UF UNIVERSITY of FLORIDA

CrossLink

BIOMEDICAL ENGINEERING at the UNIVERSITY OF FLORIDA

Spring 2014

THREE POUNDS, ONE MILLION QUESTIONS

PAGE 8

Dear BME Friends and Family,

Welcome to the inaugural issue of ***CrossLink***, the J. Crayton Pruitt Family Department of Biomedical Engineering's new magazine dedicated to advances in biomedical research and innovation!

To provide a snapshot of our program, the BME Department at UF was formed in 2002, after the initiation of a BME graduate program in 1998; the undergraduate program was implemented in Fall 2012. There are currently 20 primary faculty members. Our goal is to grow to 27 faculty members in the next few years.

As part of our growth initiative, we are in an exciting time as The University of Florida is in the midst of an impressive preeminence initiative, backed by nearly a billion dollars, and aimed to nurture the scientific and scholarly progress that will bring UF recognition as a top public research university. As part of this plan, the BME Department received five faculty positions this year in the following areas of research.

- Neuroscience and the Brain
- Big Data
- Smart Polymer Nanomedicines

This initiative will help to further expand our expertise, build on existing core competencies, and help forge stronger partnerships across campus.

The BME Department at UF is uniquely blessed with the major Pruitt Family endowment as well as a new state-of-the-art building that is strategically located next to the Health Science Center but still only a three to five minute walk to most facilities in engineering, including the new Nanoscale Research Facility. The University of Florida is one of fewer than ten universities that is designated as a comprehensive campus – in other words, UF is distinct in that it has a medical school, veterinary school, and main academic campus with a college of engineering co-localized on the same, contiguous campus. UF also has a dental school, a school of public health, the UF Health hospital system, the nursing program, and a VA Hospital, as well as research institutes with incredible facilities, including the McKnight Brain Institute, the Clinical and Translational Science Institute, the Emerging Pathogens Institute, the Nanoscience Institute for Medical & Engineering Technology, and the Institute on Aging, to name a few. In addition, the entrepreneurial and commercialization activities here in Gainesville are extremely strong – the Florida Innovation Hub, located adjacent to campus, is an amazing facility for new start-up companies and the Sid Martin Biotechnology Incubator in Alachua is recognized internationally and was recently named 2013 Incubator of the Year by the National Business Incubation Association.

As Department Chair, I am excited to have recently joined UF at this critical time in the life of the Department – to have an impact on the educational program, to help forge strong partnerships with health sciences, and to grow the department into a mature and top-ranked program.

Sincerely,

Schmidt

Christine E. Schmidt, Ph.D.
Pruitt Family Professor & Department Chair

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CrossLink

A publication of the J. Crayton Pruitt Department of Biomedical Engineering at the University of Florida

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Nanomedicine, stem cells, biomaterials, tissue engineering, and targeted drug/gene delivery.

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Machine learning, data mining, big data, biomedical informatics, pervasive health and gerontechnology.

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Ph.D., Eindhoven University of Technology
Human physiologic simulation to enhance noninvasive patient monitoring and education.

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Biomaterials for neural tissue regeneration and neural interfacing.

BRUCE C. WHEELER
Professor
Ph.D., Cornell University
Brain-on-a-chip, micropatterning neurons and microelectrode arrays, and neural signal processing.

UF BME Welcomes Three New Faculty

PARISA RASHIDI, PH.D.

Dr. Rashidi's research involves developing novel biomedical informatics systems, intelligent assistive systems, and context-aware healthcare applications, with the underlying theme of big data and machine learning. Before joining UF, she was an Assistant Professor in the Biomedical Informatics Division of Feinberg School of Medicine at Northwestern University. She received her Ph.D. in Computer Science from Washington State University with an emphasis on Artificial intelligence and Machine Learning. As part of her Ph.D. dissertation, she studied the application of data mining and machine learning techniques to assisted care solutions for elderly and dementia patients. Her current research focuses on projects such as automatic identification of depressive states in major depressive disorder (MDD) patients using Natural Language processing (NLP) and machine learning techniques, home-based assisted living solutions based on ambient and mobile sensor technology, and context-aware augmentative and alternative communication tools for individuals with communication disabilities.

GREG HUDALLA, PH.D.

Dr. Hudalla's research is focused on the development of biomedical technologies that can harness the immunomodulatory potential of mesenchymal stem cells, or functional features thereof, for transplant- or implant-based therapeutics. He is strategically positioned to make significant contributions at this intersection between bioengineering, materials science, and translational medicine. Dr. Hudalla received his Ph.D. in Biomedical Engineering from the University of Wisconsin-Madison in 2010 under the direction of Professor William Murphy. As part of his doctoral research, he created chemically well-defined culture substrates to elucidate the influence of extracellular factors on adult stem cell behavior. During his postdoctoral training at the University of Chicago and Northwestern under the guidance of Professors Joel Collier and Milan Mrksich, Dr. Hudalla's research focused on biomaterials as modulators of host immune responses. Recently, he demonstrated that nanofibers can act as vaccine adjuvants to increase production of antibodies that bind to protein antigens.

BLANKA SHARMA, PH.D.

Dr. Sharma's research is focused on elucidating the microenvironmental cues that affect the role of stem cells in tissue repair and disease, and developing biomaterials and stem cell therapies for regenerative medicine and cancer. Dr. Sharma received her Ph.D. in Biomedical Engineering from Johns Hopkins University under the direction of Dr. Jennifer Elisseeff. In her doctoral studies, she developed biomimetic 3-D tissue models to study the role of adult stem cells in musculoskeletal tissue repair, and developed a hydrogel to direct their differentiation to cartilage cells. This research was transferred to a start-up company (Cartilix Inc.), where she led preclinical studies and further developed the technology for clinical trials of cartilage repair in the knee. She pursued postdoctoral research with Dr. Vinod Labhasetwar at the Cleveland Clinic in the area of translational nanomedicine. There she developed non-viral gene delivery systems to treat cancer and demonstrated a new approach to tumor targeting of nanoparticles based on biophysical changes in cell membranes that occur during malignancy. Dr. Sharma is integrating her experience in tissue engineering, stem cells, nanomedicine, and translational research to develop new ways to treat traumatic injury, degenerative disease, and cancers that affect the musculoskeletal system.

News & Notables

MAJOR FACULTY AWARDS & PROMOTIONS

- Dr. Bruce Wheeler elected as BMES Fellow
- Dr. Bruce Wheeler named AAAS Fellow
- Dr. Carlos Rinaldi received the *International Journal of Nanomedicine* Early Career Award
- Dr. Mingzhou Ding named UF Research Foundation Professor
- Dr. Brandi Ormerod promoted to Associate Professor with tenure
- Dr. Christine Schmidt elected Chair-Elect of AIMBE's College of Fellows
- Dr. Wesley Bolch received Distinguished Scientific Achievement Award from Health Physics Society

EDITORIAL AND ADVISORY BOARD INVITATIONS

- Dr. Carlos Rinaldi named an Associate Editor of the *International Journal of Nanomedicine*
- Dr. Jon Dobson named an Associate Editor of the *Journal of Nanoparticle Research*
- Dr. Ranganatha Sitaram named an Associate Editor of special issue of *Frontiers in Neuroscience*
- Dr. Kyle Allen named to Editorial Board of *Frontiers in Bioengineering and Biotechnology*
- Dr. Benjamin Keselowsky named to Advisory Board of *Journal of Materials Chemistry B*
- Dr. Benjamin Keselowsky named to Editorial Board of *Journal of Biomedical Materials Research A*

KEY RESEARCH ADVANCES & INNOVATION

- UF Sid Martin Biotechnology Incubator named "World's Best"
- Dr. Benjamin Keselowsky's research leads to start-up company, OneVax
- Industry Partner, AxoGen, receives Product Innovation Leadership Award for Avance Nerve Graft
- Dr. Carlos Rinaldi's *ACS Nano* article spotlighted by Nanowerk
- Dr. Jon Dobson has top cited paper in magnetic nanoparticles
- Dr. Rangan Sitaram's article is in *NeuroImage's* top 5 most downloaded
- Dr. Christine Schmidt's nerve scaffold research featured on NSF's Science Nation

NATIONAL STUDENT AWARDS: NSF GRADUATE RESEARCH FELLOWSHIPS

UF BME ranks in 8th place nationwide for NSF fellowships for BME departments

- Shannon Brown
- Hillary Wehry
- Phillip Vu
- Aline Yonezawa

U.S. NEWS AND WORLD REPORT RANKINGS

- University of Florida climbs three spots to 14th among public universities
- BME Graduate Program climbs seven spots to 23rd among public universities

Leadership Distinguished Seminar Series: 2013-2014

Dr. Robert M. Nerem, Parker H. Petit Distinguished Chair for Engineering in Medicine and Institute Professor, Georgia Institute of Technology
Bioengineering: A half century of progress, but still only a beginning

Dr. Gordana Vunjak-Novakovic, Mikati Foundation Professor of Biomedical Engineering & Medical Sciences, Columbia University
Engineering Human Tissues

Dr. Martine LaBerge, Professor & Chair of Bioengineering, Clemson University
TKR Improved Outcome: A Biomaterials Perspective

Dr. Kyriacos A. Athanasiou, Distinguished Professor and Chair, Department of Biomedical Engineering, UC Davis
Some Examples Toward Bioengineering Translation

Dr. Arthur J. Coury, Principal, Coury Consulting Services
Considerations in Successfully Translating Promising Medical Concepts to the Marketplace

Dr. Gilda Barabino, Dean, The Grove School of Engineering, The City College of New York
Sickle Cell Disease: Advances toward Improved Treatment Strategies using Engineering Approaches

Dr. Shankar Subramaniam, Professor, Department of Bioengineering, UC San Diego
Challenges in Systems Biology and Medicine

Upcoming Speakers

Dr. Michael Shuler, James and Marsha McCormick Chair of the Department of Biomedical Engineering and Samuel Eckert Professor of Chemical Engineering, Cornell University

Dr. Maryellen Giger, A.N. Pritzker Professor of Radiology, University of Chicago

Dr. Mark Saltzman, Goizueta Foundation Professor of Biomedical Engineering, Chemical and Environmental Engineering & Physiology, Yale University

Dr. Cato T. Laurencin, Albert and Wilda Van Dusen Chair in Academic Medicine; Distinguished Professor of Orthopaedic Surgery and Chemical, Materials and Biomolecular Engineering, University of Connecticut

Dr. Metin Akay, Founding Chair and John S Dunn Endowed Chair Professor, Department of Biomedical Engineering, University of Houston

THREE POUNDS *one million questions*

One of the final frontiers of scientific research is sitting inside your skull.

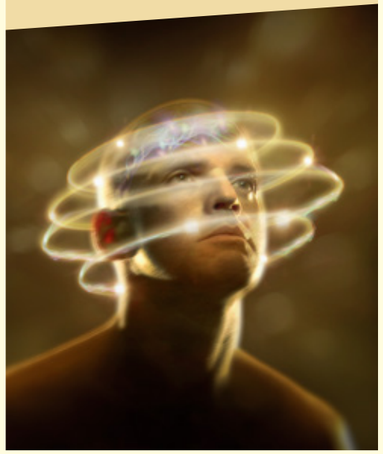
The human genome is sequenced, the 40-year quest for the Higgs particle has ended, and supercomputers churn out discoveries at ever-faster rates.

But the organ that made those discoveries possible, the brain, is still a three-pound mystery walking around on our shoulders every day, says Mingzhou Ding, a Pruitt Family Professor in the University of Florida Department of Biomedical Engineering.

BY CINDY SPENCE

We know very little about how the brain works,

says Ding, a senior member of the growing department.



Recent developments, however, have put Ding and other biomedical engineers and neuroscientists in the perfect position to learn more. President Obama has announced a $100 million brain mapping initiative that will lead to a surge in brain research. Just recently, Obama added another $100 million for an initiative to fight AIDS, in which 70 percent of patients experience neurological abnormalities. UF itself, with its preeminence campaign, will be investing an additional $2.2 million in neuroscience and brain research.

"This is the wind behind our sails, very exciting times," says Ding, who was among 30 scientists invited by the National Science Foundation last year to help figure out how to approach the $100 million BRAIN (Brain Research through Advancing Innovative Neuro technologies) initiative. "We have a lot of exciting opportunities going forward."

Ding studies higher brain function, and with multiple funded projects in his laboratory, he stays busy applying engineering approaches to neuroscience. In recent projects, he has discovered how different regions of the brain battle for dominance when a person is trying to focus but becomes distracted, and how the throbbing sensation of pain is processed by the brain.

One of his latest interests is how the brain processes vision, and he and his colleagues have applied for a $7.5 million grant to develop a computational model of how vision works.

"How are we able to see complex objects and distinguish them from complex backgrounds the object is embedded in?" Ding says. "Computer-based models have a lot of trouble accomplishing this while we do it so easily, but how is the brain actually doing it?"

A project of this kind is a perfect example, Ding says, of the interdisciplinary nature of brain research, because it would involve engineers, doctors, electrophysiologists and psychologists, along with the McKnight Brain Institute.

UF has a huge neuroscience enterprise, and collaborations are the key to tapping into its potential, Ding says. Even mixers within the department help to identify future collaborators, Ding says, because researchers often discover that the work in a colleague's lab could boost the work in their own.

"That diversity strengthens our applications for research funding," Ding says. "Agencies see our track record – with engineering, neuroscience, patient care, clinicians, all in one place – and they see a winning combination."

When people talk about brain research, they tend to talk about two areas: how the brain works and brain disorders, Ding says. Understanding the normal brain will help in alleviating pain, reducing the symptoms of aging and treating disorders.

Researchers are beginning to find neurological components to many diseases and procedures. Heart disease, liver disease, diabetes, even orthopedic surgery, all can affect brain function in surprising ways.

Knee replacement surgery, for example, although limited to that joint, sometimes causes a post-surgical memory impairment, for reasons still unknown.

Ding and other researchers are working with a grant from the National Institutes of Health to find the neural markers that identify who is vulnerable to such impairment after surgery.

Neural components to HIV/AIDS research also are under study. The neural components were not apparent early in the epidemic because people died quickly. With anti-viral therapy, HIV/AIDS patients are living longer, and Ding and his colleagues have applied for funding to study the ways in which the virus attacks the brain.

A third area of brain research has piqued Ding's interest of late. The collection of information from biological systems is creating a huge amount of data.

"What if we could use brain-inspired computational algorithms to help us decipher what all this big data is

Above: Dr. Mingzhou Ding and his lab members are working to measure brain waves wirelessly with the help of Emotiv EEG Neuroheadsets.

telling us?" Ding asks. "There are all kind of algorithms to deal with big data, but how many do it the way the actual brain would do it?"

A computer operating with the brain's algorithm would be infinitely more effective than either the brain alone or a computer alone, Ding says.

The brain is a good operating system, but slow. A computer is not as good as an operating system, but is very fast. A computer can win a chess match, but that doesn't make it smart, just able to process all the possible moves to find the optimal move quickly. The computer, however, will never possess the ability to look at a chessboard and intuitively know the next move.

"It's not a real brain, it doesn't have intuition," Ding says.

What is intuition?

"That's the problem. We don't know!" Ding says.

Neuromodulation, he says, could work much like cardiac modulation. Pacemakers modulate heartbeat,

> As brain research progresses, Ding predicts more products will be bio-inspired, based on the brain, and says UF could be at the forefront of that movement.

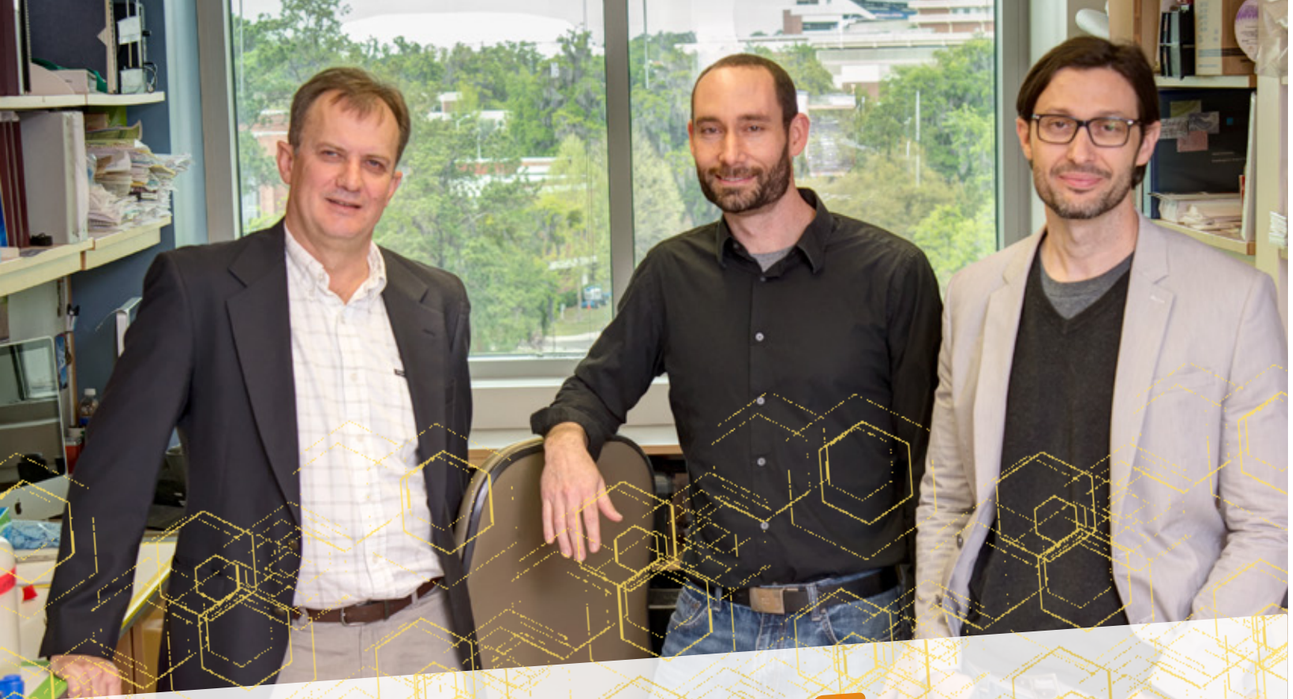
saving the lives of many, but neuromodulation could be an even bigger market.

Can we harness brainpower to do good things for our health?" Ding asks. "Once we understand how the brain works, we can design future products based on that."

Ding has arrived at an interesting spot for a former mathematics professor, who got his start in brain research when neuroscientists kept pestering him to write algorithms for their work. Then the National Institutes of Health asked him to review the math on other researchers' grant applications, "so I had to learn this thing pretty fast." Two decades later, he says, he is still learning.

"How does this three-pound thing work, making us uniquely human. We create all this wonderful technology, art, music, science, everything, because of the three-pound object that sits right here," Ding says, pointing at his temple. "How does the brain generate all this function we enjoy every day, so seamlessly, so smoothly?

"Understanding the brain is the last frontier of scientific inquiry," Ding says, "and our department, our discipline is perfectly positioned to be the kind of place that glues different disciplines together to make things happen."



MANY COLLABORATORS,

OneVax

Collaborating to Beat Diabetes

In the body of a person who has Type 1 diabetes, the immune system — which normally attacks harmful viral and bacterial invaders — also attacks insulin-producing cells in the pancreas. That means there's no insulin to promote absorption of sugar from a person's blood. Continuously high blood sugar levels can lead to serious heart, eye and kidney complications.

BY MORGAN SHERBURNE

UF researchers are studying ways to deliver agents directly to the cells causing problems in a person with Type 1 diabetes. They have started a company that aims to improve the effectiveness of these kinds of drug therapies. Called OneVax, the company hopes to develop a vaccine that will prevent and reverse Type 1 diabetes

The start-up began as a collaboration between the J. Crayton Pruitt Family Department of Biomedical Engineering and the Department of Pathology, Immunology and Laboratory Medicine.

Ben Keselowsky, Ph.D., associate professor in the biomedical engineering department, was one of the founders of the company. He studies controlled release systems for vaccines.

"My background is biomaterials, so when I came here in 2005, I was looking for an immunology collaborator," Keselowsky said.

> **"The Department of Pathology, Immunology, and Laboratory Medicine is just an elevator ride away. We can go to lunch together and brainstorm about research."**

Keselowsky found an initial collaborator in the department's chair, Michael Clare-Salzler, M.D. He eventually founded the company with Todd Brusko, Ph.D., Clive Wasserfall, M.S., both immunologists within the Department of Pathology, Immunology and Laboratory Medicine, as well as Mark Atkinson, Ph.D., co-director for the UF Health Diabetes Center of Excellence.

"Mark suggested that hey, we should start this company," Keselowsky said.

Atkinson has been studying Type 1 diabetes at UF for three decades.

"I started here at UF trying to find ways to prevent and cure Type 1 diabetes, and 30 years later, I'm still trying to figure that out," Atkinson said. "Not to say we haven't been successful along the way. We've discovered a lot. But bringing people from the biomaterials side of research together with medical research has made for a nice marriage."

The company's goal? To keep a body's immune system from attacking those insulin-producing cells.

If successful, the researchers' vaccine would block the immune system from attacking the insulin-producing cells, allowing those cells to do their job. To do this, postdoctoral researcher and company senior scientist Jamal Lewis, Ph.D., is studying how to use biodegradable microparticles to deliver therapeutics to the cells of the immune system responsible for attacking insulin-producing cells. The therapy consists of agents that can help re-educate the immune system.

"We're training the immune system to not be self-destructive, basically," said Lewis. "That will ultimately help to restore glucose imbalances (in people with Type 1 diabetes)."

The company has already found traction in a National Institutes of Health-funded small-business grant. Lewis applied for and won the $225,000 grant. The researchers say they have three different technologies that could lead to a vaccine in the process of being patented, and Lewis' grant will focus on studying the safety of the most advanced technique.

"Our long-term goal is that we definitely want to make a product that has some type of impact on Type 1 diabetes," said Lewis.

Currently, OneVax is housed in the Florida Innovation Hub at UF. Located in downtown Gainesville at the site of the former Alachua General Hospital, the Innovation Hub provides facilities as well as office space, laboratories and all of the legal and patenting advice needed to bring a product to the market place.

Both Lewis and Keselowsky said that while the vaccine was promising in mouse studies, clinical trials require millions in funding as well as interest from big businesses or pharmaceutical companies. On March 11, the team found out that OneVax was a "Sweet 16" finalist for the fifth annual Cade Museum Prize. The $50,000 prize is awarded to an individual or company bringing an innovative idea or product to market.

Opposite page: Three of the four original OneVax co-founders, Clive Wasserfall, M.S., Todd Brusko, Ph.D. and Benjamin Keselowsky, Ph.D. Above: Jamal Lewis, Ph.D. and Benjamin Keselowsky, Ph.D. working out of the OneVax lab at the Innovation Hub

"In the long term, it will require investors. It will require business leaders," said Keselowsky. "But the end goal is to make a product that will help people."

Welcome Dr. Thomas Pearson!

BIOMEDICAL ENGINEERING AT UF: BRIDGING COLLABORATION, INNOVATION AND DISCOVERY

To Thomas Pearson, M.D., Ph.D., M.P.H., the J. Crayton Pruitt Family Department of Biomedical Engineering is a bridge.

It's a bridge to the UF College of Medicine and the five other UF Health colleges, and it's a bridge to the College of Engineering and the health science campus.

"I would really like to see more traffic across that bridge," said Pearson, who is UF Health's executive vice president for research and education. "I was delighted to find that here at UF, the biomedical engineering department was located at the same site as our health science colleges."

Pearson started at UF in October 2013, and has been exploring collaborative possibilities between the health science colleges and other parts of UF ever since. He came to UF from the University of Rochester, where he was senior associate dean for clinical research at the university's School of Medicine and Dentistry and director of the Rochester Clinical and Translational Science Institute. There, he took advantage of the interplay between biomedical engineering and medicine.

"Biomedical engineers really fit into this team of translators because they can problem-solve," said Pearson. "On one hand, the scientist will have developed some kind of assay, or device, or molecule that has some type of metabolic action. Then, they need the engineers to transform it from an experiment to a product."

That the lab researcher, biomedical researcher and clinician work on the same campus can be a great advantage, Pearson said.

As Pearson notes, however, bridges are often two-way streets. Biomedical engineering researchers can benefit from the health science colleges by seeing the patient side of their research, from learning more about clinical trials to using human subjects in their research.

> ***Here, the link for Pearson continues to be obvious: engineers can put into play what bench scientists dream, test and refine in a lab.***

He hopes to encourage the conversation by further exploring the VIVO database, implemented at UF by Michael Conlon, Ph.D., the co-director of the UF Clinical and Translational Science Institute and director of UF College of Medicine's Biomedical Informatics Program. Originally developed at Cornell University, the database is an open-access web application in which researchers can list their research interests, activities, publications and grant funding. It's searchable, so a scientist working on Type 1 diabetes, for example, can search for a biomedical engineer with whom the researcher can collaborate.

"You can see how rich this can be," said Pearson.

Along with David Norton, Ph.D., vice president for research at UF, Pearson hopes to expand the database from its current approximate 1,000 researchers at UF to 2,500 or more.

Pearson said having the biomedical engineering department strategically located next to the Health Science Center is attractive to the researchers UF is courting as part of UF Preeminence, a new initiative aimed to nurture the scientific and scholarly progress to bring UF recognition as a top public research university.

"These are exciting times at UF, with growth in all parts of the university," Pearson said. "Here we are with a new group of exciting leaders like Dr. Christine Schmidt, Ph.D. (Chair of the J. Crayton Pruitt Family Department of Biomedical Engineering) and other deans, as well as new people coming in for the UF Rising Preeminence Initiative. The opportunities for innovation and discovery are enormous."

BY MORGAN SHERBURNE

UF RISING

Nanoscience Institute for Medical and Engineering Technology

NANOSCALE RESEARCH AT UF PROVES EXPANSIVE

Across the University of Florida campus, research at the nanoscale, as well as that enabled by nanotechnology, now involves over 200 faculty, students, and staff from many different departments in several different colleges. As a university-wide institute, the mission of the Nanoscience Institute for Medical and Engineering Technology (NIMET) is to focus and coordinate research and educational activities at UF in the fields of nanoscale science, engineering, and technology. By being intellectually and geographically situated at the intersection between medicine, engineering, and the sciences, NIMET is well positioned to serve the faculty, students, and staff from each involved department. In particular, it is expected that a growing number of people from the biomedical engineering department will be actively involved in and benefit greatly from NIMET-supported resources and activities.

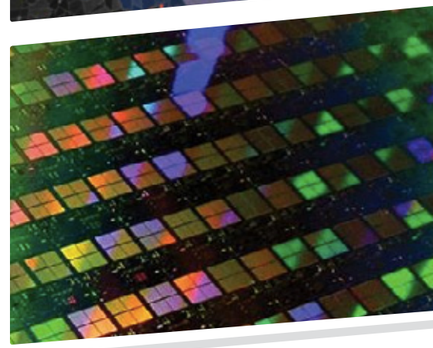
> ***As the largest academic clean room in the State of Florida, the NRF (Nanoscale Research Facility) represents the state's flagship center for research and development of both micro- and nanotechnologies.***

It is also expected that NIMET will involve and serve the rest of the departments in the Colleges of Engineering and Medicine, as well as significant portions of the Colleges of Liberal Arts and Sciences, Pharmacy, Dentistry, Public Health and Health Professions, and also Agricultural and Life Sciences and Veterinary Medicine. The leadership of NIMET is also reaching out to researchers and clinicians at the Malcom Randall Veterans Affairs Medical Center adjacent to campus.

A recently constructed 55,000-sqft building, the Nanoscale Research Facility, is home to NIMET.

Within the NRF's >7000 sqft Class 100/1000 cleanroom is an extensive set of advanced materials synthesis, nanofabrication, nanoimaging, and nanocharacterization equipment and supporting laboratories for back-end processing, device assembly, and testing. The mission of the NRF is to provide state-of-the-art micro/nano fabrication capabilities and expert technical support (the NRF staff has 60+ years of experience) to UF researchers and external users from industry and other academic institutions. Also housed within NIMET's building is a dedicated instructional cleanroom, where students can obtain unique hands-on experience with micro/nanofabrication and characterization. New instructional laboratory experiences, specifically designed to be of interest to students in BME, are being developed.

The new director of NIMET is Dr. Jack Judy, who has an appointment in Electrical and Computer Engineering and is a member of the BME Affiliate Faculty.



Above, top: The Nanoscale Research Facility serves as a collaborative space for colleges across campus. Above, bottom: Through the UF Nanoscale Research Facility, NIMET supports wafer-scale integration and production of advanced electronics, micro-electro-mechanical systems (MEMS), and nanotechnologies.

Prior to arriving at UF, Dr. Judy was a professor at UCLA in Electrical and Biomedical Engineering for 12 years and a program manager at DARPA in the Microsystems Technology Office for 4 years.

Left: Dr. Joanne Lagmay, Department of Pediatric Oncology, with a pediatric osteosarcoma patient. Below: Pediatric osteosarcoma patient working on handprint art project.

Hyundai Hope Grant

CONQUERING BONE CANCER THROUGH RESEARCH

In an effort to conquer osteosarcoma, a bone cancer common in children, the UF Department of Biomedical Engineering has teamed up with the Hyundai Hope on Wheels Foundation to utilize a $250,000 grant towards saving lives.

Osteosarcoma has seen little change in its prognosis in over 30 years with chemotherapy resistance plaguing most treatments. According to the American Cancer Society, 400 of the approximate 800 cases each year are children.

Although radiopharmaceuticals have some success in adults with the cancer, their targeting of areas of active bone growth negatively affects large portions of a growing child's skeleton creating a need for further research in treatment of osteosarcoma in children.

The award, the Hyundai Hope Grant, was given at the children's hospital at the University of Florida to BME Professor Wesley Bolch, Ph.D., and a team of five interdisciplinary researchers. The research involved collaboration across biomedical engineering, chemical engineering, materials science & engineering, veterinary sciences, pediatric oncology and radiation oncology to investigate new therapies for the young cancer patients.

So far, the research intends to develop biocompatible polymers which are capable of binding to different therapeutic nuclides that will assist to fight cancerous tissue while not disturbing healthy tissue. This new therapy will be first tested on client-owned dogs because of their genetic similarities to human pediatric bone cancer.

Not only will this testing provide therapy to dogs that may have otherwise had to go through amputations but it will provide a platform for human therapies.

> *To diagnose proper doses, the team will establish a series of "phantom models," or internal and external computer-images of dogs using the same software that Pixar artists used to make Toy Story, according to Bolch.*

These models include microimaging of bone needed to estimate dose to active bone marrow, which is a more radiosensitive tissue.

The Hyundai Hope on Wheels Foundation, established in 1998, is an organization derived from the united effort of Hyundai Motor America. More than 800 dealerships are committed to raising cancer awareness and celebrating the lives of children battling cancer.

BY CARINA SEAGRAVE

Student Endeavors: Organizations & Outreach

UF BME STUDENTS REACH OUT TO THE COMMUNITY

The Society of Health and Medical Physics Students (SHMPS), a student organization within UF BME, held their annual holiday food drive for the Bread of Mighty Food Bank. The food drive ran from October 30 to November 14 and 270 pounds of food was collected. This equates to providing a family of four with three meals per day for 17 days. The participation from both undergraduate and graduate students was outstanding.

Another regular SHMPS community effort is volunteering at the American Cancer Society's Hope Lodge. The Hope Lodge provides short-term housing and convenient access to Shands Hospital for patients and their families who must travel large distances for appointments and treatment. Patients are required to supply their own food during their stay. So, for the past four years SHMPS has hosted an annual dinner and bingo night during the spring semester for nearly 60 Hope Lodge residents.

Every April, SHMPS participates in another event sponsored by the American Cancer Society (ACS) — the Gainesville Relay for Life. To commemorate the on-going battle against cancer, members of each team alternate walking around a track for 18 hours while also participating in a series of competitions and uniquely-themed laps to raise money and awareness.

With the onset of the new undergraduate program, ***the UF chapter of the Biomedical Engineering Society (BMES)*** has gained significant traction.

In the past year, BMES has participated in various outreach and educational events within the community. Members have made multiple presentations about the biomedical engineering field to elementary, middle and high school students encouraging them to take on future problems using science, technology, engineering and mathematics.

The members of BMES look forward to seeing the organization grow as they continue working with both industry and academic leaders to reach out to the community.

Top: SHMPS group photo at the 2013 Relay for Life at Santa Fe College, Gainesville. Bottom left: SHMPS members organizing canned food for the annual holiday food drive. Bottom right: BMES members working with students during Chiles Elementary's Engineeing Night

Student Endeavors: UF Biodesign

ENGINEERING A HEALTHIER WORLD

University of Florida BME undergraduates are designing technologies in collaboration with physicians to meet global health challenges. UF provides a unique infrastructure with the co-localization of engineering, medicine, the UF hospital system, veterinary medicine and many other resources crucial for health care innovation and for training the engineers who are instrumental in these technological advances.

In addition, these engineers are receiving state-of-the-art training from Dr. James Schumacher, formerly a senior R&D engineer and project leader for new medical device product development at Fortune 500 company Kimberly-Clark. Student teams are formed to execute the Biodesign Innovation Process developed at Stanford University.

One UF team has focused on developing a product designed to apply a sealant to ruptured esophageal varices, swollen veins common in liver disease patients. This project, called VariSeal, is among many monitored through the design course.

Aline Yonezawa, a senior biomedical engineering student and a member of the design team, is excited about the prospect of VariSeal helping those in developing countries who suffer from esophageal varices.

"Many countries are not fortunate enough to have expensive medical equipment and specialized physicians such as gastroenterologists," Yonezawa said.

"The rupture of blood vessels in the esophagus is a global clinical unmet need that VariSeal hopes to address by developing a simple-to-use medical device that can stabilize patient bleeding."

VariSeal is only one example of UF Biodesign's ability to educate and demonstrate the process for inventing, designing and commercializing medical devices with emphasis on FDA design controls, regulatory pathways, product risk analysis and intellectual property protection. Teams are mentored and sponsored by health care professionals on campus, biomedical engineering faculty and local medical device companies.

The overseeing physician for the VariSeal team is Giuseppe Morelli, M.D., an Associate Professor of Medicine at the University of Florida. Dr. Morelli has clinical expertise in Gastroenterology/ Hepatology and is highly active in pursing medical device innovations in this field.

Morelli feels the VariSeal product, if implemented, will address medical needs across the globe.

"The majority of the world lives in the southern hemisphere, in developing countries such as China and India," he said. "A product such as this could have great impact if introduced in these countries where resources are unavailable."

Because of the wealth of knowledge they can share, clinicians are the most valuable resources for practicing biomedical engineers.

It is through their interaction that previously unrecognized medical needs are identified. The skill of accurately translating these unmet needs into an engineered solution is the true essence of biomedical engineering. Products would likely have little value without continual interactions with physicians, surgeons, and other health care professionals throughout the product development process.

These clinical and industrial relationships continue throughout the projects in order to receive feedback as the student teams create concepts, develop product specifications, and fabricate prototypes. Engineering faculty provide technical expertise and guidance throughout the innovation process. The main deliverable for the course is a device prototype and validated final design that addresses the identified unmet need.

"The best part about working as a team was including a physician," Yonezowa said. "I learned so much from working with a multidisciplinary group of engineers because everyone had a different set of skills to offer. The moments I really enjoyed were when we would all contribute to one initial idea that would result in an idea we would have never been able to come up with on our own."

The goal as a department is for undergraduates to have a real impact on patients' lives." said Dr. Christine Schmidt, chair of UF BME. "With the resources at UF, there is no limit to what the students here can accomplish!"

BY CARINA SEAGRAVE

Left and above: Iris Liang and Robert Miner, two of the current students pursuing UF BME's online graduate certificate.

UF BME LAUNCHES ONLINE MEDICAL PHYSICS CERTIFICATE

With the same convenience of checking email from your cell phone, the University of Florida hosts a new online graduate program that allows people in remote locations and those working full time to pursue their career goals.

The online graduate certificate in Medical Physics at UF, launched spring of 2013, is the first of its kind according to Dr. David Gilland, BME Associate Professor.

This accredited, five-course program focuses specifically on medical radiological physics.

Generally speaking, medical physics is the application of physics concepts, theories and methods to medicine. The field has played a significant role in terms of diagnosis and treatment of diseases, particularly cancer.

Provided by UF E.D.G.E. (Electronic Delivery of Graduate Engineering), this new program allows professors to reach out to students online through video lectures and slide presentations.

Because the UF certificate received accreditation by the Commission on Accreditation of Medical Physics Educational Programs (C.A.M.P.E.P.), students completing the certificate are eligible to enter a residency required of medical physicists, Gilland said. As such, the certificate is an alternative to a M.S. or Ph.D in medical physics.

Robert Miner, a nuclear technologist and distance education director in Ottawa, Canada, has his M.S. in Nuclear Medicine but hopes to someday go into radiation safety or another medical physics-related field. He will complete his certificate provided by UF this spring.

"The online program allowed me to take courses while working," he said. "The local university offered a similar program but it was only full-time, on-campus. "

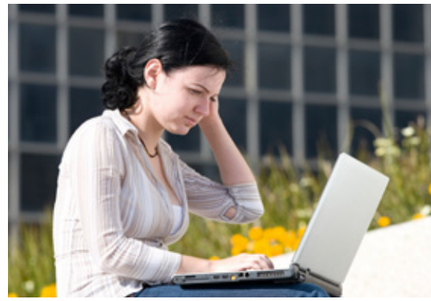
Among other talents, Miner has received a "Guardian Angel" award for excellent patient care at a hospital for which he previously worked. The UF online graduate program will help him further pursue patient care.

Iris Liang, another student of the UF online program divides her time between online classes and a post-doctoral fellowship in radiation oncology at Stanford University.

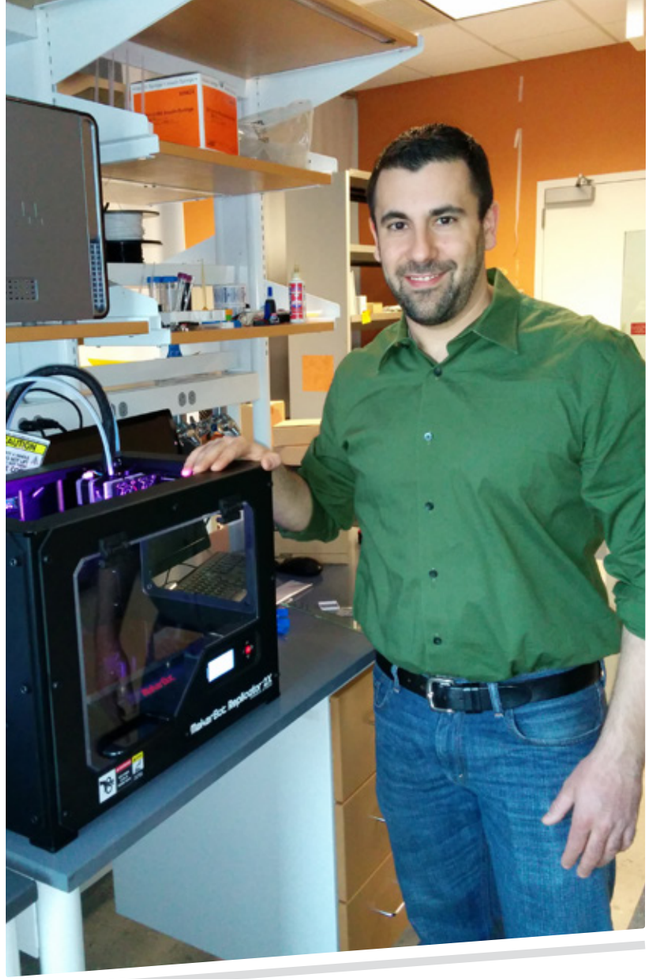
She plans to take the American Board Radiology (ABR) Medical Physics Part 1 Exam to become a resident physicist.

For individuals currently employed full-time or without access to similar graduate degrees, the UF online certificate opens up an exciting new opportunity to pursue a career in a rewarding field.

BY CARINA SEAGRAVE



ADAM FEINBERG: THE STUDENT BECOMES THE PROFESSOR



University of Florida alumnus Adam Feinberg knows why it's great to be a Florida Gator even as a professor at Carnegie Mellon University (CMU) in Pittsburgh, PA.

Feinberg received his undergraduate degree at Cornell University and was granted his Master's degree and Ph. D. by the University of Florida in 2002 and 2004. His research under Dr. Tony Brennan, an Affiliate Professor of BME, was focused on controlling cell attachment to surfaces, which lead to the development of Sharklet technology, currently its own company.

His training in biomedical engineering and biomaterials provided a strong foundation for his subsequent postdoc at Harvard and faculty position at CMU where he conducts research in his lab known as the Regenerative Biomaterials and Therapeutics Group.

Feinberg's research interests include how to encode information in biomaterials that can guide cells to reform tissues. More specifically, by integrating developmental biology, cardiac stem cell biology and materials science to engineer human heart muscle he hopes to learn how the developing heart dynamically builds itself. Through this research, Feinberg hopes we will eventually be able to rebuild damage to human hearts sustained in the event of a heart attack. This study is supported by the NIH Director's New Innovator Award and the American Heart Association Scientist Development Grant.

In addition to research on tissues of the human heart, he is also working to develop a tissue-engineered corneal endothelium which can be used to restore vision as an alternative to corneal transplantation. He hopes to begin human studies within the next five years.

Feinberg is also developing new 3-D bioprinting technologies, which will enable researchers to create advanced tissue engineering scaffolds. Bioprinting in 3-D provides the unique ability to create patient-specific scaffolds based on MRI and CT medical images.

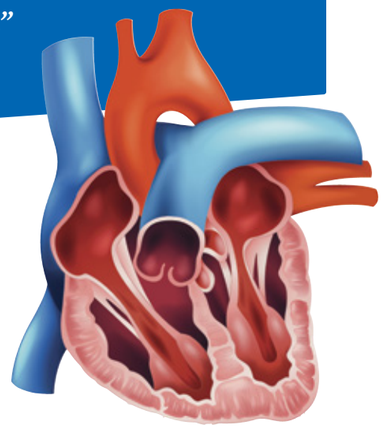
Although he is now a professor, Feinberg recalls his experience at UF fondly as being academically as well as socially stimulating. His advice to current biomedical engineering students is to build a strong educational foundation.

"Students need to have an open and inquisitive mind to be able to take diverse areas of science, engineering and medicine and creatively integrate them to solve problems. And to find out if research is right for them, they really need to get in the lab and try it," Feinberg said.

Feinberg adds that biomedical engineering students are fortunate to work at the exciting interface of engineering and medicine and need to "keep their eyes open for the unexpected" because a failed experiment can often lead to more interesting opportunities in this rapidly evolving field.

BY CARINA SEAGRAVE

"Students need to have an open and inquisitive mind to be able to take diverse areas of science, engineering and medicine and creatively integrate them to solve problems..." Feinberg said.



BRYAN CONRAD: HELPING ATHLETES GET OFF ON THE RIGHT FOOT

Through orthopaedic research with Nike, UF alumnus and former professor Bryan Conrad helps athletes "just do it" using skills obtained with the UF J. Crayton Pruitt Family Department of Biomedical Engineering.

Currently a senior researcher working with Basketball at Nike, Conrad said he knew he wanted to go into biomedical engineering as early as high school. His mother, a nurse in orthopaedics and sports medicine, encouraged him to meet with a surgeon she worked with who recommended the up-and-coming field.

"He mentioned that if I was interested in medicine and was good at math that I might want to consider a career in biomedical engineering," he said. "After I started to research the field, I was sure that's what I wanted to do."

After receiving his undergraduate degree at UF in engineering science with a minor in biomechanics, Conrad started his master's degree in biomedical engineering while simultaneously accepting a position as a research engineer in orthopaedics.

Under the guidance of UF BME Affiliate Professor Roger Tran-Son-Tay, Ph.D., Conrad worked on a study for therapeutic treatment of knee osteoarthritis and decided to pursue a Ph.D. for himself in biomedical engineering. His work with the Orthopaedic Biomechanics Lab in 2004 under Scott Banks, Ph.D., also a UF BME Affiliate Professor, inspired Conrad to accept a career in orthopaedics biomechanics research.

"Throughout my grad school experience, I had been incredibly blessed to be mentored by exceptional faculty members who were not only great academics, but had great character," Conrad said. "I had a great experience as a grad student and was able to see the BME department evolve dramatically from when I started my master's program in 1999 to when I finished my Ph.D. in 2009!"

After eight years of working full-time and academics part-time, he obtained a faculty position in the UF orthopaedics department where he managed the Biomechanics and Motion Analysis Lab as well as the Comparative Orthopaedics Lab.

Conrad worked with two Heisman trophy winners and 2 silver medalists for the U.S. Olympic Archery Team also publishing 74 academic papers. He was also interviewed by ESPN, CBS, and the Discovery Channel for his labs' work with the UF volleyball team.

After nearly three years working with students, Conrad made the decision to pursue a career with Nike in Portland, OR, to lead a team performing basketball research to develop high performance footwear for all athletes.

"If you have a body, you are an athlete," he said, in regards to his work to improve the quality of athletic footwear.

Conrad's experience at UF helped develop his skills that allow him to evaluate performance and improve protection of elite basketball players.

BY CARINA SEAGRAVE

Remembering Christian Aguilar

In the wake of the hardship of losing a son, the Aguilar family proudly received an *in memoriam* biomedical engineering degree from the UF College of Engineering and representatives from UF's Society of Hispanic Professional Engineers October 12, 2013.

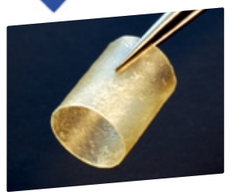
The event was held to celebrate the passionate life of Christian Aguilar who wanted to be an engineer and later attend medical school to become a cardiologist. Those of us in his UF and immediate family described Christian as "possessing intelligence, dedication, and a strong heart". The event was also attended by many of his friends and family who traveled up to Gainesville from Miami.

Aguilar went missing September 20, 2012, initiating a month-long search effort resulting in the discovery of his death. Despite their loss, the Aguilar's have founded a nonprofit organization called the Christian Aguilar Search and Rescue Foundation and have partnered with the Missing Children Global Network to launch an app that will help locate children who have gone missing. The new app is called, Christian Aguilar Mobile Alert.

The UF Department of Biomedical Engineering is saddened by the loss of one of their students and extends its support and condolences to his family.

Industry News

INDUSTRY PARTNERS STRENGTHEN UF BME



Left: Greg Freitag, Jill Schiaparelli and Karen Zaderej in Times Square when their company, AxoGen, joined the NASDAQ. Top right: AxoGuard® Nerve Connector Bottom right: Surgeons practicing nerve repair techniques at the AxoGen Nerve Course

The J. Crayton Pruitt Family Department of Biomedical Engineering is proud to launch its new Industry Partners Program this spring and is happy to announce Axogen as the first partner.

AxoGen Inc. is located just outside of Gainesville in Alachua, Florida. The company seeks to provide surgeons with solutions to repair and protect peripheral nerves. AxoGen was recently awarded the 2014 Product Innovation Leadership Award for Peripheral Nerve Repair from research organization Frost & Sullivan in recognition for the development and commercialization of Avance Nerve Graft. In addition to being an Industry Partner, Karen Zaderej, who is the CEO of AxoGen, is a member of the External Advisory Board for UF BME.

The goal for the new Industry Partners Program is to share knowledge and ideas, and to engage in research and educational collaborations with our industry partners in pursuit of solutions that will help advance patient outcomes and train the next generation of engineers.

Together, we can become a much more influential force in helping to move the discoveries of today into the solutions of tomorrow.

This new program will provide strategic connections between our BME students, faculty, and industry partners through several meaningful interactions, such as:

- Senior Design Projects
- BME Student Internships
- Research Collaborations
- Participation in Guest Lectures and Seminar Series

We are eager to recognize and acknowledge our BME Industry Partners in a number of ways. This will include their name & logo featured on our new Industry Partners Homepage for increased visibility among the UF Community and nationally.

If your company or organization would like more information on how to become a BME Industry Partner, please contact Mike Masem at 352-392-6795 or mmasem@eng.ufl.edu.

UF BIOMEDICAL ENGINEERING GRADUATES ITS FIRST UNDERGRADUATE CLASS

The College of Engineering is making history this May as it graduates its first class of undergraduate students from the J. Crayton Pruitt Family Department of Biomedical Engineering.

Generous gifts from the Pruitt family helped to grow a thriving biomedical engineering department over the course of a decade. Then in 2012, after several years of specializing in graduate-level research, the undergraduate program opened its doors.

"I am particularly proud of this inaugural class," says Christine Schmidt, professor and chair of the BME department. "As the first students in a new program, they are a self-selected group defined by their willingness to take chances and think outside the box. These qualities, combined with the rigorous and interdisciplinary technical training in the BME curriculum, will allow them to be true leaders in their field."

As graduation approaches, Amanda Eifert is thankful for the opportunity to pursue the goals she initially had her heart set on. "I think it's really cool to be part of the first class of BME students," Eifert said. I came in at the right time to be able to be a part of the program, and to not have to find some alternative route to the degree I really wanted."

Philip Vu is also graduating from the program in May.

"We have a patient who has neural problems that are not diagnosed," said Vu. The patient experiences sudden imbalance and loses coordination mid-stride, so Vu and his senior design class are building a device to send electrical stimulation to the back of the patient's ears, the area responsible for balance. "It's a real challenge, actually," said Vu, who expressed excitement in being able to improve the life of a real patient through his work. Vu will be attending the University of Michigan for his Ph.D. studies.

Long before graduating and entering the job market, Vu has already had opportunities to help real patients.

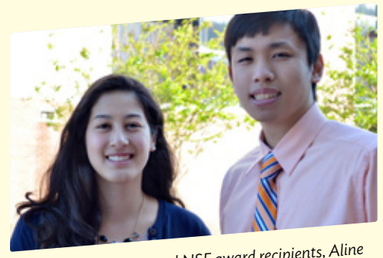
This is the kind of innovative work that surgeon J. Crayton Pruitt envisioned for the department when he invested in it. When a heart attack put Pruitt in the patient role, and a biventricular assist device bought him enough time to find a heart donor, his eyes were opened to the importance of bringing technology and medicine together.

Hans van Oostrom, associate chair of BME, says "the real power of a BME degree is that students are prepared to work at the interface of engineering and medicine." He said undergraduate students are benefiting from increased collaboration with clinicians. "We are perfectly situated right in the middle of UF's Health Science Center.

Within the small inaugural class, both Vu and his classmate Aline Yonezawa have received highly prestigious National Science Foundation (NSF) Graduate Research Fellowships. With these awards, UF ranks in 8th place nationwide for NSF fellowships in BME departments this year.

"To be awarded the NSF graduate fellowship is one of the biggest accomplishments I could have achieved in my undergraduate career," said Yonezawa, who believes the BME department and faculty members have prepared her for future endeavors in graduate school.

On May 3rd, before sending its first undergraduate class to don their regalia and garner their diplomas, the BME department will begin an annual tradition with its first ever pinning ceremony. Each of the 17 graduates will receive a custom designed BME alumni pin, acknowledging his or her achievements and serving as a reminder of the ethical responsibilities that accompany a biomedical engineering education. In future ceremonies, BME alumni will be able to sponsor pins for graduates who are following in their footsteps.



BME undergraduates and NSF award recipients, Aline Yonezawa and Philip Vu

BY KRISTI CAMARA

UF UNIVERSITY of FLORIDA

J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida
Biomedical Sciences Building JG56
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Gainesville, FL 32611-6131

ENGINEERS *for* LIFE.

UF BME HISTORY

The Department of Biomedical Engineering at the University of Florida is made possible by the vision and generosity of Dr. J. Crayton Pruitt Sr., and his family.

Dr. Pruitt was a visionary leader and inspiration to all who knew him. An accomplished cardiothoracic surgeon, researcher, inventor and philanthropist, he achieved much good and improved many lives in his 80 years.

He devoted his career to the treatment of stroke, co-creating one of the most widely used shunts of its kind for many decades and pioneering the surgical treatment of carotid artery arteriosclerosis for stroke prevention. At the time of his death in 2011, he was thought to have performed more of these surgeries than any other surgeon in the nation.

In 1995, Dr. Pruitt received a heart transplant at UF Health Shands Hospital. The experience left Dr. Pruitt and his family with a profound appreciation for biomedical engineering. They expressed their gratitude through multiple gifts to the biomedical engineering graduate program at UF. University leaders created the first-ever named department at UF with the naming of the J. Crayton Pruitt Family Department of Biomedical Engineering.

Since its inception in 2002, the Department continues to excel in interdisciplinary research that merges engineering with biology and medicine.

To learn more, please visit our website: www.bme.ufl.edu