LSU

Department of
Biological & Agricultural
Engineering

SPRING 2019 NEWSLETTER

DEPARTMENT HIGHLIGHTS

Update From the Department Chair

The BAE Department has had a very successful year in research, with Drs. Boldor, Astete, Sabliov, and Monroe receiving major awards. Sponsors such as NSF, USDA/AFRI, Board of Regents, and NIH have awarded the department $6.5 million for various studies over the next three to four years. There have been 25 recent refereed journal publications, and BAE's student numbers are stable with nearly 311 undergrads, six graduate students, and nine PhDs, with the majority of the latter now enrolled in the BE PhD program. BAE has 16 undergraduates in the Fast Path BS/MD/PhD, with one attending LSU Health Sciences Center in New Orleans. Our students continue to excel in graduate studies, medical school, and the public and private sector.

BAE has made four new hires in the last four years, and we anticipate significant growth in our programs with these new hires. We were fortunate to receive a 3% raise pool this year and hope this trend continues as we bring our salaries back in line after many years of budget cuts. Next year, we will expand the ongoing assessment process for accreditation in 2020–2021 for the BS program. The lengthy a-k assessment matrix has been revised to a more straightforward 1-to-7 list.

The Advisory Council is very active now and meets with us three times a year to assist with development, capstone design, and growth targets for the programs. The faculty has been engaged with their usual duties of teaching, research, and service, and we are now looking at offering graduate (MS level) courses online via LSU's growing online program. This is a multi-year effort, and we will start with a post-baccalaureate certificate type of program as a base for the full MS. Return on this investment will add to our modest budget as these programs become available.

— W. David Constant

Update From the Graduate Program Coordinator

The Graduate Program in Biological and Agricultural Engineering is growing. We currently have 11 PhD and four MS students enrolled in our program. With the newly added PhD in Biological Engineering and the addition of new faculty, not only is the number of students increasing, but so is the diversity of our student population. Tissue engineering, cancer biology, numerical simulations of biological systems, and cell-free systems are a few of the new areas available for our students to pursue during their graduate studies. We are pleased to see that Fulbright and self-funded graduate students and visiting scientists from various parts of the world, including Cameron, Egypt, Honduras, Iran, and Romania, decided to join our department for various periods of time over the past year.

Every month, graduate students meet and enjoy each other's company during a department-funded working lunch. It is a great opportunity for the students to share experiences and learn from each other. Occasionally, invited speakers discuss topics of interest with the students. We welcome BAE Alumni to interact with our students and use the meeting to share knowledge, guide students, and possibly recruit our students for internships or full-time positions at their respective companies/organizations. If you would like to learn more about the graduate program, email BAE Graduate Coordinator Dr. Cristina Sabliov at csabliov@lsu.edu.

Update From the Undergraduate Program Coordinator

This has been an exciting semester for the undergraduate program. We had about 50 graduates in the 2018 calendar year who are now pursuing professional or graduate schools or working in industry around the country. Some students have moved to England for graduate school, some moved to an island for a job, and many have started their career. We had our largest group ever—a little more than 100 students—come to Fall 2018 orientation. This led to the largest BE 1251 Introduction to Engineering Methods (new version of BE 1250) course with 116 students. Thank you to all alumni who were interviewed for the BE 1251 career assignment!

With the new assistant faculty and the hire of Dr. Kevin Hoffseth (see below for his biography), new design electives are now offered, including Cancer Biomaterials taught by Dr. Martin; Industrial Molecular Biotechnology taught by Dr. Kwon; and Mechanics of Biological Composites taught by Dr. Hoffseth.

We had several BE Distinguished Communicators graduate in 2018. Congratulations to:

May Graduates

- Beatriz Garcia
- Calvin Rome
- Grace Bingham
- Katie Render
- Olivia Derise

December Graduates

- Cameron Larks
- Jeanne Steyer

Congratulations to Sheila Mallenahalli, Caroline Bergeron, Angelle Leger, Spencer Lemoine and any other current seniors who have been accepted to medical schools, professional schools, or jobs upon graduation! If you have any internships or full-time positions you would like to share, please email Nick Totaro at ntotar1@lsu.edu.

Meet the Faculty

Dr. Kevin Hoffseth

Assistant Professor

PhD, University of California—Santa Barbara, 2018

Dr. Hoffseth's research is targeted at the intersection of biomedical engineering and mechanics of materials, investigating deformation and fracture in cortical bone tissue under indentation and cutting. His work seeks to clarify the mechanistic phenomena of clinical indentation data seen in developing bone health diagnostic instruments and to assist in prediction and prevention of unintended bone tissue damage sustained during orthopaedic operations. Dr. Hoffseth appreciates fishing, baseball, and spicy foods, and is excited to part of the LSU campus.

Spring Awards Banquet

Join us on the evening of April 9, 2019.

If interested in joining, please contact Nick Totaro at ntotar1@lsu.edu for more information.

Scholarships awarded:

Carl H. and Christine F. Thomas Family Scholarship
Wiley D. Poole Memorial Scholarship
Harold T. Barr Memorial Scholarship
Mansel M. Mayeux Honorary Scholarship
Scott – Windham Scholarship
Charles E. Severance Endowed Fellowship
Richard L. Bengtson Endowed Scholarship
William H. and Barbara A. Brown Scholarship
Albert P. Halluin Memorial Scholarship
ASABE Scholarship
BESO Awarded Mailander Scholarship

BAE Advisory Council

Mission

The mission of the Advisory Council is to advise the Chairperson and the faculty of the Department of Biological and Agricultural Engineering on matters pertaining to academic quality and stature of the department. It will provide counsel on how the department and college can improve relationships and meet the needs of students, industry, commerce, government, and the society through best utilization of available resources. This includes actively supporting the department's development efforts in securing additional resources through individuals and industry.

1 Year Goals

- 15 active members on Advisory Council
- 30 networks of alumni for internships

2 Year Goals

- Industry partners with senior design projects
- Progressively advance funds

Save THE Date

All alumni are invited to the first Alumni Network Reception on April 26, 2019, in the E.B. Doran breezeway from 4:30 to 6 p.m. This event will be a great opportunity to reconnect with past professors and meet current BE students and other BE alumni.

If any alumni are interested in joining the BAE Advisory Council, please email Chairperson Nick Gerbo at ngerbo1@gmail.com.

DEPARTMENT NEWS

LaHouse Celebrates 10-Year Anniversary!

Amid 250 celebrants on July 8, 2008, the green ribbon was cut and tours commenced at LaHouse Home and Landscape Resource Center, a permanent high-performance housing educational exhibit, attraction, and outreach program of the LSU AgCenter and BAE funded largely by gifts and donations from more than 300 supporters. It was created to provide a one-stop source of research-based information on here-and-now housing solutions to the challenges of the Gulf Coast region climate, natural hazards, and environment, from low-cost to premium options.

"It's fulfilled that purpose for 10 years and is now even more relevant and valued by its users than ever before," declared Dr. Claudette Hanks Reichel, LaHouse director and LSU AgCenter Extension and BAE professor. "So, we're celebrating with a series of special events and offerings, including an appreciation program last July for the supporters who helped, LaHouse Anniversary Open House Saturdays for the public, and "$10 for 10 Years" continuing education seminars for professionals."

LaHouse was strategically designed to demonstrate how to achieve five integrated benefits—**resource-efficiency, durability, health, convenience and practicality**. These serve as a criteria of sustainability, and a standard for "high-performance" home and landscape.

"That means, with the power of knowledge, it's truly doable to enjoy high comfort with low energy bills; breathe easy with healthy air quality; and have control of your future with a storm-resilient, quality-built home and secure financial asset," Dr. Reichel said.

The exhibit house includes four climate-tailored building and foundation systems; three high-efficiency HVAC systems; and a wide variety of materials, products, assembly methods, and technologies with green, healthy, and low-maintenance characteristics. The layout and interiors exhibit family-friendly "universal design for life" features that accommodate diverse and changing needs and abilities.

Some of the high-performance features you can see in LaHouse via its cutaways, models, and displays with point-of-feature signs about each special feature and its advantages include:

- Advanced framing, engineered wood products, and panelized and insulated concrete building systems
- Flood-hardy restoration and building systems and materials
- Wind-tested roofing; hurricane connectors; impact-rated windows, shutters, panels and screens; hurricane and tornado storm shelters
- Multiple lines of defense from Formosan termites—steel mesh barriers, rock beds, chemical barriers, and borate-treated woods and insulations
- Long-life, cool roofing and attics; three solar PV systems
- Insulation alternatives in strategic applications; and a wide array of Energy Star-rated, appealing LED and CFL lighting, windows, doors, appliances, and fans
- A geothermal heat pump, dual-fuel air source heat pump, tankless water heater, hydronic heating systems, and efficient ductwork within conditioned space (four methods)
- Indoor air quality features—four types of dehumidifiers, controlled fresh air ventilation, sealed combustion fireplace, quiet exhaust fans, and low VOC paint; smooth floorings
- Universal design kitchen and bath layouts with storage, fixtures, appliances, curb-less shower, and tub with cantilever seat and air jets
- Low-maintenance, long-life exterior and interior finish materials, Louisiana art, and more

The sustainable landscape has a walking trail and plant identification signs with Louisiana horticulture exhibits, storm water management features to prevent pollution, integrated pest management features, and more.

What else?

- LaHouse is open for self-guided tours Monday-Friday, 10 a.m.-4:30 p.m., and periodic seasonal Saturday events as a public service. A suggested donation of $5 is appreciated to help support exhibits and programs.
- Free print materials on many topics are available at LaHouse. A wealth of information is also free at www.lsuagcenter.com/lahouse, www.youtube.com/mylahouse and www.facebook.com/mylahouse
- *Building Your High Performance Home—Gulf Region Homeowners Guide* is available in print ($15), and the content is free in articles on the LaHouse Resource Center website.
- LaHouse Mobile, a traveling supplemental exhibit, shows additional features, materials and methods to improve existing homes.
- To find the sources and attributes of nearly everything in LaHouse, visit the online keyword searchable LaHouse Product and Services Contributors Directory at www.lsuagcenter.com/LaHouseProducts

"It's not about building a home of the future," Dr. Reichel said. "It's about shaping the future with homes that are not only beautiful and marketable, but also keep comfort affordable; save money, time, toil, and grief by preventing damage and loss from hurricanes, floods, termites, mold, and decay; create healthy and safe living for people of any age; protect our environment for future generations; and benefit our communities, nation, and planet."

LaHouse Resource Center was made possible by the generous support and involvement of many. Major sponsors include Mrs. Paula Garvey Manship, Entergy of Louisiana, the Borate Treated Wood Alliance of U.S. Borax, Osmose and Louisiana Pacific, Building Science Corporation, the Louisiana Home Builders Association, Roy Domangue (LaHouse builder) and RoyOMartin Lumber Company. The U.S. Department of Energy and Louisiana Department of Natural Resources were primary partners with grant and contract support.

For more information about LaHouse Resource Center and its programs, visit www.lsuagcenter.com/LaHouse.

Lima Honored by ASEE With Chester F. Carlson Award

LSU Biological and Agricultural Engineering Professor Marybeth Lima was recently presented with the Chester F. Carlson Award by the American Society for Engineering Education in recognition of her work as an educator.

The award consists of a $1,000 honorarium and plaque and is presented annually to “an individual innovator in engineering education who, by motivation and ability to extend beyond the accepted tradition, has made a significant contribution to the profession.” It is named for Carlson, who invented xerography, which is the process of dry copying using electrostatic charges to transfer printing halftones to paper.

One of Lima’s more notable achievements during her career is the creation of the LSU Community Playground Project, which celebrated its 20th anniversary this year. The service-learning program brings together first-year engineering students with elementary school students to design and build playgrounds at local public schools. To date, the program has led to the construction of more than 30 playgrounds.

Additionally, ASEE representatives noted that Lima has published and presented widely on community engagement in engineering, “leading to this education innovation being used throughout the engineering profession.”

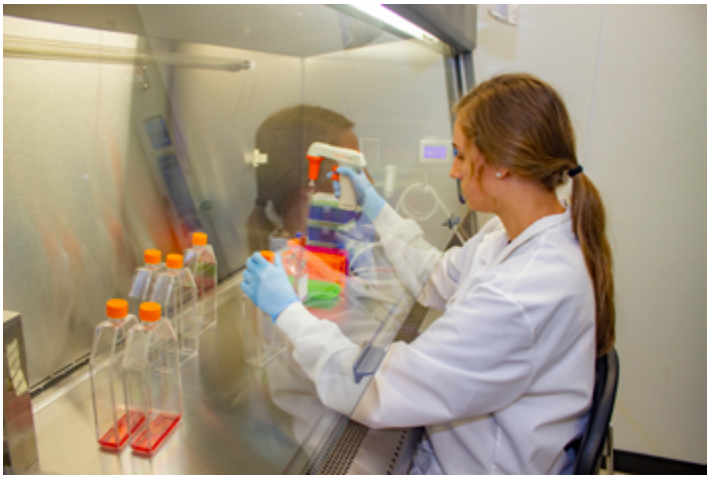
In fact, earlier this summer, Lima was named editor of the *Journal for Community Engagement and Scholarship*, a peer-reviewed international publication through which faculty, staff, students, and community partners disseminate scholarly works. JCES integrates teaching, research, and community engagement in all disciplines, addressing critical problems identified through a community-participatory process

The first issue under her leadership was published this fall.

BAE Students Analyze Breast Cancer Cells to Improve Treatment

With an estimated 266,120 cases of breast cancer expected to be diagnosed by the end of 2018, research on the disease is more important than ever.

In fact, each study further contributes to eradicating a cancer that affects one in eight women in the United States each year. Aiding in this challenge are LSU Biological and Agricultural Engineering Assistant Professor Elizabeth Martin and a team of BAE students who are working to identify how breast cancer and stromal interactions lead to drug resistance, which can help doctors discover the best, individualized treatments for their patients.



“Overall, we want to think outside of the tumor itself and see how the environment facilitates cancer progression,” Martin said. “So, instead of just looking at the cancer cells, what else is there that’s different?”

The environment around a breast cancer tumor consists of matrices, collagens, adipose (fatty tissue), and stem cells. Tests have shown that a person’s stem cells can enhance cancer, making the cancer cells more drug-resistant and invasive. What Martin and her team don’t know, is how the stem cells in breast tissue are affected by cancer.

“It’s not just a one-way street,” Martin said. “There must be a lot of cross-talk, where the cells are talking back and forth.”

to expose the cancer secretome to stem cells to see if there is a phenotypic change—that they are not the same as the cells not exposed to the secretome of cancer cells. So far, he has found that there are changes.

“Their ability to become different cell lineages is different, and there’s a difference in the amount of adipose,” King said. “Our job is a very tiny building block on this extremely complex system.”

BAE junior Gracie Miller of Geismar, Louisiana, has found that since cancer cells can make their own matrix, there is a correlation between certain types of matrix genes and the outcome or survival of patient samples.

In order to communicate to one another, tissue cells “talk” to their environment by releasing, or secreting, proteins. The secretome, as it’s called, not only affects the cancer cells, but also the cells around them. LSU BAE graduate student Connor King of Baton Rouge works in the H.D. Wilson Laboratory

“Meggie Lam [BAE senior from Hammond, Louisiana] is taking those specific secreted matrix proteins and over-expressing them in cancer cells to see, if they start making this matrix, what happens when they grow on it?” Martin said. “Does it alter the way they respond to chemotherapy? That way, you

can tell if someone has this less identified matrix and whether or not that will dictate how they're going to respond to therapy. It gives you another level for identification on how the tumor may respond beyond traditional prognostic markers for breast cancer."

Prognostic markers for breast cancer include estrogen and progesterone receptors. Cancer cells with these receptors depend on estrogen and hormones, such as progesterone, to grow. ER+ means estrogen is likely causing the cancer cells to grow. Depending on what the markers are, a patient will need endocrine therapy, chemotherapy, or an HER2 (human epidermal growth factor receptor) inhibitor, in addition to therapy or removal.

"They're not always accurate, though," Martin said. "For ER+ patients, 40-45% of individuals develop resistance or have de-novo resistance, which means they were already resistant and they're not going to respond to therapy. So, if we can add another layer of markers, like if you have this estrogen receptor but also have a specific collagen up, that may be indicative of more drug resistance. If we can identify what induces drug resistance, then we have another layer of identifying how a person will respond to treatment."

BAE PhD student Ethan Byrne of Walker, La., works alongside King and Lam in the lab, placing cancer cells on different matrices instead of growing them on a flat dish. He has seen that there are different response profiles, depending on what the cells are growing on, which demonstrates that not all tumors are created equal.

"The idea is, if you have cells that respond better on fibronectin versus laminin to a particular therapy, then you can say tumors with high fibronectin should respond best to that therapy," Martin said.

Helping further explain why there is no cure-all for breast cancer, Martin says each tumor is different, especially with breast cancer.

"It's so heavily related to the environment, the individual and what specific mutations brought it that way, such as a person's age, BMI, race, etc," she elaborated.

The next step for Martin and her team is validating the tumor samples by showing the correlation between the patient's tumor type, matrix and other components.

"Right now, we are just cells in a dish," she said.

As for how long it will be before doctors are able to start pursuing more individualized treatment plans for breast cancer patients, Martin says they are already heading in that direction.

"They're already moving toward this idea of patient precision medicine," she said. "If you want to know how to treat someone, you have to treat that individual on their entire genetic background. However, it's super expensive and they need to have someone analyze all the data. But if you can find a couple of other indicators, in addition to traditional ER, PR, HER2 presence, then we can say we are moving closer to that ideal."

STUDENT HIGHLIGHTS

Congratulations to These 11 BSBE Fall 2018 Graduates:

Brad Barksdale
Tyler Chaves
Logan Daigle
Anndia Donahue
Jordan Gros
Aaron Hargrove
Mary Klapperich
Cameron Larks
Jeanne Steyer
Bradley Villars
Evan Wilson

Fall Senior Design Presentations

The Design of a Chill Spray System for the Reduction of Pathogen Load on Fresh Shrimp
Advisor: Dr. Subramaniam Sathivel

3D-Printed Drug Delivery Implants for Canine Osteomyelitis Treatment
Advisor: Dr. Kevin Hoffseth

3D Model of Lung-Based Hydrogel for Metastatic Breast Cancer
Advisor: Dr. Elizabeth Martin

Gait Analysis of Long Distance Running Using a Drone
Advisors: Dr. Marybeth Lima and Ms. Ashley Flynn

Design of a Stratification Interface Seeking Mixer
Advisors: Drs. David Constant, Chandra Theegala and Louis Thibodeaux

Radical Board Design for Left and Right Cardiac Catheterization
Advisors/Sponsors: Drs. Philip Jung, Kevin Hoffseth, and Ochsner Hospital

Tamper-Proof Automated Pill Dispenser
Advisor: Mr. Nick Totaro

Automated Flow Control System for Cellular Diagnostic Microfluidic Devices
Advisor: Dr. Todd Monroe

Artificial Tree Pump to Enhance the Transpiration of VOCs
Advisors/Sponsors: Drs. Chandra Theegala, David Constant, and Mr. Scott Bergeron

Myringotomy with Tympanostomy Tube Insertion Simulator
Advisors/Sponsors: Drs. Yongchan Kwon, Kevin Hoffseth, and Michael Dunham (LSU HSC)

Pressure-Sensitive Limb Liner for Below the Knee Amputees
Advisors: Dr. Marybeth Lima and Mr. Nick Totaro

Porous Membrane for Non-Contact Communication of Breast Cancer and Adipose Stem Cell Lines
Advisors: Drs. Elizabeth Martin and Adam Melvin

Phantom Project

Moore 3D Prints First Full 'Human' for Radiation Therapy Research

At just 1 year old, she is 5 feet 1 inch tall and weighs 15 pounds. She can hold 36 gallons of water for up to eight hours. She has a detachable head but remains faceless. Her name is Marie, and no, this is not her online profile.

For the past year, LSU Biological and Agricultural Engineering senior Meagan Moore of Baton Rouge has been working to 3D print the first actual-size "human body" for radiation therapy research. The Phantom Project, also known as Marie, will help test radiation exposure on a real-size human to figure out the best angle for dose distribution.

"Phantoms have been used in medical and health physics for decades as surrogates for human tissue," Moore said. "The issue is that most dosimetric models are currently made from a standard when people of all body types get cancer. No personalized full-body phantoms currently exist."

While current phantoms cost $40,000, have no limbs, and don't represent every body type, Marie represents an entire human body that is more realistic and only costs $500 to create. Using 3D scans of five real women that were procured from the Pennington Biomedical Research Center, Moore developed a lifelike female phantom made of bioplastic that can be filled with water to establish varying density similar to a patient.

"I specifically wanted to work with a woman because, in science, women typically aren't studied because they're considered complex due to a variety of reasons," Moore said. "I want a person with the most complex geometry."

It took 136 hours to print Marie in four sections on the BigRep printer in LSU's Atkinson Hall. To connect the sections, Moore used a combination of soldering, friction stir welding, and sandblasting. She even used a hammer and chisel at times to take off chunks of plastic without damaging Marie. The main trouble was figuring out where to put the pipe for dose measurements. It ended up going down the midline from her head to her pelvic floor.

In order to test the phantom on multi-million-dollar equipment, multiple water tests first had to be conducted. During each test, 36 gallons of water were poured into Marie to see if she could hold that weight for 4 1/2 hours. Moore then im-

provised by using a PVC pipe to catch the “dribbles” that were coming out of some areas.

“This process always makes me nervous, but I know it won’t burst because it has roofing sealant covering it,” Moore said. “The way Marie is shaped also helps.”

Prior to the water testing, Marie was coated with liquid latex and purple roofing sealant for protection. Why purple sealant?

“Purple was on sale,” Moore said. “Turns out the color matches LSU and the University of Washington. She also wears her anti-skid LSU socks.”

Meagan Moore adjusting Marie modelThis past October, Moore brought Marie to the UW Medical Cyclotron Facility in Seattle, where researchers were interested in testing fast neutron therapy on her. This type of therapy—a specialized and powerful form of external beam radiation therapy—is often used to treat certain tumors that are radio-resistant, meaning they are extremely hard to kill using X-ray radiation therapy.

“UW and Oregon Health and Science University came onto the project very recently,” Moore said. “I built a coffin for Marie to get shipped in. I gave workers and handlers a thorough write-up on how to take care of her.”

Marie’s trip was brought about by LSU Medical Physics Program Director and Professor Wayne Newhauser, who not only served as Moore’s mentor on the Phantom Project, but also knew researchers on the West Coast who would be interested in the project.

“The initial idea for the whole project wasn’t completely my idea,” Moore said. “Dr. Becky Carmichael [LSU Communication Across the Curriculum science coordinator and TEDxLSU speaker coach] told Dr. Newhauser that he should talk to me. I met him at his TED Talk, where he did a presentation on 3D printing and how it’s interfacing with science. Since I had just started doing 3D modeling of my own, I showed him my 3D prints. This project took off from his work with breast cancer and computational modeling.

“One reason I like working with Dr. Newhauser is he is good at finding the yes’s,” Moore added. “That’s what pushes each project into existence. Not just having an idea, but the action behind the idea. That’s the kind of environment I like working in, where we can make something happen.”

Art and Science

Moore enrolled at LSU as a BAE student this past fall because she felt the discipline was a platform where she could combine art and science.

“This project started from the art perspective, then became science,” said Moore, who initially wanted to double major in art and science before discovering BAE. “I love talking about the interface between art and engineering because I think it’s really important for how I exist in the realm of science in a lot of ways.”

Moore’s love of science began at a young age, studying fish otoliths with an LSU graduate student while she was in the seventh grade and obsessively attending science fairs.

“I always knew I wanted to do science,” she said. “I was making art with some of the science I was doing and eventually realized I was just tap-dancing around doing engineering. The biomedical engineering environment just kind of came together, and I thought, ‘This is what I’m already doing. This is what I’m supposed to do in life.’

“I created an interdisciplinary role for myself by taking a little bit longer to work on my degree,” she continued. “I’m able to work in a lot of different programs and use a lot of tools. I would love to get a degree and move on, but I learn differently, and if I can share in the process while I’m learning, that’s kind of an incredible setup.”

As for Marie, whose name is a combination of Marie Curie (radiation researcher), Marie Antoinette (detachable head), and Marie Laveau (purple symbolism), Moore hopes personalized replicas of her will be created and used in the medical field to more precisely treat cancer patients.

“What I’d like to see for this project is the research to be used as foundational work to personalize cancer treatments for people with more complex treatments,” Moore said. “Children and breast cancer patients have really differing morphology that is usually very difficult to treat. I find that the more we learn about any body, the more complex it’s going to be. We’re still getting medicine wrong on a lot of levels. We have a lot to learn.”

Alumni Highlight

Dr. Kevin Mis Solval, former graduate student at Biological and Agricultural Engineering and School of Nutrition and Food Sciences, joins the University of Georgia

Dr. Kevin Mis Solval, former graduate student of Dr. Subramaniam Sathivel, joined the Department of Food Science and Technology at the University of Georgia as an assistant professor of food engineering. Dr. Mis Solval obtained both M.Sc. and PhD degrees at LSU. Much of his PhD study involved developing co-current and counter-current spray drying computational fluid dynamics (FD) simulations to predict the quality of fish oil microencapsulated with egg white hydrolysates powders. When he was a student at LSU, Dr. Mis Solval also assisted Dr. Sathivel with several seafood processing projects, including a method developed to improve the peeling operation of shrimp. He has published 17 manuscripts and has given several presentations at the Institute of Food Technologists' (IFT) annual meetings. He received first place for presenting a paper at the 2012 Graduate Student Paper competition of the IFT-Refrigerated and Frozen Division. In 2010, He received a Louisiana Gulf Coast Section of the IFT Scholarship to attend the IFT Annual Meeting. He also received a 2013-2014 IFT Feeding Tomorrow General Education Scholarship. Before Dr. Mis Solval joined the University of Georgia, he worked as an assistant professor of biological and physical sciences at the University of Holy Cross in New Orleans, from July 2015 to August 2017. Subsequently, he joined Angstron Materials—Global Graphene Group in Dayton, Ohio, as a drying process engineer (https://www.linkedin.com/in/kevin-mis-solval-phd). Dr. Sathivel and his students would like to congratulate Dr. Mis Solval on his new job and wish him continuous success in his professional career development.

Summer Research Highlight

Joseph Penrod's REU Experience

1. Please tell us about yourself.

Joseph Penrod, (rising) senior chemical engineering student at Trine University.

2. What was your motivation to participate in the REU program at LSU?

I plan on getting my PhD after I graduate and wanted to get some experience and insight into what it would be like to research at another university.

3. What was your expectation and anticipation of the REU project?

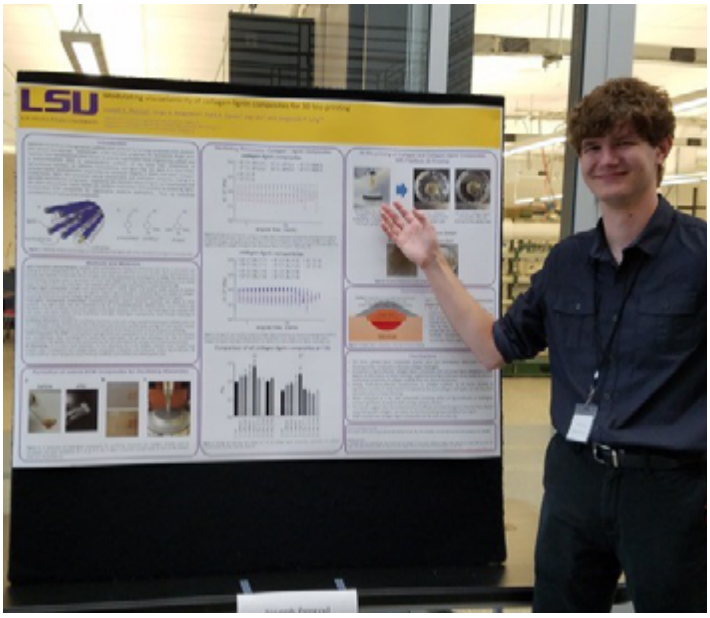
I was expecting to be given new opportunities to grow my skills and to learn more about what graduate life would be like. I was nervous at the start because I didn't know whether or not I would live up to what was expected of me, but Jorge Belgodere (the grad student I worked with) did a great job of helping me out and making sure I knew what I needed to do.

4. What was the most difficult task? What was the most interesting/fun task?

The most difficult part of the program wasn't any particular task, but rather when you think you do everything right and the results don't come out right, or you try to synthesize something and it just doesn't work. And conversely, the most fun I had was when I finally figured out what was going wrong with a given experiment and was able to fix it.

5. Please tell us about your research experience with the people in your lab.

Everyone I worked with in lab was great. I had the most direct contact with Jorge and Akbar, since they were working on the same project as me for most of the time I was there. But even the people I wasn't directly working with were friendly and helpful. There was a strong sense in the office that we were sort of like a family, all helping each other out.



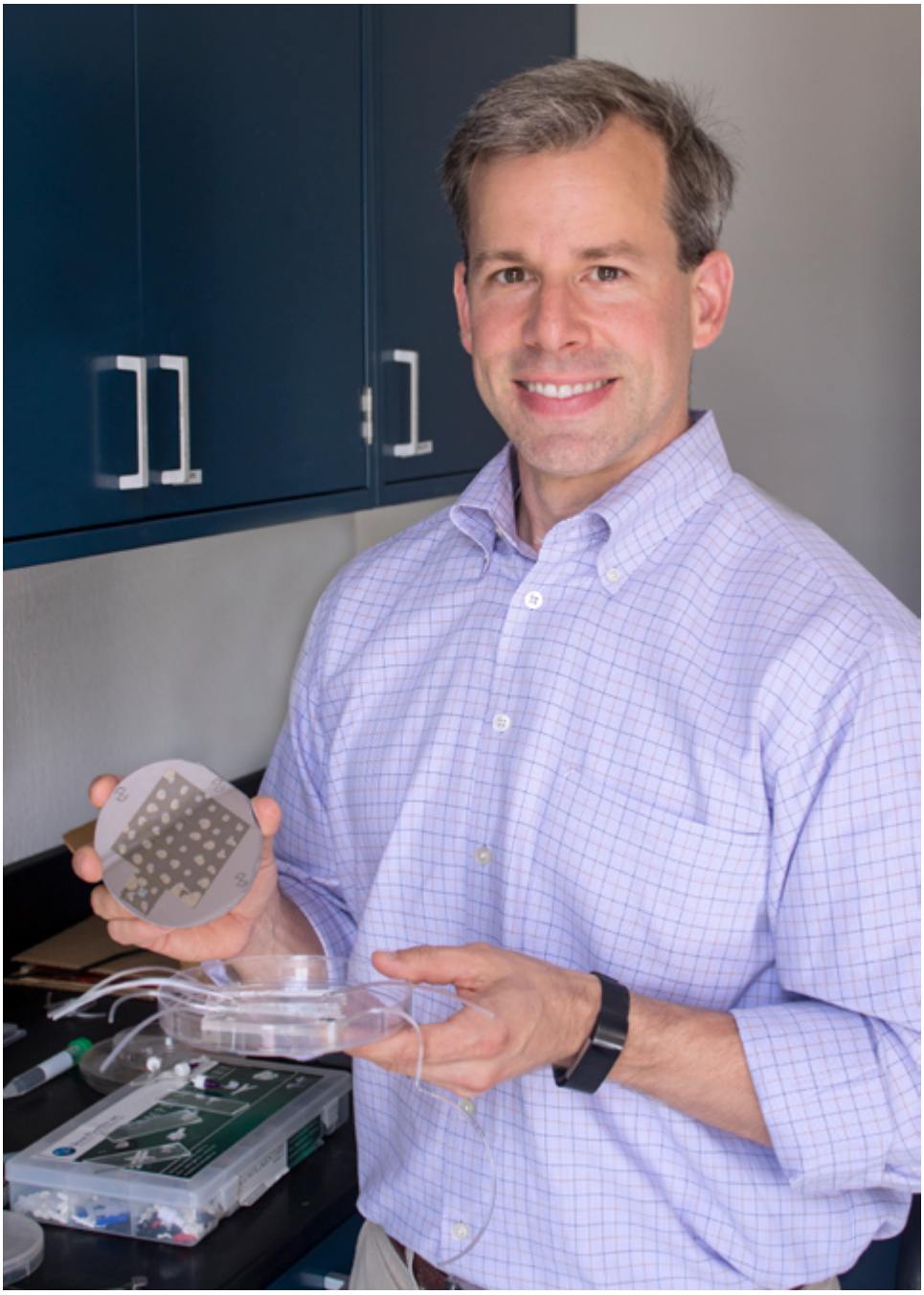
Penrod's contribution to the project will be included in the upcoming paper from the Jung Laboratory, which is also a funded project from the NSF EPSCoR program (PI: Dorin Bolder). The paper focused on characterizing lignin as biomaterials for stem cell scaffold and tissue repair. Lignin is a plant extracellular matrix component responsible for structural support and water transport. However, lignin has not been appreciated in tissue engineering and regenerative medicine applications. Toward this goal, the Jung Laboratory investigates lignin composites for biomaterials by assessing mechanical properties, cytotoxicity, immunogenicity, and 3D bio-printability. Penrod's graduate mentor, Belgodere, presented these results (oral presentation) at the Biomedical Engineering Society Annual Meeting in the session of Natural Biomaterials (Session Chair: Philip Jung) in Atlanta on October 19, 2018.

Join Us

Please join us for poster presentations on April 11 at 4:30 p.m. in the LSU Union's Cotillion Ballroom, and final presentations on April 23 and 25 at 4:30 p.m. in 1245 Patrick F. Taylor Hall. For more information, please contact Nick Totaro at ntotar1@lsu.edu.

RESEARCH HIGHLIGHTS

BAE Professor Todd Monroe and Collaborator, Professor Terry Tiersch, Received a $2 million NIH Grant



BAE Professor Todd Monroe and collaborator Professor Terry Tiersch at the LSU AgCenter's Aquatic Germplasm and Genetic Resources Center recently received a $2 million National Institutes of Health (NIH) grant to use microfluidic and 3D-printing technologies to develop devices and methods for cryopreserving cells. Monroe and Tiersch have collaborated for more than a decade to create devices to facilitate the study of zebrafish sperm cells. Zebrafish have become an important biomedical research model, with more than 30,000 genetic lines created to date across the globe. Realizing the value in these genetic resources, NIH has made their cryopreservation a priority, where frozen sperm cells can be shipped to collaborating facilities and are more cost-effective to maintaining than live fish. Evaluation of zebrafish sperm is challenging due to the small sample size and that they only swim for about a minute. Monroe recalls an initial discussion with Tiersch where they agreed that microfluidic devices created in the Monroe BAE Labs, those that control the flow of fluids in channels smaller than the diameter of a piece of hair, would be ideal to study the motility of zebrafish sperm in the Tiersch AGGRC labs, where this swimming behavior is the standard assay for quality of cryo-

preserved samples. Monroe notes that “without the help of several talented BE senior design teams, who over the past several years have developed micromixers, microelectrode sensors, microfabrication methods, and new total-analysis microfluidic chips, this work wouldn’t have been possible.”

BE undergraduate students apply the fundamentals of Computer Aided Design (CAD) they learn in Monroe and Totaro’s BE1251 class to not only design these microfluidic chips, but also simulate their performance using Computational Fluid Dynamics (CFD), which saves time and money in fabricating these tiny structures. 3D printing has also been harnessed to quickly fabricate prototypes for freezing and analysis of sperm cells, which has roots in the BE 1251 class, where students design and then 3D print their final projects. Tiersch and Monroe recently reported that the polymer filament used in most 3D printers, poly-lactic acid (PLA), has superior material properties at cryogenic temperatures in that it does not become brittle and shows little change in shape and strength when submerged in liquid nitrogen. This discovery has led to several PLA devices they have designed for freezing, including holders for sample vials, loops to rapidly freeze a thin film of cells, and even a conveyor system that moves sample vials held in a chain over liquid nitrogen to achieve a specific freezing temperature protocol. Through the four-year NIH grant, Monroe and Tiersch will create such devices and protocols and then send them for beta-testing at renown collaborating partner facilities, such as ZIRC—the Zebrafish International Resource Center in Eugene, Oregon—where the goal is to disseminate these technologies to biologists in laboratories and repositories worldwide. The hope is that these devices will enable the standardization of cryopreservation, improving quality control, and maintaining these valuable resources for biomedical research.

Kevin Hoffseth Presents Cone and Wedge Indentation of Cortical Bone

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