

BioBrief

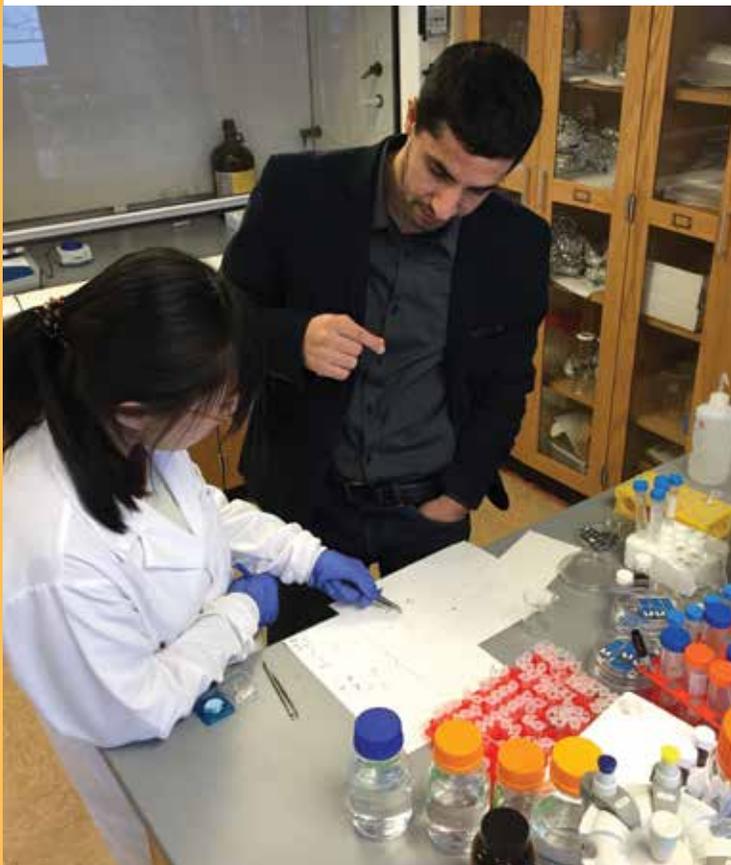


Department of
**BIOPRODUCTS AND
BIOSYSTEMS ENGINEERING**
UNIVERSITY OF MINNESOTA

BBE NEWSLETTER // ISSUE 10

EXCITING NEW TECHNOLOGIES TO IMPROVE FOOD SAFETY AND QUALITY

by RICH BRODERICK, Photos by ERIN OMBERG



Dr. Abbas reviews instantaneous microbial screening technology with graduate student Ke Xu, and her efforts to optimize this technology.

Each year, more than 30 percent – or about 130 billion pounds – of food produced in the United States goes uneaten.

The reasons for this astonishing level of waste are many. One of the principle causes is that the process of getting products from farm to table sees large quantities of food discarded due to loss of quality or risk of contamination by potentially disease-causing organisms. This latter reality is underscored by another startling statistic: every year, one-in-six Americans will suffer from a food-borne illness.

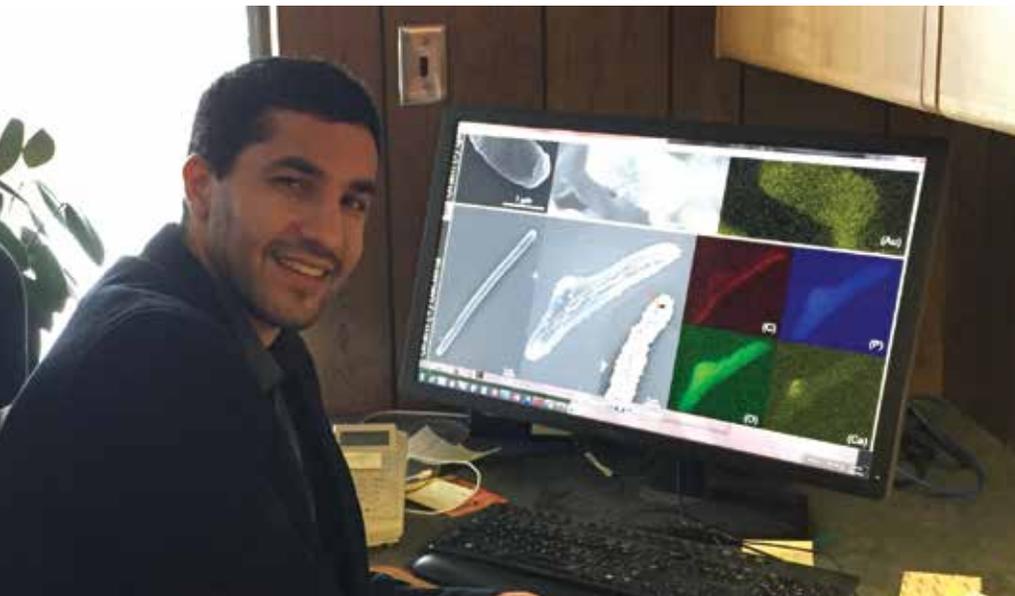
“The origin of the problem is that the food industry evolved for a long time without a corresponding improvement in food safety technologies,” explains Abdennour Abbas, Assistant Professor in Bioproducts and Biosystems Engineering (BBE) who specializes in, among other fields, the use of biosensors and bionanotechnology for food safety. “Food safety only became an important issue a few years ago because of the data on food waste and outbreaks of food-borne illness and the new and increasingly stringent federal regulations on the matter. Most of the technological development for detecting pathogens over the last decade was applied to health care – not food.”

In response to this truly unsustainable problem, Abbas is developing technologies to allow the industry to monitor food quickly and economically at every stage of production, storage, and distribution. He is not alone in this endeavor. Fellow BBE faculty members like Roger Ruan and Paul Chen are also hard at work trying to solve this problem.

One of the technologies Abbas’ research team is working on is a nitrate sensor. This allows immediate measurement of nitrate levels



EXCITING NEW TECHNOLOGIES TO MAKE FOOD SAFER AND BETTER QUALITY *continued from page 1*



Dr. Abdenmour Abbas reviews digital images of his group's latest instantaneous microbial screening technology.

in farm soil – nitrate is a critical component of fertility. In turn, these readings enable farmers to limit the amount of nitrate they apply when cultivating a field, thus limiting runoff and other potential problems caused by the substance, a chief culprit in water pollution and disease-generating algae blooms. His lab has also developed a sponge technology capable of removing mercury from water, a source of contamination that has rendered once popular species of fish all but unfit for human consumption, especially for children and pregnant women.

Once food has left the farm, food quality and safety issues change, and here again, Abbas is offering other solutions.

“In terms of food safety the number one priority is to have a technology that can detect microbes in samples in less than two hours,” he says; current methods can take from several days to a whole week, during which time a particular shipment of uninfected food might decline in quality to the degree that it needs to be discarded.

His answer includes colorimetric labels that change colors in the presence of microbes. The technology has already proven effective with milk products. Abbas expects it to find wider application throughout the food industry.

For several years now, BBE Professor Roger Ruan and his colleague, Research Associate Professor Paul Chen, have been looking for technologies that ensure safety in ways that do not have a negative impact on quality. Their search illustrates Abbas’ observations on the gap that still exists in simultaneously ensuring food quality and safety.

“Initially we worked on ensuring shelf-stability without loss of quality,” says Ruan, whose experience goes back to his employment as a researcher for food giant Pillsbury while he was pursuing his post-doctorate at the University. This experience led him to the use of NMR technology (nuclear magnetic resonance) and MRI (magnetic resonance imaging) in improving food quality and safety. These are capable of detecting quality changes even in dry packaged foods, like soup packets. What’s more, the technology can be used to predict

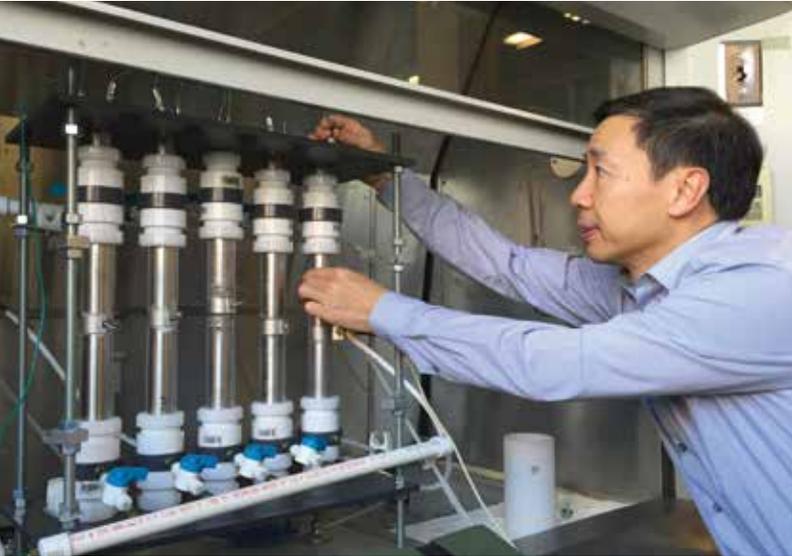
quality and safety during processing or storage of foods.

Until now, the most widely employed technique for ensuring food safety has been the direct application of heat (think thermal pasteurization) to destroy microbes and preserve the safety of food during its shelf life. Unfortunately, thermal processing not only kills microbes and fungi, it can also have an adverse effect on taste, color, and nutritional value.

Ruan and Chen are developing non-thermal plasma (NTP), intensive pulsed light (IPL) and concentrated high intensity electrical field (CHIEF) technologies as effective alternatives to thermal processing. To date, equipment that generates NTP and CHIEF operates on DC current, making the cost prohibitively high for use in large-scale food treatment. To counter this potential stumbling block,



Dr. Roger Ruan next to his patented Concentrated High Intensity Electric Field (CHIEF) liquid disinfection system.



Research Associate Professor Paul Chen using the tubular non-thermal plasma (NTP) system. The NTP system can be used for non-thermal treatment of powder and gas.

Ruan’s team has developed systems that employ AC current – and that can process food without using inserted electrodes, which can be the source of contamination.

“We have a lot of interest in this.” Ruan says. In fact, they are currently working with a local company to develop such a system. He has also received significant USDA funding to develop the technology further. “If it works as we think it will, we can apply it industry-wide.”

The research conducted by Abbas, Ruan, Chen and other BBE faculty place the department in the forefront of confronting one of the major challenges facing the country – and the world. As Abbas says, “This problem is becoming an important political, social and economic issue. The department is developing technology essential to making the University a leader in food safety and quality.”

For more information on the labs featured in this article, visit their research websites at the following:

www.biorefining.cfans.umn.edu

www.abbaslab.com

NOTE FROM THE DEPARTMENT HEAD



Dear Colleagues, Alums, Friends and Stakeholders,

Greetings! Wish you all a happy and healthy New Year! We are off to a good start in 2016.

Thanks to Erin Omberg and others, we are pleased to roll out another edition of our newsletter. In this issue, we highlight some of the outstanding food-related research being done by our faculty, students and alumni. We are very grateful to The Schwan

Food Company, a great Minnesota based leader in the food industry, for establishing a graduate fellowship and several undergraduate scholarships for students studying in the areas of food safety and food engineering. Thank you!

Special congratulations to Elizabeth Alonzi, one of our undergraduate engineering students, for winning the Global Food Challenge program supported by Land O’ Lakes Corporation and being selected as one of the Emerging Leaders. Please read the article on Elizabeth to learn more.

Please join me in welcoming our newest faculty Dr. Pete Marchetto. He comes to us from Cornell and has expertise in the areas of sensing and sensors, robotics and their applications to agriculture and the environment.

We are also pleased to extend a special welcome to Ms. Marlee Mollet who will be helping us with number of important activities including student recruitment, retention, placement, scholarship coordination and working with advisory council and external stakeholders. Marlee has a wealth of experience advising students at the high school level.

Our new Sustainable Systems Management undergraduate major got off to a good start in the Fall. With Marlee, Erin and faculty help we are continuing to develop promotional materials and marketing of this

program. We are looking forward to significant growth and success in this program.

Our senior capstone class is underway with 34 students enrolled and several challenging projects suggested by our industry and stakeholders. We are thankful for all the industry partners who suggested great ideas. If you come across a project opportunity in the future please do keep this in mind. Our spring capstone design show featuring student projects is scheduled for Wednesday, May 4th, 2-5 pm. Hope you can plan to attend and help evaluate the student projects and recognize them for all of their hard work.

We are in the process of making scholarship awards to our incoming students for next year. Thanks to your continued generosity and support we are hoping to continue a strong scholarship support program for our students. Your contributions are making it possible to support the highly qualified and deserving students. Please visit our web site www.bbe.umn.edu/Giving to learn more about how you can help and make a difference.

Improving our facilities and infrastructure continues to be one of our key priorities. We are working with our advisory council, donors and the University in making the necessary improvements as soon as possible.

I would like to thank you again for continued support. Please do drop by when you get a chance. Hope to see you here on campus on May 4th, if not earlier.

Sincerely,

Shri Ramaswamy, Professor and Department Head

SCHWAN FOOD ESTABLISHES BBE GRADUATE FELLOWSHIP

On September 1, 2015, Dimitrios Smyrniotis, CEO of The Schwan Food Company and chairman of Schwan’s Corporate Giving Foundation, announced a new investment in University of Minnesota. Within this investment our Department of Bioproducts and Biosystems Engineering will benefit from the support from Schwan’s Corporate Giving Foundation for scholarships in the College of Food, Agricultural and Natural Resource Sciences (CFANS), including nutritional and food-safety research programs for students working toward their PhDs. The first recipient of the Schwan Food Fellowship is PhD student Snober Ahmed, advised by Dr. Abdenmour Abbas.

“We are excited and proud at The Schwan Food Company to deepen our relationship with the University of Minnesota,” said Smyrniotis. “This investment reinforces our commitment to advancing healthier communities and promoting youth education and leadership development within our home state of Minnesota.”

“We’re very happy that The Schwan Food Company and the Foundation have chosen to support our students in such a significant way,” said Brian Buhr, dean of CFANS. “Targeting these scholarships toward students studying food science, food safety and engineering will help ensure Minnesota continues to play a leading role in an ample, sustainable, safe food supply.”

In regards to the first BBE Fellowship award due to Schwan Food Company’s generosity, Dr. Jeff Varcoe, VP of Food Safety and Quality shared, “As a part of our overall investment in the University of Minnesota, we are excited and proud to have The Schwan Food Company and Schwan’s Corporate Giving Foundation collectively sponsor a graduate fellowship in food safety within the Bioproducts and Biosystems Engineering Department. We believe the work that Ms. Ahmed will be doing under the direction of Dr. Abbas has the potential to revolutionize the food and agricultural industry by creating cost-effective, highly sensitive methods for detecting food-safety concerns.

At The Schwan Food Company, safety is our highest priority, and we look forward to seeing the results of this work. Foods are subjected to a variety of microbiology tests to determine if they meet food-quality and food-safety specifications. The work being conducted by this University of Minnesota team could enable the food industry to complete these tests in the matter of hours, which is a fraction of the time it takes today. We expect that this research will give food companies

timely food-safety data so potential problems can be addressed more quickly or, if no problems are found, reduce the time it takes to release product into commerce. Additionally, we believe this project will give food companies more flexibility and help reduce the handling and storage time for foods being tested.

This research project has the potential to drive a tremendous amount value into the food industry, which is why we are energized to support it within Schwan’s Food Safety & Quality and Product Innovation & Development departments. We are looking forward to seeing the results of Dr. Abbas’ and Ms. Ahmed’s hard work.”

To learn more about the first recipient of the Schwan Food Fellowship PhD student Snober Ahmed, see the adjacent page (5) for her spotlight article.



Pictured left to right: Stacey Fowler Meittunen, SVP Product Innovation & Development with the Schwan Food Company; Snober Ahmed, first recipient of the Schwan Food Company Graduate Fellowship and BBE Ph.D. student; Dr. Shri Ramaswamy, BBE Department Head and Professor; Jeff Varcoe, VP Food Safety & Quality with the Schwan Food Company; Julie Simonson, VP Research & Development with the Schwan Food Company.

GRADUATE STUDENT PROFILE

SNOBER AHMED

Photo by John Brockgreitens



Doctoral Student and
 Nanotechnology Enthusiast

Where are you from and what is your educational background?

I am from Pakistan, specifically the city of Lahore located in the northeast part of the country. I did my Bachelor's degree in Biochemistry and Biotechnology from the Institute of Biochemistry & Biotechnology, University of the Punjab,

Quaid-e-Azam Campus, Lahore. Then I pursued my Masters in Biochemistry from the same institute, and currently am pursuing my PhD at UMN with BBE.

What are your research interests?

Nanotechnology has inspired me from the beginning of my undergraduate studies. I am interested in using nanotechnology in combination with various fields like immunology, biochemistry and molecular biology. The combination of these fields will help me in developing biosensors and antimicrobial surfaces. I am also interested in studying the interaction between biological molecules and materials at the nanoscale.

Why are you interested in this research and what lead you to do this research?

Nanotechnology is a rapidly growing field. The multidisciplinary use of nanotechnology has made it more attractive. I entered this field by using nanoparticles in targeted drug delivery. This short introduction to the field made me excited to explore nanotechnology in detail. To accomplish this goal, I joined Dr. Abdennour Abbas' research group. The Abbas Research Group is focused on developing biosensors using nanotechnology. In addition to this, the other area of research includes bio-nanotechnology. After getting here to UMN and exploring my niche through this vast field, I have become more passionate about nanotechnology.

In what ways have the Schwan's Fellowship Award affected your studies and research?

First of all, I would like to thank the Schwan Food Company for their support. It has enabled me to look at real world problems. It is really an exciting opportunity for me to develop something that helps address the challenges faced by the industry. In addition, it is a unique opportunity to interact with the industry while in a graduate school. This fellowship will help to bridge the gap between demands of industry and academic research.

What are your future goals upon graduation from UMN?

After successful accomplishment of my PhD degree, I will be seeking a job in the research and development sector of companies or as a postdoc at different universities.

What is your favorite thing about the BBE department?

My favorite thing about BBE is the multidisciplinary research that is being conducted here. It offers a wide range of research interests and backgrounds. This unique combination can help to efficiently transform research into useful technologies.

ALUMNI PROFILE

ANITA HALL



Class of '78
 Food Engineer at General Mills

Where are you originally from?

I am from Waconia, MN where my family owned and operated a full service gas station.

What was your major and why did you choose it?

My major was Food Engineering. I chose engineering because my brother in-law suggested it. Bob is a Mechanical Engineer who at the time was working on the Apollo program. He told such fascinating stories about what he did. I was flattered that he thought I could be an engineer too. I looked into Mechanical Engineering but the one field that caught my eye was Food Engineering - I liked the idea of making food for people. An interview with Dr. David Thompson, the department chair at the time, sealed the deal.

Where are you currently employed and what is your position?

I started at General Mills right after graduation and I am still here today. I saw an ad in the Star Tribune that General Mills was hiring engineers, so I walked in the front door and filled out an application. Over the years I've had many different roles. I currently work in a group called Process Systems Development. We are tasked to design processes to manufacture the many different foods that our R&D groups develop. It sounds very simple but it is wonderfully complex. We need to consider food safety, human safety, manufacturing efficiency, reliability, sustainability, timing, financing and of course the product has to taste great too. General Mills is involved in so many sectors of the marketplace: frozen pizza, yogurt, snacks, soups, vegetables, and cereal, just to name the main ones. Each project is unique and even after all these years, I still have fun and I'm still learning.

What is the most rewarding part of your work in this position?

I get to work with great people and make really good products. I still get a kick out of seeing the products that I've worked with on the grocery shelves and, when no one is looking, I have been known to straighten our products on the shelves.

What are some important concepts/skills you learned while earning your degree that have enhanced your career?

Learning requires tenacity, good humor and a willingness to seek help when something isn't clear. This is where I admit that I wasn't a straight A student - in fact, I got straight Cs my first quarter. But thanks to Dr. Thompson and many patient teaching assistants, I learned that if I stuck with it and asked good questions, I could master topics that initially seemed out of reach.

What do you miss most about the BBE department?

I get back to campus often so I don't miss it too much. I like that BBE is a small department within a huge university. And, the campus is beautiful. I grew up on the edge of a small town, so the farms and fields and green space on the St. Paul campus always felt like home. The small size also means that the professors know your name and it's easy to drop by to chat.

UNDERGRADUATE PROFILE

ELIZABETH ALONZI

Photo courtesy of Land O' Lakes



BBE Sophomore, Food Engineering
Land O' Lakes Emerging
Food Security Leader

Where are you originally from?

I'm from Bloomington, Minnesota.

Where did you attend high school and what led you to the University of Minnesota?

I went to high school at Bloomington Jefferson, and I originally chose the

University of Minnesota because I was interested in Chemical Engineering.

How did you discover the Global Food Challenge fellowship opportunity?

I discovered the Global Food Challenge through the Associate Dean of CSE, Susan Kubitschek. I volunteered for a student panel she was hosting and worked in the CSE office over the summer, and she told me about the Global Food Challenge program, which she had been a mentor for the previous year. I went home that night and started working on my application.

How did you discover BBE and decide on your major?

I discovered BBE while in CSE 1001. I was talking with my CSE 1001 professor about how I didn't think Chemical Engineering was quite the right fit for me; people liked it for how broad the major was, but I knew I wanted to work with bioproducts for green applications. I was discussing maybe adding a sustainability minor to help focus it more when my professor (Ulrike Tschirner, if you haven't guessed yet) looked at me and said, "You know, we have a major for that."

What goals would you like to accomplish while experiencing your LOL GLC fellowship?

I, and I believe all my fellow Emerging Leaders, are in the program primarily for one reason: to help solve world hunger. Yes, I'm excited to get an inside look into a Fortune 500 business, yes I'm excited to meet with agricultural policy makers, and yes, I am most definitely excited to go to Africa and learn about the real situation of global agriculture, but these are all just great benefits of the position. I am in the program to accomplish exactly what I applied for: to make a difference in the sustainability of global agricultural practices.

What are you most looking forward to as part of your Food Challenge experience?

While the program is just beginning, I've really enjoyed what I've gotten to do so far! Attending the Global Food Prize in Des Moines was an amazing experience, and getting a chance to talk with Land O'Lakes CEO Chris Policinski was really incredible. Talking to someone who is so knowledgeable and successful presents a truly unique opportunity to learn from both an academic and professional standpoint.

What are you most looking forward to as part of your Food Challenge experience?

I am most looking forward to traveling to Africa, where I will be able to learn firsthand about the issues African farmers face in agricultural production and thus will be able to develop a more focused solution.

What was it like attending the World Food Prize and the Borlaug Dialogue in Des Moines?

Attending the World Food Prize was truly an awesome experience. Being surrounded by hundreds of people who are fully invested in solving the major issues facing global agriculture today inspires you to work even harder. Some of it was just unbelievable: at one point I was sitting just a few feet from the former President of Malawi!

What has been your favorite course or project at the U so far?

I really enjoy organic chemistry! I really like the focus on theory in Ochem II, but I also am really enjoying my organic chemistry lab this semester. It's a lot of fun!

Have you had any other internships or research experience?

This will be my first internship experience. As to research, my organic chemistry lab is research oriented (it combines the regular organic chemistry lab with the advanced organic synthesis lab) and I will be researching with my Ochem II professor Chris Douglas this spring.

Are you involved in any student groups on campus?

Sadly, my class schedule this semester prevents me from being really involved in any student groups. However in the past I've been active with the American Institute of Chemical Engineers, the Society of Women Engineers, and the University Honors Student Association.

What are your career goals after graduation?

My career goal has always been to work on developing sustainable solutions to global issues. I'm directing my college experiences to try and peruse the various fields I could go into: I've studied abroad looking at alternative energy, I'm taking this internship to look into agricultural production, etc. I'll see where my experiences take me and decide from there.

What are some of your hobbies outside of school?

I like glass working! I have a stained glass window that I've made and a lot of fused glass bowls, coasters, and more. I also love to play the saxophone, watch John Oliver and Chopped, and follow politics.

What information would you share with prospective BBE students interested in pursuing a degree in BBE?

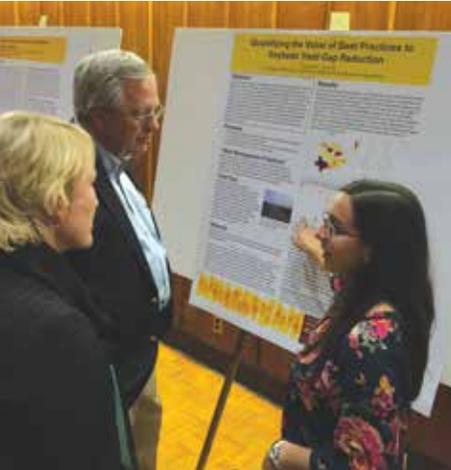
BBE is really a great major to have right now. I've had a lot of recruiters look at my resume and say, "Bioproducts and Biosystems Engineering? What's that?" It gives you the perfect opportunity to explain what you're studying, why it's important, and what you hope to accomplish with what you're learning. The employers I've talked to are always very intrigued and excited to learn about the field because there is huge push in industry to "go green," and BBE students are uniquely qualified to bring an environmental perspective to more traditional engineering work. Also, I love that the major is a little smaller. You get to have your classes with a lot of the same people, so you make a lot of really good friends that you can also study with!

What information would you share with BBE students interested in pursuing a fellowship such as the one you're experiencing?

Apply to internships where your interests lie, even if you're not superbly qualified. If you are truly passionate about the work you want to do, it will come through in your application. Employers will look at you, because the information you don't know can be taught on the job, but passion cannot. Just apply and see where it leads you.

To view Elizabeth's Land O'Lakes online student profile, and to watch her Global Food Challenge Fellowship application video, visit z.umn.edu/LOLalonzi

ANNUAL BBE SHOWCASE



Shantal Pai shares information on her poster titled, "Quantifying the Value of Best Practices to Soybean Yield Gap Reduction," a poster co-authored by BBE faculty Dr. Jason Hill.

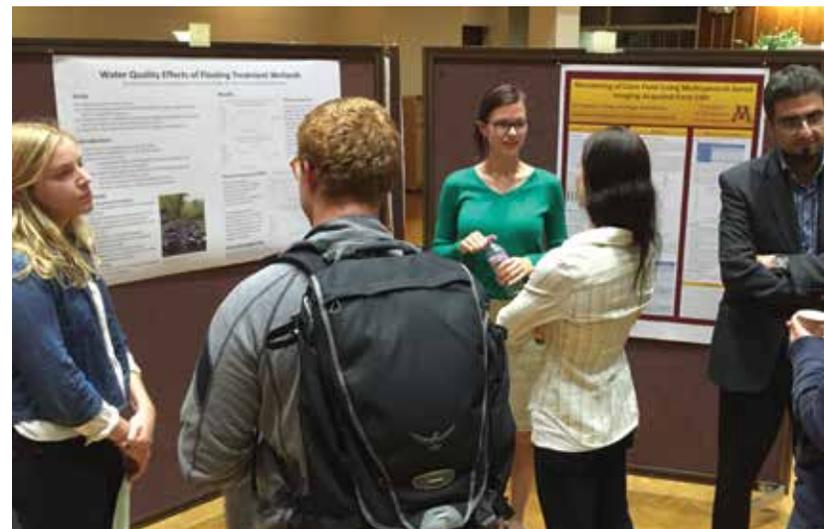
This fall's Annual BBE Showcase was held on October 8, 2015 in the North Star Ballroom of the St. Paul Student Center. As part of the Showcase day, the Department of Bioproducts and Biosystems Engineering held a luncheon which recognized undergraduate scholarship recipients, as well as graduate student fellowship recipients.

As part of the luncheon, a keynote speech was given, this year by Raj V. Rajan, PhD. P.E. Dr. Rajan is the Vice President of Research, Development and Engineering for Ecolab Inc, out of Eagan, Minnesota. His keynote was titled, "Water: At the Nexus of Safe Food, Abundant Energy, and Healthy Environments."

The day concluded with a networking and poster session that featured the cutting-edge and creative solutions which department researchers and students are taking part in. A record-setting total of 58 posters represented five research categories: (1) Bioproducts and Renewable Energy, (2) Advanced Building Systems and Energy Efficiency, (3) Environment and Ecology, (4) Food Production Processing, Safety and Security, and (5) Sustainability.



L to R: Department Head Shri Ramaswamy; Advisory Council Board Chair and CEO of Viking Forest Products Bruce Johnson; Dr. Raj V. Rajan, VP, Ecolab Inc.



Undergraduate Research Assistant Bailey Rockwell (L) and Graduate student Emily Deering (C) share their poster, "Water Quality Effects of Floating Treatment Wetlands," also co-authored by BBE faculty Dr. Joe Magner, Dr. Lawrence Baker, and Dr. Chris Lenhart.

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BioBrief Issue 10: Winter 2016