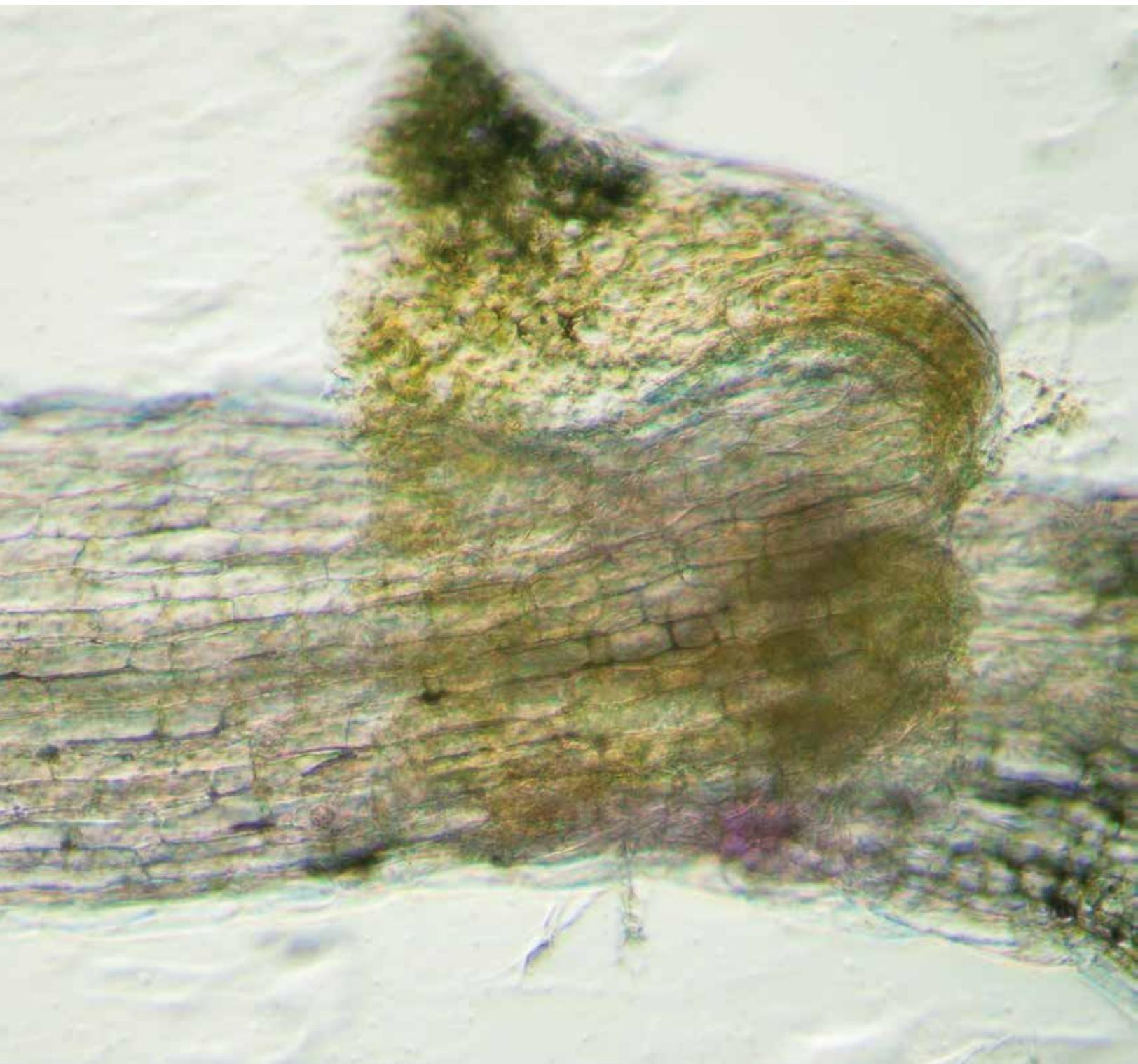
"The more you give of yourself to the university, the more successful you are in everything," Hammer said. "The more service you do, the more opportunities you create. You may think you need to be in the lab until midnight churning out data, but you also need to show students you care."

"My philosophy is that teaching and research and service are intertwined. Working in all three of those areas is critical for success in any one of those areas. Being able to help serve those in the community helps us. Teaching helps recruit students and make them good researchers."

Hammer's success benefits the entire department, Hussey said.

"Dr. Hammer is a star faculty member," Hussey said. "His positive teaching and research activities have affected all aspects of the department's mission. They also provide a positive example and encouragement for our younger faculty members as they embark on their careers."

"Feeding and Powering the World - Capturing Sunlight to Split Water and Generate Fertilizer and Fuels" is funded by EPSCoR Cooperative Agreement OIA-1539035. **CA**



and their revolutionary research

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