DISCOVER NEW WAYS TO EXPLORE U-M BME RESEARCH

RESEARCH AREAS

BIOMECHANICS & MECHANOMICS
COMPUTATION & MODELING
ENGINEERING EDUCATION
NEURAL ENGINEERING
MOLECULAR TECHNOLOGY & MOLECULAR ENGINEERING
IMAGING & BIOPHOTONICS
REGENERATIVE MEDICINE

CLINICAL APPLICATIONS

CANCER
IMMUNOLOGY
CARDIOVASCULAR
NEUROLOGICAL DISORDERS
SKELETAL / ORTHOPAEDICS

TECHNOLOGY

IMAGING

MOLECULAR IMAGING
FUNCTIONAL & PHYSIOLOGICAL
MULTISCALE MODELING
SYSTEMS BIOLOGY

COMPONENTIAL

CELLULAR

3D CULTURE
BIOMECHANICS & MECHANOMICS
IMMUNOTHERAPIES
MOLeCULAR, CELLULAR, & TISSUE DIAGNOSTICS
HISTOTRIPSY
NEURAL INTERFACES

DEVICES

SINGLE CELL ANALYSIS
GENE AND DRUG DELIVERY
CARDIOVASCULAR
CELL TRANSPLANTATIONS AND THERAPIES

http://bme.umich.edu/explore-research/
Incubators are common among entrepreneurs to nurture and develop a new product, application, or business idea. Assistant Professor Aileen Huang-Saad is also applying the concept to biomedical engineering practice – and to engineering education – through a novel “instructional incubator” and series of short, experiential courses.

The goal of the instructional incubator is multifaceted: To expose undergraduate and graduate students to diverse career opportunities in and outside academia and, for those who are considering academic careers, to help them gain teaching and curriculum development skills. Employers, too, benefit from BME job candidates who have acquired a set of capabilities rare among BME programs.

“Colleges and universities are realizing the growing need to train a workforce that is innovative and entrepreneurial-minded,” says Huang-Saad, the Department’s first tenure-track faculty member in engineering education who also co-founded the College of Engineering Center for Entrepreneurship. “Many programs are more broadly emphasizing hands-on, team- and problem-based learning to increase student engagement and development.”

Huang-Saad was inspired in part by her own non-traditional path, leaving academia to work in industry and returning as teaching faculty. Along the way, she observed plenty of changes — limited numbers of faculty positions, increased competition for funding, and many BME and other engineering students who don’t necessarily want to move into more traditional faculty positions. “We need to prepare them to for a multitude of careers, not just academic research,” she says.

MATERIAL SYNTHESIS

Many students agree, reporting that finding jobs can be challenging and, once they do begin working, they notice a gap between what they’ve learned in school and industry needs and expectations.

Huang-Saad believes the gap in part results from the fact that “students have to take many courses in other disciplines – physics, math, biology, for example – before they take ‘BME’ courses.” Often, that’s not until their junior year. “And then we have limited time to help them synthesize and integrate all of that material and learn about the actual field of BME. We’re not doing as well as we could be,” she says.

Committed to transforming how engineering programs teach, Huang-Saad wanted to do something to bring more hands-on courses to the first- and second-year program. Yet, the facts remain: Faculty tend to come from varied disciplines, often outside of BME, and many have never worked in industry or been mentored as instructors. Few have experience guiding students through the project-based, interactive courses that might provide an edge in the job market.

The situation led her to ask an important question: How do we get discipline-based engineering faculty – faculty who trained as engineers – to understand more about student learning so that they can impact engineering education? “How do we capitalize on the wealth of talent we have here at the university right now?” she asks.

CAPITALIZING ON THE WEALTH OF TALENT

The answer, at least in part, lies in the new incubator course (BME 499/599), in which junior and senior undergraduates, graduate students, post-docs, and faculty conceive of new first- and second-year courses. These one-credit “BME-in-Practice” courses help synthesize BME material and impart important professional engineering skills.

The incubator, first taught in Fall 2017, teaches students about learning, including learning theories, pedagogy, instructional design, constraints when developing curricula, and more. For their final project, student teams develop a curriculum for a one-credit experiential course for first- and second-year students. The following semester, incubator participants, a.k.a. “apprentices,” are given the opportunity to teach the courses they’ve developed.

The resulting courses, developed in Fall 2017 included:

• Introduction to Neural Engineering and Modeling
• Building a Tumor, an Introduction to Tissue Engineering

“COLLEGES AND UNIVERSITIES ARE REALIZING THE GROWING NEED TO TRAIN A WORKFORCE THAT IS INNOVATIVE AND ENTREPRENEURIAL-MINDED”

- Aileen Huang-Saad, PhD
The Biomedical Engineering department formally became a joint department of the U-M College of Engineering and the Medical School in 2012, just five years before celebrating its 50th anniversary in 2017. But the spirit and impact of the collaboration that spurred its founding five decades ago continue at an ever-increasing pace today.

At the heart of the Department’s many collaborative efforts lie clinicians’ desire to offer new and better solutions to their patients and engineers’ passion for applying their knowledge to solve important health and medical problems.

Take Jacqueline Jeruss, MD, PhD, a surgical oncologist who treats benign and malignant breast disease. An investigator focused on breast cancer biology, she’s also an associate professor of BME. “Once a patient becomes metastatic, that’s when what I as a surgeon can offer to patients falls into the background.”

That disheartening situation led Jeruss to ask, “If I can’t help these patients anymore through my surgical practice, what can I do in the lab?”

The answer: Quite a lot. Jeruss works with William and Valerie Hall Chair and Professor Lonnie Shea (the two also are married) to better understand the cellular changes that lead to metastasis and to devise new methods for detection.

Drs. Jeruss, Shea, and other collaborators have been working to engineer pre-malignant niche sites – areas in other parts of the body that are “primed” to shelter and nurture metastatic cancer cells. Engineered niches offer opportunities to observe how and where cancer cells travel, paving the way for new detection systems and therapies to thwart the process.

What enables such collaboration? “The real opportunity here is having a top-10 engineering school and a top-10 medical school co-located,” Shea says.

“Michigan is very unique in that it’s an incredibly collaborative environment, not just within a department or division but across the schools and colleges,” adds Dr. William Roberts. “It’s very simple and easy to pick up the phone and call someone in BME, talk about a problem and start to develop a research relationship.”
FOUNDATION OF COLLABORATION

The seeds of collaboration between what is today the BME department and the U-M Medical School were sowed in the 1960s. At the time, faculty from both schools were already working together on joint projects such as nuclear imaging, prosthetics, and signal processing in neurons.

Other early research included electrophysiological studies by Daniel Green that informed our understanding of how humans see in changing light. The work of Clyde Owings, who held appointments in both Pediatrics and BME, led to specialized medical care of abused children, including through the Child Abuse and Neglect Clinical and Teaching Services program he established.

A testament to the many joint projects between the Bioengineering Program and the Medical School, during a difficult time for the Program in the late 1970s, two Bioengineering faculty with Medical School appointments launched a letter-writing campaign. More than 20 distinguished faculty from nearly a dozen medical specialties responded by sharing their strong support.

Among the many fruitful research efforts of that era were development of the “spherocentric knee,” an early ball-in-socket, rather than hinge, design that more closely imitated typical human knee motion by David Sonstegard, Herbert Kaufer, and Larry Matthews. Groundbreaking work by Dr. Robert Bartlett on a new system — extracorporeal membrane oxygenation — provided life support to infants and children with acute respiratory failure. The now famous “Michigan probe,” a multi-channel neural probe still widely used in brain research, was developed by Kensall Wise and David Anderson.

SEEKING OPPORTUNITIES

Further cementing collaboration in the early 1990s, then Bioengineering Program Director Charles Cain encouraged faculty from the College and the Medical School to propose joint research to the Whitaker Foundation. Their efforts resulted in a Special Opportunity Award in 1994.

Building on its success, two years later the newly formed BME department – thanks in part to Cain’s continued efforts – won a $3 million Whitaker Foundation Development Award to support its growth and continued collaborative work.

Research at the time included co-development of gene-activated matrix technology for wound repair by Steven Goldstein and Jeffrey Bonadio and in situ tissue engineering, which has become an important research technology. Work by Lawrence Schneider on the biomechanics of automotive injuries has led to improved crash-test dummy design and vehicle occupant safety, and advances in ultrasound and multimodal imaging by Paul Carson have led to improved imaging safety and effectiveness.

CREATING A SUSTAINABLE AND TRANSLATIONAL MODEL

With the aim of advancing promising joint engineering and medical research projects from the laboratory to market to clinical settings, in 2005, the Department won a $5 million Wallace H. Coulter Foundation Translational Research Partnership Award, one of only nine universities in the country to do so.

Matthew O’Donnell, BME chair from 1999 to 2006, was thrilled about the award. As he said in the Department’s history, Biomedical Engineering at Michigan: A Product of Vision and Persistence, “…how wonderful, especially for our junior faculty, to be exposed to a world where you don’t just write papers, you put out a device or process or new molecule that people will actually use in the clinic.” The program provided funding for four collaborative clinician-engineer teams in its first year alone.


Five years later, given its strong track record, U-M received an endowment through the U-M Coulter Partnership for Translational Biomedical Engineering Research. This time, U-M was one of only six universities nationwide to receive the $10
BME STUDENT RECEIVES NSF GRADUATE RESEARCH FELLOWSHIP

First year Ph.D. student Kritika Iyer has been selected to receive a fellowship from the 2018 National Science Foundation Graduate Research Fellowship Program. Iyer is part of C. Alberto Figueroa’s Computational Vascular Biomechanics Lab, which aims to perform state-of-the-art blood flow simulation. Iyer is currently working on machine learning for coronary hemodynamic simulations.

BME 599 TEAM WINS FAST FORWARD MEDICAL INNOVATION AWARD

Congratulations to Team Counting Sleepzzx from BME 599: Graduate Innovative Design, who recently won an award through Fast Forward Medical Innovation for their project on the "Design, Development, and Early Validation of a Pediatric Home Sleep Study." The project’s goal is to develop a monitoring device that enables polysomnography sleep studies to move from the sleep lab to patients’ homes. The team includes BME students Brittany Gadigan, Camila Luciano, Ted Sallen, David Sniescinski, and Franklin Qiu and clinical mentors David Zopf, M.D. from Pediatric Otolaryngology and Jon Barkham, M.D. from Internal Medicine.

ZHEN XU TO SERVE AS BIOMEDICAL IMAGING TECHNOLOGY REVIEW BOARD MEMBER

Recently, Dr. Zhen Xu, Ph.D., has accepted an invitation to serve as a member of the Biomedical Imaging Technology: A Study Section, Center for Scientific Review, for the term beginning July 2018 and ending June 2024. Members are selected on the basis of their demonstrated competence and achievement in their scientific discipline as evidenced by the quality of research accomplishments, publications in scientific journals, and other significant scientific activities, achievements and honors.

Dr. Xu’s research group focuses on developing image-guided therapy for cardiovascular applications. The Xu Lab has been developing non-invasive therapy methods to remove pathological blood clots, which are the key mechanism behind many cardiovascular diseases including stroke and deep vein thrombosis.

BME STUDENTS REPRESENT M-HEAL AT DEI SYMPOSIUM

Saumya Gupta and Noah Hagood.

BME STUDENT AWARDED AHA PREDOCTORAL FELLOWSHIP

Congratulations to Sabrina Lynch for being awarded an American Heart Association Predoctoral Fellowship for her proposal titled "Early Initiation of Venous Thrombosis Examined Through a Photoacoustic Imaging Driven Computational Model.” Lynch is part of C. Alberto Figueroa’s Computational Vascular Biomechanics Lab, which aims to perform state-of-the-art blood flow simulation.

DESIGN TEAMS HONORED AT C-SED DESIGN EXPO

Congratulations to two teams who took prizes at the 2018 C-SED Design Expo. Team MINT from BME 452 won the Socially Engaged Design Award for their project titled, "Neonatal transport device." Winning an honorable mention for the same award was team Ichorvane from BME 450 for their project on "a device for low resource settings that easily finds blood vessels and draws blood.”

JAMES DAY AND RACHEL SUROWIEC RECEIVE RACKHAM PREDOCTORAL FELLOWSHIPS IN BME

James Day, a PhD student in Prof. Ariella Shikanov’s Lab, won a Rackham Predoctoral Fellowship to work on his project titled, "Immuno-isolating Synthetic Hydrogel System Supports Ovarian Tissue Survival to Promote Restoration of Reproductive Endocrine Function.” His research focuses on restoring reproductive endocrine function in an ovariectomized mouse model. We do
this by developing a poly (ethylene glycol) hydrogel that is conducive for ovarian tissue survival, as well as protecting the tissue from the host immune system.

PhD Candidate, Rachel Surowiec, in Prof. Ken Kozloff’s Lab, received a Rackham Predoctoral Fellowship to pursue her project titled, “Novel Models to Study Bone Drug Efficacy In Vivo: Addressing the Fragility Phenotype.” Rachel’s work provides two different yet equally-important modalities to safely improve patient outcomes and guide evaluation of novel bone therapeutics in vivo through the development of a xenograft model using patient-derived bone isolates and the implementation of a zero echo time MRI sequence to quantify changes in bone composition without harmful ionizing radiation.

**CARLOS AGUILAR WINS 2018 3M NON-TENURED FACULTY AWARD**

Assistant Professor Carlos Aguilar has been selected to receive the 2018 3M Non-Tenured Faculty Award from the 3M Corporation. The 3M award recognizes outstanding faculty on the basis of research, experience, teaching and academic leadership. The award was created over twenty-five years ago by 3M’s Technical Community in partnership with the 3Mgives program to invest in individuals who will lead university teaching and research programs in the future.

Aguilar directs the Nano-Omic-Bio-Engineering-Lab (NOBEL) at U-M Biomedical Engineering. His research develops, optimizes and applies innovative technologies such as integrative genomic assays and high-throughput sequencing, micro/nanofabricated devices, genome editing and computational modeling to their primary area of focus, skeletal muscle.

**BME GRADUATE STUDENTS SHINE AT 2018 MICDE SYMPOSIUM**

BME PhD student, Sabrina Lynch, from Prof. Alberto Figueroa’s Computational Vascular Biomechanics Lab, won second place at the 2018 MICDE (Michigan Institute for Computational Discovery and Engineering) Symposium poster competition. Sabrina’s poster titled, “Non-Newtonian Computational Model of Thrombosis Initiation,” took second place among a field of approximately 50 posters from post-docs and graduate students from across campus.

Kritika Iyer, BME PhD student also from Dr. Figueroa’s lab, received an honorable mention for her poster titled “Non-invasive Diagnostics of Coronary Artery Disease using Machine Learning and Computational Fluid Dynamics.”

**RESEARCH ON FEMALE SEXUAL DYSFUNCTION**

Tim Bruns, assistant professor of biomedical engineering at the University of Michigan, along with Rackham student Lauren Zimmerman, published a paper this month on their research for a therapy to help women who struggle with sexual arousal. This is the first therapy of its kind to address a solution for the physiological problems of women suffering from female sexual dysfunction.

In this published study, Bruns’ lab used the same therapy that exists to treat bladder issues on 16 rats in order to see if this would cause arousal. The process includes injecting a needle into a part of the rat’s leg, anesthetizing them and watching their blood flow. After 30 minutes, arousal was determined by an increase in their vaginal blood flow. Bruns indicated he does not know why the study results showed this treatment causes increased stimulation for the rats. The lab intends to do the same study on awake conscious rats and get similar results.

**THREE BMES SECURE NIH INDIVIDUAL FELLOWSHIPS**

Ph.D. candidate Grace Bushnell from Lonnie Shea’s lab received an NIH F31 fellowship for her project titled “Heterogeneity of early metastatic cells.” The central hypothesis of her proposed research is that the metastatic cells recruited to the scaffold are phenotypically distinct subset of highly plastic or stem-like cancer cells whose phenotype is modified by the local microenvironment. By investigating the mechanisms behind the observed survival benefit, she hopes to provide support for a novel platform to detect and treat metastatic disease.

Matt Hall, a post doctoral researcher, also in the Shea lab, received an NIH F32 (postdoc) fellowship for his project titled “Engineering Natural Killer Cell Homing and Activation at the Metastatic Niche.” By applying dynamic systems-level pathway and signaling analysis to NK cells at their highly controlled synthetic metastatic niche, Hall will identify and subsequently test therapeutic strategies for improving natural killer cell homing and activation for therapy against solid metastatic cancer.

Lauren Zimmerman is a BME Ph.D. candidate in Tim Bruns’ pNEURO Lab who won an NIH F31 fellowship for “Investigating peripheral nerve stimulation as a treatment for female sexual dysfunction.” Her project focuses on preclinical studies investigating pudendal and tibial nerve stimulation in anesthetized rats to determine changes in vaginal blood flow in response to stimulation.
million endowment, with an additional $10 million in matching funds from the College of Engineering and the Medical School. Coulter projects have led to impressive results, including 14 start-up companies that will no doubt have a positive impact on patients. For example, Charles Cain, J. Brian Fowlkes, Timothy Hall, William Roberts, and Zhen Xu have been developing a non-invasive ultrasonic technique to treat severe congenital heart disease in newborns as well as many other conditions. “It was an organic thing that evolved,” said Cain, founding BME chair, of his and other long-standing collaborations. “There were [clinical] problems that needed a solution.”

EVER-INCREASING BREADTH, DEPTH AND IMPACT

Since the early 2000s, collaborative research has expanded continuously. Other game-changing work over the past two decades includes:

- Intravascular diagnostic ultrasound techniques to detect lipid pools within atherosclerotic plaque by Matthew O’Donnell.
- Improved functional MRI techniques for brain imaging to improve speed and reduce distortion by Douglas Noll.
- Advances in image reconstruction for multiple imaging modalities and a low-dose CT scan method that reduces radiation exposure by Jeffrey Fessler.
- Mechanistic studies to improve ultrasound diagnostics and therapies, including drug and gene delivery by Cheri Deng.
- Development of optical molecular imaging and diagnostics, including a new optical spectroscopy method to diagnose pancreatic cancer by Mary-Ann Mycek.
- Creation of a “5-D protein fingerprint” by David Sept and Michael Mayer to provide insights into neurodegenerative diseases such as Alzheimer’s and Parkinson’s disease.
- Development of modular micro-tissues and biomaterials that direct cell phenotype in order to regenerate bone, cartilage, and blood vessels by Jan Stegemann.

EDUCATION TO SUPPORT COLLABORATION AND INNOVATION

Enhancements to the BME curriculum over the years are ensuring students receive the training to follow in the footsteps of so many interdisciplinary engineering and medical researchers. Several design courses round out the common BME core. These include Biomedical Instrumentation & Design (BME 458), in which students design an instrument to take electrophysiological measurements, Biotechnology and Human Values (ENG 100), in which students design a new diagnostic test, and the senior capstone design course, BME 450, in which students design and test a prototype for actual stakeholders.

Broadening “bench to beside” translation, the design curriculum has been further bolstered with a year-long graduate course, BME 599, created by Aileen Huang-Saad to expose students to the full innovation process, including commercialization. Rachael Schmedlen introduced a year-long senior capstone design course (BME 451/452) and a clinical-needs-finding course (BME 499). Andrew Putnam created a new course in computer modeling in design (BME 350).

The Department also launched a new medical product development master’s concentration in 2015. Headed by Jan Stegemann, the program was designed to teach students how not only to design a medical device but to address the many regulatory, intellectual property and reimbursement-related factors involved in successfully bringing new products to a competitive market.

In addition, 2015 brought new clinical immersion and experiential learning opportunities to students through greater support for device prototyping, a collaboration with the Medical School’s Clinical Simulation Center, a Clinical Peer Mentors program and the Medical Device Sandbox. All offer the chance for BMEs and medical students and clinicians to work together – ultimately toward improved patient care and safety.

A novel “instructional incubator” course, launched by Huang-Saad in 2016 continues to build on the collaborative nature of biomedical engineering practice by having students themselves create several new short courses. Courses piloted in 2017 included...
3D printing and prototype development, biological signaling in neural tissue, and computational modeling for drug development (See the related: BME-in-Practice: Iterative curriculum design).

**POISED FOR A NEW ERA**

With 12 new faculty hires in the past three years, BME is well positioned to address both intractable and new health and medical challenges with a next-generation arsenal that includes precision health (molecular imaging and diagnostics, gene and drug delivery, and histotripsy), data analytics (systems biology and multiscale modeling) and regenerative medicine (brain-machine interfaces, immune therapeutics, cell transplantation).

In this last area, BME’s **David Kohn** is co-leading U-M’s Regenerative Medicine Collaborative, comprised of more than 150 faculty across campus. The groundswell recalls BME’s earliest days, when the department was a burgeoning program, its growth and stature fueled by a vision that blurred disciplinary boundaries. The momentum continues, offering clinicians, engineers, and students alike the opportunity to improve lives.

Dr. **Parag Patil** is a neurosurgeon who works closely with BME’s **Cindy Chestek** on brain-machine interfaces and welcomes those opportunities. “Engineering helps because when I’m doing my clinical work, I’m always thinking about ways to make things better,” he says.

**Zhen Xu**, too, is excited by the prospect of opportunity and change. “I hope one day we can tell patients that we can actually remove your blood clots or remove your tumor noninvasively,” she says.

And Dr. Jeruss describes the “renewed sense of optimism about what I can offer to patients. One of the most wonderful things that come out of this whole process for me is a new perspective on what’s possible for us to do in our lifetime.”

**EXPLORE ALL OF THE BME RESEARCH BY AREA, CLINICAL APPLICATION, OR TECHNOLOGY USED.**

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**“ONE OF THE MOST WONDERFUL THINGS THAT’S COME OUT OF THIS WHOLE PROCESS FOR ME IS A NEW PERSPECTIVE ON WHAT’S POSSIBLE FOR US TO DO IN OUR LIFETIME.”**

- Jacqueline Jeruss, M.D., Ph.D.

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CONTINUED FROM INCUBATOR PAGE 3

- Introduction to Medical Product Design Iteration and Validation
- Biomechanical Design and Rapid Prototyping
- Computational Cell Signaling: Roadmap to Drug Development

Three of the six courses were taught in the 2018 winter semester.

“TAKING THE INCUBATOR COURSES HAS SHOWN ME MORE OF WHAT A PROFESSIONAL IN NEURAL ENGINEERING AND TISSUE/TUMOR ENGINEERING STUDIES AND WORKS ON.”

- Raahul Ravi

Week students spent one class session focused on learning and pedagogy and the second session working in teams to create the new courses. Students also attended master classes, where they observed an experienced instructor and reflected on their observations. They interviewed industry professionals about their work and expectations when hiring students, and they interviewed faculty not only at U-M but across the country.

During the second part of the course, BME Assistant Professor Kelly Arnold, a systems biologist, taught a class in which she asked students to apply ordinary differential equations to a particular problem, receptor-ligand binding, and model the process using MATLAB. Once students completed the assignment, they reflected on the experience to help them better understand the difference between novices and experts.

Finally, during the last part of the course, students completed their short-course curricula, following two key criteria: First, courses had to integrate at least two disciplines, for example, math and biology or electrical engineering and molecular biology. And second, courses had to include the acquisition of a tangible skill, such as CAD, Autodesk Fusion 360, or LabVIEW, that students could use toward solving critical BME problems.

GAINING A COMPETITIVE ADVANTAGE

Building specific skills was critical to the BME-in-Practice concept. “At the end of the day,” says Huang-Saad, “you can’t get a job by just telling someone you’re a great critical thinker; you need to be able to plug in and add value from the minute you hit the ground.”

Second-year student Regan Bernstein agrees. “As a sophomore, I didn’t really have any technical skills that would set me apart from anyone else bombarding the companies at the Career Fair. In BME, students don’t get experience with lab work, 3D modeling, or many other vital skills companies are looking for until later in their college career. These modules gave me the skills I needed to comfortably speak with recruiters and confidently say I had the skills they were looking for.” Bernstein hopes that by taking the courses, she’ll have set herself up for “meaningful and successful” internship opportunities early on.

LEARNING ABOUT LEARNING

The incubator followed a carefully planned curriculum. Each
RAVE REVIEWS

Not surprisingly, the incubator earned high marks from the students who participated, with evaluation scores near 5.0 in several areas, including course excellence, advancement of students’ subject matter understanding, increased student abilities, and whetting students’ appetites for learning more about the subject matter.

The incubator course gave recently-hired Lecturer Barry Belmont a more nuanced understanding of teaching and learning, helping him further ground his “own teaching in theoretical framework mentalities” to better guide students as they internalize new material in conjunction with new behaviors and connect those ideas and behaviors with previously learned concepts. “The incubator class has led me to other teaching seminars and engineering education opportunities, which are both career aspirations and goals,” he adds.

Doctoral candidate Karlo Malaga took the incubator because he intends to pursue a career in teaching after earning his doctorate. The opportunity to “design and develop a course from the ground up, [and] to actually launch and teach it is truly unique, and I think it will strengthen my application when it comes to applying for future jobs.”

Malaga found the experience, in a word, he says, “humbling. I found out first-hand just how much work can go into creating a course. By far the most enjoyable part of the experience for me was seeing the course that I had spent all semester working on come to life.”

Malaga taught Introduction to Neural Engineering and also presented his incubator work at an American Society for Engineering Education regional conference. He describes the incubator and teaching experiences as a turning point. “At the end of the day, it reaffirmed to me that I was on the ‘right’ career path since I enjoyed every aspect of teaching and developing the course.”

Huang-Saad is now working with School of Education graduate student Jacqueline Handley and BME graduate student Cassandra Woodcock to conduct qualitative research to evaluate the impact of the incubator model on undergraduate and graduate students and industry participants, including pre- and post-course surveys, focus groups, and interviews.

The first class of BME Instructional Incubator instructors.

“…IT REAFFIRMED TO ME THAT I WAS ON THE ‘RIGHT’ CAREER PATH SINCE I ENJOYED EVERY ASPECT OF TEACHING AND DEVELOPING THE COURSE.”

- Karlo Malaga

ITERATIVE DESIGN FOR CURRICULUM AND FACULTY DEVELOPMENT

Going forward, the incubator will serve as an iterative design tool for the BME curriculum. “Because we're constantly reaching out to stakeholders about their needs, expectations, and opportunities for BME students, our students will always be at the leading edge of what technologies are being used and what questions are being asked,” says Huang-Saad. “In effect, we're creating a sustainable process for integrating career guidance into our undergraduate and graduate programs.”

The incubator also has the potential to become a valuable resource for new faculty, helping them better understand the Department’s curriculum and offering direction and mentorship as they think about new courses to develop and new ways to teach existing and core courses.

When asked about her vision for success of the incubator, Huang-Saad lays out the following scenario: “What I’d most like to see is, when employers in industry, government, or academia are looking for BMEs to hire, they’re going to look to U-M graduates. Not only because our students are incredible interdisciplinary researchers, but also because many of them will have had an opportunity to gain new skills and learn something about teaching – they’ve had a mentored approach to helping others learn.”

For more information on the instructional incubator or BME-in-Practice courses, visit teel.bme.umich.edu/projects/incubator and teel.bme.umich.edu/bme-in-practice-courses.