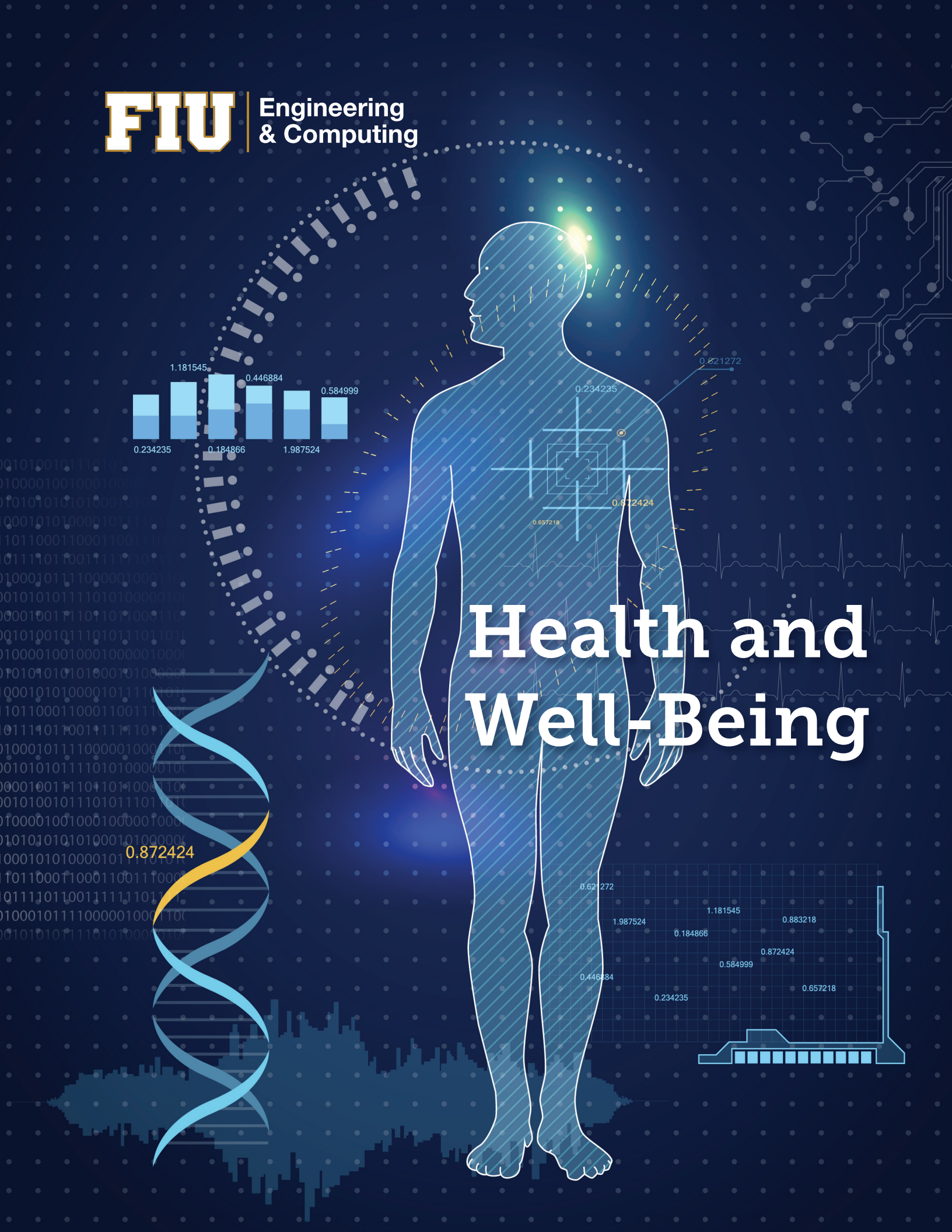
FIU Engineering & Computing

Health and Well-Being



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HEALTH & WELL-BEING CLUSTERS

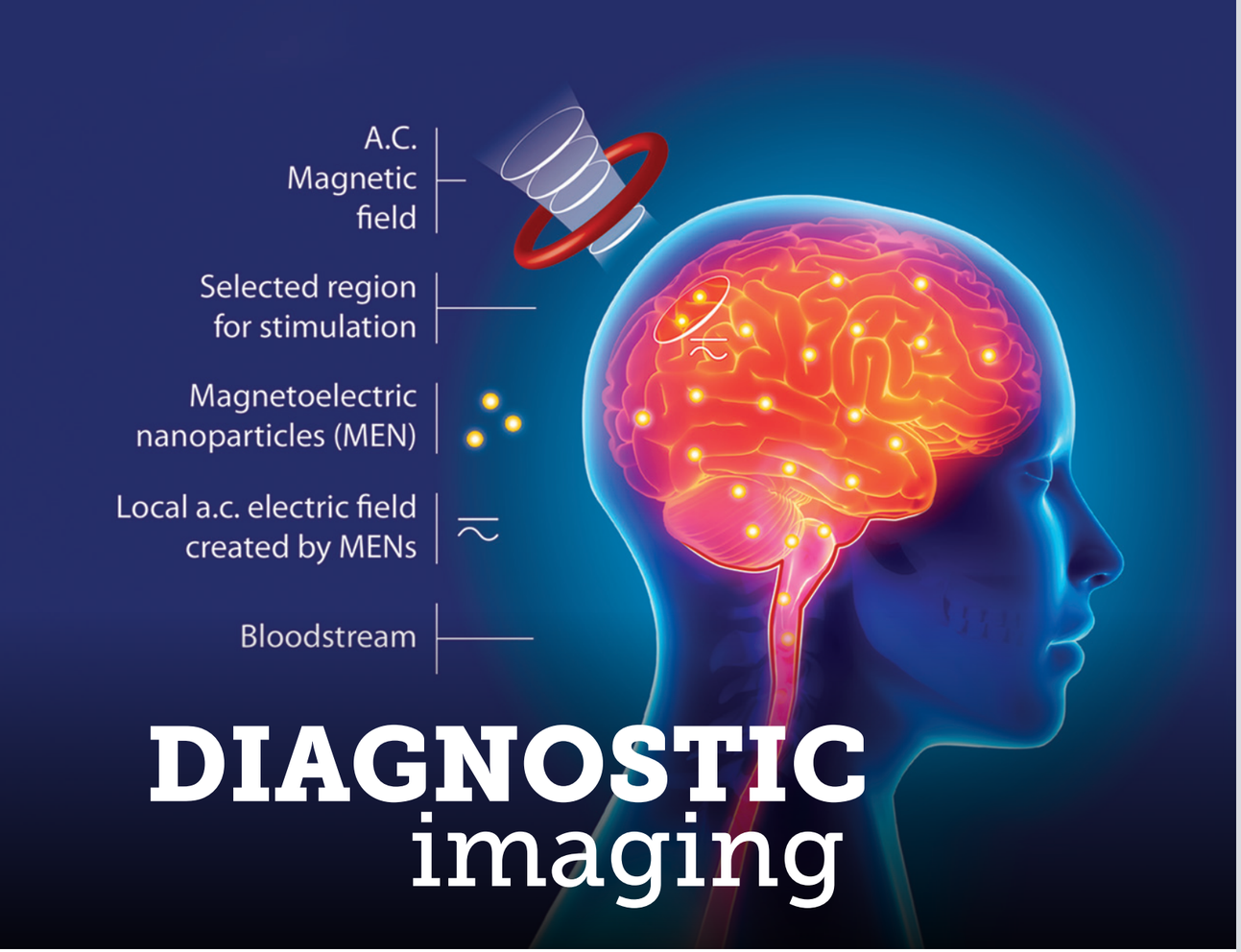
Located in Miami, a globally connected city, the College of Engineering and Computing (CEC) belongs to FIU, which has multiple campuses across South Florida and an international presence online and in China. FIU is classified by Carnegie as a **Highest Research Activity: R1: Doctoral University**, as a Carnegie Community Engaged university, an Ashoka U Changemaker institution, and a minority and Hispanic serving institution. As a member of one of the country's top-tier research universities, the college is actively engaged in cutting-edge research, entrepreneurship and education, and is home to top-level laboratories and facilities. It is ranked #91 by the National Science Foundation out of 358 in its Higher Education Research and Development rankings for federal research expenditures across all engineering disciplines.

With close to 6,000 students, CEC graduates the largest number of Hispanic engineers in the continental United States. U.S. News also ranked CEC #41 for best online graduate programs. CEC has two schools – OHL School of Construction and School of Computing and Information Sciences – and four departments – Biomedical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, and Mechanical and Materials Engineering.

[Summary]

Building on the NAE's (National Academy of Engineering) 2014 report "Making a World of Difference: Engineering Ideas into Reality," FIU's College of Engineering and Computing has developed research clusters within the areas of augmented connectivity; health and well-being; and smart and sustainably built environments. These areas unite engineering and computing with the overall research mission of the university to offer transdisciplinary solutions for the 21st century by weaving traditional engineering and computing disciplines into the broader tapestry of sciences, health, arts, architecture and public affairs. Engineering has indeed solved problems for individuals and society, and in doing so, transformed the way we live and the world we live in. Over the past three decades, CEC has offered this "world of difference" to our South Florida community and beyond. The college has adopted bold and innovative approaches to drive an ambitious agenda of growth, entrepreneurship, and sustainability that are responsive to the needs of the Greater Miami urban ecosystem.

Continued growth, research excellence, and unlimited potential – this is what defines our health and well-being cluster at CEC. Consisting of 31 tenure and tenure-track faculty members, the health and well-being faculty make up approximately 30 percent of the college's researchers. Research in the focus areas address four NAE "Grand Challenges for Engineering." They are: engineering better medicines, reverse-engineering the brain, advancing health informatics and engineering the tools of scientific discovery. The college features experts from biomedical engineering, electrical engineering, mechanical engineering, and computer and information sciences. The students and faculty within the health and well-being group not only reflect the diverse makeup of our city, but they also embody our college's unequivocal commitment to enhancing the engineering profession, and our global community.



DIAGNOSTIC imaging

Remote-Controlled Brain

Sakhrat Khizroev and colleagues are investigating non-invasive brain stimulation. Smart nanoparticles are injected into the bloodstream, which generate a local electrical field when exposed to a magnetic one. A strong magnet draws the particles upward through the blood brain barrier, a filter that keeps unwanted molecules out of the brain. The nanoparticles allow the electric field that exists in the brain to combine with the magnetic field outside the brain. Signals can then be sent from a computer to the particles, causing them to pulse and stimulate the brain. This deep brain stimulation wirelessly repairs the brain circuit. This technology may help treat neurological disorders such as Alzheimer's, autism, dementia, epilepsy, essential tremor and Parkinson's disease. It is also poised to potentially treat psychiatric disorders, including anxiety, depression, obsessive compulsive disorder (OCD) and schizophrenia.

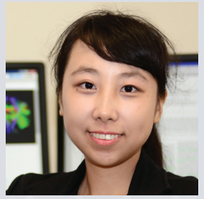
FACULTY

Armando B. Barreto, Ph.D. Professor

Dr. Barreto, and his research team, have several projects that involve processing signals from biomedical transducers, such as blood volume pulse photoplethysmography, electroencephalogram (EEG), and electromyogram (EMG) electrodes. His team has applied processing to the signals from these transducers towards the development of alternate human-computer interfaces for the benefit of users with severe motor disabilities. Their recent work has focused on integrating an infrared video eye gaze tracking system with the EMG-driven interface. **Diagnostics, Neurotechnology**

Shekhar Bhansali, Ph.D. Professor

Dr. Bhansali's work synthesizes 2D and 3D nanostructures and biological systems, and integrates them into novel nano-enabled systems. He and his colleagues have created a wearable sensor for diagnosis and management of chronic diseases. His research also includes reusable biosensors for monitoring of cortisol and stress management, alcohols for addiction management, and ketones for diabetes management. **Diagnostics**



Ruogu Fang, Ph.D. Assistant Professor

Dr. Fang is researching how to reduce radiation from CT scans through the use of math and computer technology. She has developed several mathematical algorithms, tested and validated them on simulated data. The next step is to validate her technique in actual patients using low-dose CT scans. Fang's research is focused on stroke patients, but her technology has the potential to be applied to other medical conditions, including cardiovascular diseases and kidney dysfunction. **Diagnostics, Neurotechnology**

Sakhrat Khizroev, Ph.D. Professor

Dr. Khizroev's research could lead to the non-invasive treatment of Parkinson's and other neurodegenerative diseases through the use of non-invasive brain stimulation. By injecting smart nanoparticles into the bloodstream, a local electrical field can be generated when exposed to a magnetic one. A strong magnet then draws the particles upward through the blood brain barrier. Computer signals can then be sent to the particles, resulting in deep brain simulation that repairs the brain circuit wirelessly. **Diagnostics, Neurotechnology**

Chenzhong Li, Ph.D. Associate Professor

Dr. Li's research centers around the development of biosensors through the use of nanotechnology. His projects include developing miniaturized biosensors for point of care testing used to treat and diagnose cancer, stroke and head trauma. He focuses on conducting whole cell analysis and manipulations in sensor systems used to assess nontoxicity, and in neuronal mapping, and the creation of environmental sensors for detecting biological toxins and other chemical pollution assays. **Diagnostics, Tissue Engineering**

Chunlei "Peggy" Wang, Ph.D. Professor

Dr. Wang's main research interest is synthesizing, characterizing, processing and integrating various multifunctional materials, such as carbon based materials, Si and polymer materials for electrical, electrochemical, optical and biological applications. **Diagnostics, Tissue Engineering**

NEURO technology

Neural-Enabled Prosthetic Hand System

Ranu Jung and her Adaptive Neural Systems Laboratory team have developed an advanced prosthetic system to restore sensation to upper extremity amputees. Sensors embedded in the prosthetic hand detect hand opening position and grip forces when coming in contact with an object. Signals from the sensors control an implanted electrical stimulation device that elicits sensation by delivering weak electrical pulses via electrodes. The electrodes are implanted in the fascicles of the peripheral nerves in the residual arm. The neural-enabled prosthetic hand system allows users to precisely differentiate between size and varying fragility of different objects.

FACULTY

Malek Adjouadi, Ph.D. Professor

Dr. Adjouadi is conducting brain research on instrumentation, neuroimaging, and curative protocols for neurological disorders. His work on neuro-navigated transcranial magnetic stimulation with compatible EEG module is currently being used at Baptist Hospital to help improve diagnosis in neurological disorders. Adjoudi's research on brain stimulation aims to stop or slow down the progression of Alzheimer's disease, as well as Parkinson's disease and epilepsy. **Diagnostics, Neurotechnology**

Ou Bai, Ph.D. Assistant Professor

Dr. Bai is helping to improve how lower-limb prostheses work under different walking conditions, such as stair walking or walking on an uneven plain. He is designing a wearable body area sensor for real-time measurements of the user's physical load and mental effort to reduce the user's energy expenditure, and a volitional prosthesis controlled technology for comfortable and effortless user control of the prosthesis to adapt to altered situations and environments. **Neurotechnology**

Mercedes Cabrerizo, Ph.D. Assistant Professor

Dr. Cabrerizo is using TMS technology to map brain function to optimize diagnosis and treatment planning, and research the potential of brain stimulation in patients with neurological disorders as a curative interventions. **Diagnostics, Neurotechnology**

Zachary Danziger, Ph.D. Assistant Professor

Dr. Danziger's work in neural engineering and neuroscience aims to mechanistically understand diseases that affect the nervous system, and then use that insight to treat the underlying dysfunction by creating new technology. He has two ongoing areas of research in neural engineering, one in brain-computer interfaces, allowing paralyzed users to control assistive devices, and the other in neurourology, which tries to alleviate bladder dysfunction through targeted neural stimulation. **Neurotechnology**

Ranu Jung, Ph.D. Professor

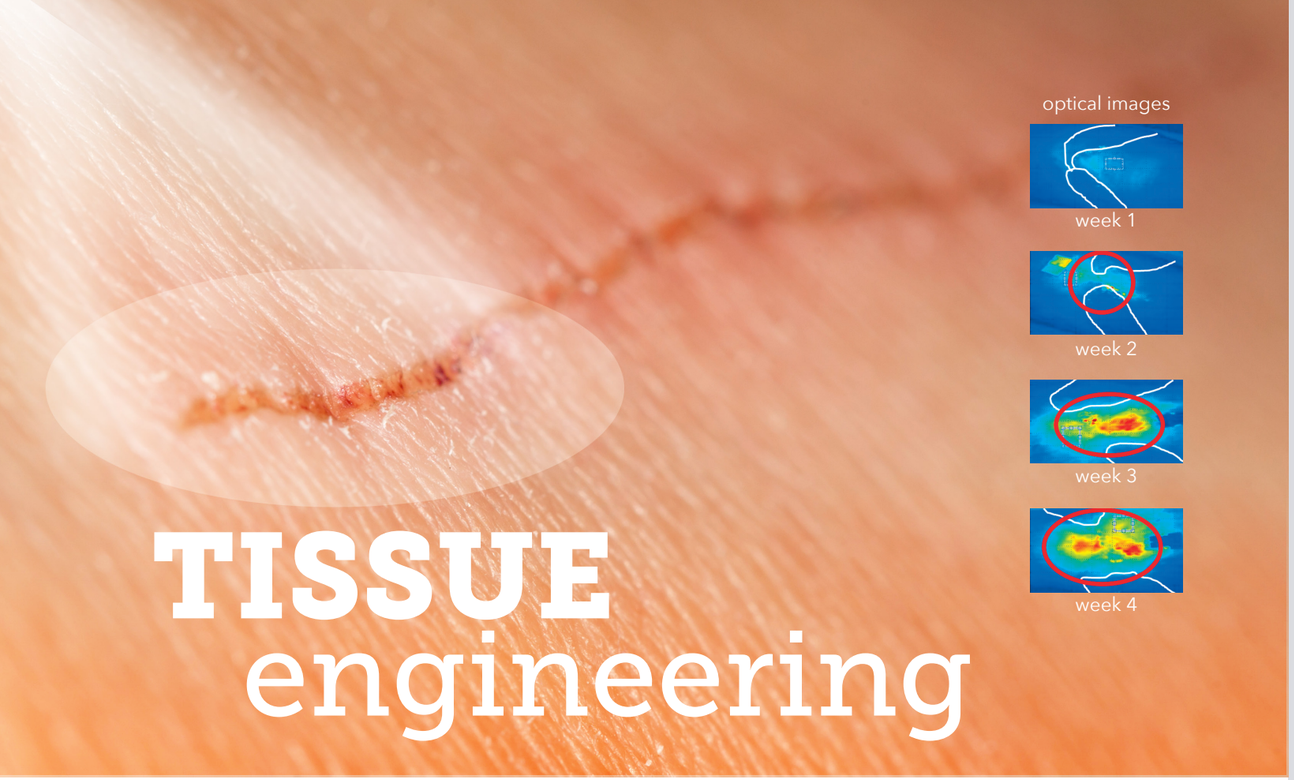
Dr. Jung, and her team, are developing neurotechnology and adaptive therapeutic devices that aim to restore lost functionality and they are investigating the effects of trauma and disorders of the nervous system. They have designed the first implantable, wirelessly controlled, direct intrafascicular neural interface system. The neural-enabled prosthetic hand system could restore sensation to upper extremities, allowing users to precisely differentiate between size and varying fragility of different objects. **Neurotechnology, Diagnostics**

Jacob McPherson, Ph.D. Assistant Professor

Dr. McPherson's research attempts to elucidate fundamental neuropathophysiological mechanisms that contribute to motor and sensory impairments following injury to the central nervous system, with the ultimate goal of ameliorating the deleterious effects of these conditions. His research spans both pre-clinical (i.e., animal) and clinical (i.e., human) neural engineering and neuropathophysiology, and includes investigations of motor and sensory function before, during, and after neuroprosthetic, pharmacological, and physical therapy-based interventions. **Neurotechnology**

Jorge Riera, Ph.D. Associate Professor

Dr. Riera, and his team, perform experiments that combine pharmacological manipulations and four main recording techniques. Through pharmacological manipulations, his group aims to isolate crucial pathways within the neurovascular coupling route and to enhance the activity of particular cortical microcircuit networks both in normal rodents and in those used to model pathological situations. His research hopes to change the way physicians diagnose and treat debilitating conditions such as dementias, epilepsy, hypertension and the cerebro-vascular trauma. **Diagnostics, Neurotechnology, Biophotonics**



TISSUE engineering

Near-InfraRed Optical Scanner (NIROS) for Wound Monitoring

The Near-InfraRed Optical Scanner (NIROS), developed by Anuradha Godavarty and team, is an ultra-portable optical scanner to perform non-contact 2D area imaging of wounds. NIROS includes a quantitative method to differentiate healing from non-healing wounds. It currently has 91 percent specificity in detecting the status of the wound without the need for tissue contact or X-ray radiation. NIROS can potentially impact early intervention in the treatment of diabetic foot ulcers and venous leg ulcers.

FACULTY

Arvind Agarwal, Ph.D. Professor

Dr. Agarwal's research focuses on developing nanomaterials reinforced polymer and ceramic coatings and composites for orthopedic and tissue engineering applications. He also works on developing characterization techniques to measure mechanical properties of low dimensional and biological materials including tissues and single cell. His research techniques include plasma spraying (FDA approved technique to deposit coatings on bone/hip implant), nanoindentation and nanotribology. **Tissue Engineering**

FACULTY

George S. Dulikravich, Ph.D. Professor

Dr. Dulikravich is attempting to improve on current methods of preserving a human heart. He is testing the possibility of pumping the heart with a +4 degree Celsius cold liquid during travel for transplant surgeries. The cold solution would extend the life of the heart to more than 10 hours, thus allowing transport to the entire inhabited part of North America. His research could also lead to a new way of treating patients with stroke and brain trauma. He hopes to determine if brain temperature can be lowered by using an external head and neck cooling device. The possibility of cooling the brain within 30 minutes of the onset of cerebral ischemia could allow the patient to regain vital functions through therapy. **Tissue Engineering, Neurotechnology**

Joshua Hutcheson, Ph.D. Assistant Professor

Dr. Hutcheson's work focuses on the mechanisms through which tissues are built and maintained, and the pathological changes that lead to disease. His work primarily targets cardiovascular diseases, the leading cause of death in Western societies. His research combines advanced imaging, materials science, biomechanics, and molecular biology to connect cellular processes to tissue function. **Tissue Engineering**

Kinzy Jones, Ph.D. Professor Emeritus

Dr. Jones' research is in co-fired ceramics for high density, biocompatible microelectronic systems, with special interest in co-fired Pt-alumina system from materials development and characterization to realization of complex 3-D implantable systems. This development effort is being extended to rapid manufacturing processes to support researchers in industry and academia to produce small quantity, implantable miniature packaging systems and micro-connectors. **Tissue Engineering, Diagnostics**

Anthony McGoron, Ph.D. Professor

Dr. McGoron's research focuses primarily on drug delivery and drug transport modeling. His research may involve the design of new drugs, or developing strategies to monitor and improve drug transport to target tissue. He is also developing PET radiochemicals that report on the functional variables of organs or tumors, respiratory gated PET imaging that accounts for the movement in the lungs, and nanoscale drug design and delivery for improved cancer diagnosis and therapy. **Tissue Engineering, Diagnostics, Biophotonics**

Norman Munroe, Ph.D. Professor

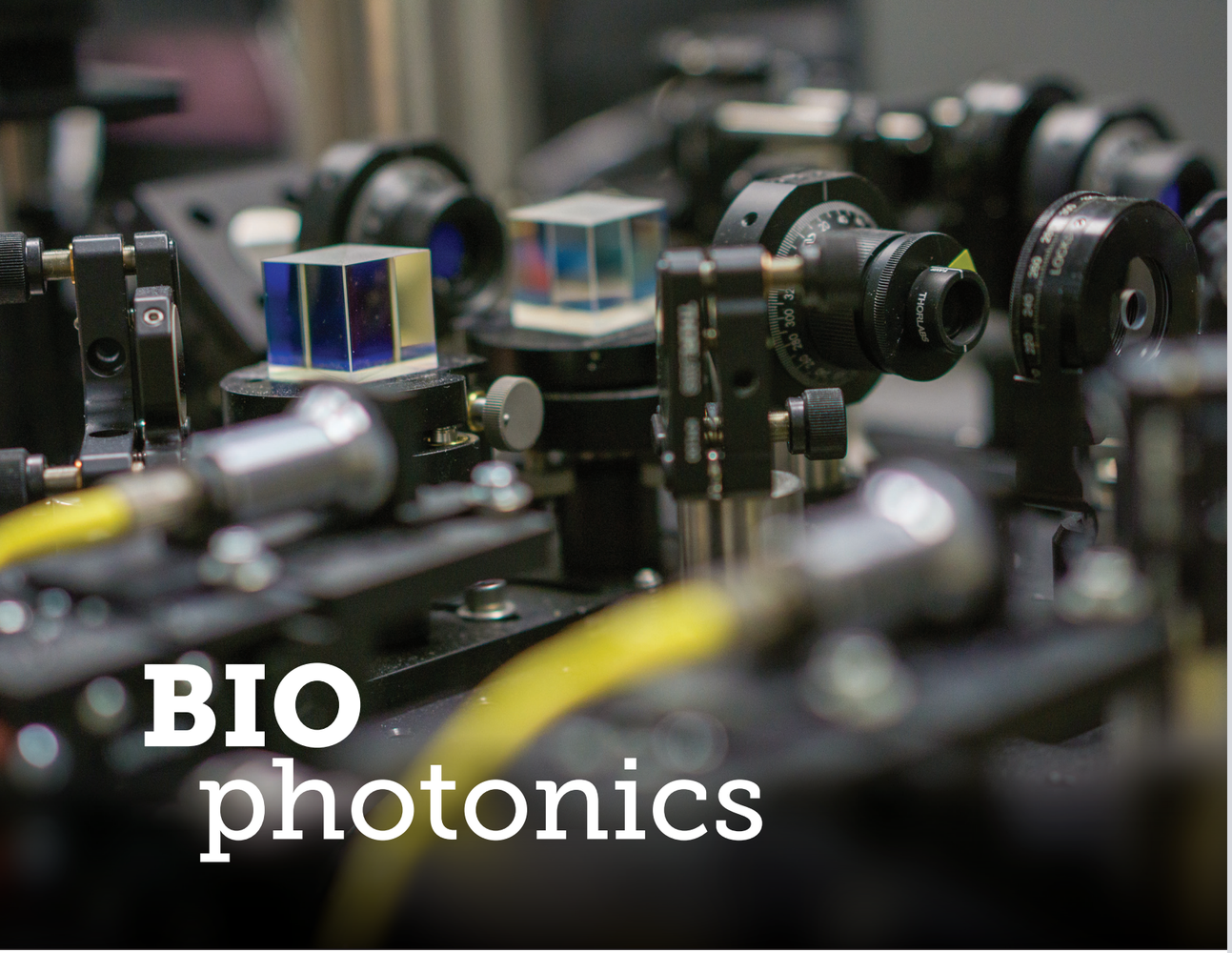
Dr. Munroe's research interests center around explanted orthopedic prostheses, the development of magnesium based bioabsorbable alloys for orthopedic and cardiovascular applications, antithrombogenicity-platlet adhesion, and biocompatibility and corrosion of implanted materials. **Tissue Engineering**

Sharan Ramaswamy, Ph.D. Assistant Professor

Dr. Ramaswamy's research interests lie primarily in the area of cell and engineered tissue mechanics with application in cardiovascular regenerative medicine. His Tissue Engineered Mechanics, Imaging and Materials Laboratory (TEMIM LAB) conducts both experimental and computational investigations in this area. In addition to this, Dr. Ramaswamy's laboratory conducts evaluation of emerging cardiovascular implants, such as heart valve prostheses, vascular stents and intra-vascular access devices (IVAD). **Tissue Engineering**

Nikolaos Tsoukias, Ph.D. Associate Professor

Dr. Tsoukias' research interests are in the areas of computational medicine and biology, systems physiology, drug delivery, and biotransport. In his laboratory, his team is focused on the mechanisms that regulate blood flow and pressure in the human body. His goal is to understand function at the macroscale level (tissue/organ) by integrating mechanisms at the subcellular and molecular level. **Tissue Engineering**



BIO photonics

Biophotonics for Diagnostics

Biophotonics is an emerging area of scientific research that uses light and other forms of radiant energy to understand the inner workings of cells and tissues in living organisms.

The biophotonics research conducted in the Department of Biomedical Engineering tackles a wide range of important medical conditions such as eye disease, breast cancer, skin lesions, and pre-term labor, to name a few. Biophotonics is highly translational where novel technologies are quickly transferred to the clinical setting.

FACULTY

Anuradha Godavarty, Ph.D. Associate Professor

Dr. Godavarty's Near-InfraRed Optical Scanner (NIROS) has implications for monitoring a wide range of wounds. Her research focuses on imaging diabetic foot ulcers and venous foot ulcers, the latter which accounts for 80 percent of all leg ulcers. This mobile, handheld device is currently in extensive clinical studies. **Biophotonics, Tissue Engineering, Diagnostics, Neurotechnology**

Shuliang Jiao, Ph.D. Associate Professor

The long-term goal of Dr. Jiao's research is to help prevent and cure blindness through technological innovations. Dr. Jiao's Ophthalmic Imaging Lab is dedicated to the development of novel optical technologies for 3D high resolution imaging of the anatomy and functions of the eye in vivo. The optical imaging technologies the lab currently focuses on include optical coherence tomography (OCT), photoacoustic microscopy, and multimodal imaging. These technologies serve as tools for the research and diagnosis of diseases such as age-related macular degeneration, glaucoma, and diabetic retinopathy. They also provide powerful tools for monitoring the functional regeneration of photoreceptors in regenerative medicine such as stem cell therapy. **Biophotonics, Diagnostics**

Wei-Chiang Lin, Ph.D. Associate Professor

Dr. Lin's research involves developing non-destructive optical and mechanical technologies that can detect disease development and tissue injuries in vivo. These techniques can be either one-dimensional (i.e., point detection) or multi-dimensional (i.e., imaging). The potential medical applications for such techniques, once developed, are abundant. For example, they may be used intraoperatively to guide tumor resection and to monitor the progression of a novel therapy. **Biophotonics, Diagnostics, Neurotechnology**

Jessica Ramella-Roman, Ph.D. Associate Professor

Dr. Jessica Ramella-Roman, and the Medical Photonics Laboratory (MPL) conducts research in biophotonics and focuses particularly on the development of devices and methodologies for diagnosis of disease. They focus on the detection of early signs of diabetic retinopathy, a disease associated with diabetes, using spectroscopic and polarimetric techniques. Her lab is also developing methodologies for non-invasive monitoring of the skin, and is conducting research on the discrimination of melanoma. Her team is seeking insight into several forms of skin damage including pressure damage, thermal damage, and electrical damage. **Biophotonics, Diagnostics, Tissue Engineering, Neurotechnology**

Wireless Power and Data Transmission for Wearables/Implantable Devices

Stavros V. Georgakopoulos and his colleagues are researching wireless power and data transmission for wearable and implantable sensors and devices. Current "plugged in" biomedical equipment hampers patient and caregiver mobility and poses safety hazards. Also, batteries do not last. A wirelessly powered/charged wearable thermometer and pulse oximeter eliminates power cords and supports a new way to take people's vitals and measure oxygen saturation in the blood. This wireless system, which includes a transmitter and receiver, is mobile, more reliable, comfortable, safer, faster and more sanitary. The technology has multiple applications and can be used for various devices.

FACULTY

Stavros V. Georgakopoulos, Ph.D. Associate Professor

Dr. Georgakopoulos and his colleagues are researching wirelessly powered/charged wearable devices that eliminate power cords. The mobile, wireless system allows medical personnel to take patients' vitals and measure saturation in the blood without the need for plugged-in equipment. **Data Analytics**

FACULTY

Mark A. Finlayson, Ph.D. Assistant Professor

Dr. Finlayson's lab develops computational techniques for understanding language, with a special focus on higher-level forms of discourse organization such as narrative. He and his team are applying these techniques to a variety of problems and questions, including: mining electronic health records to identify patient sub-cohorts responsive to particular therapies; understanding health decision making in patients; modeling and improving doctor training and communication; and automatically detecting and treating psychological disorders. His work combines natural language processing, machine learning, and cognitive science. **Data Analytics**

Sitharama S. Iyengar, Ph.D. Professor

Dr. Iyengar's work focuses on addressing existing challenges, techniques, and future directions for computational health informatics in the big data age. He has proposed a systematic data-processing pipeline for generic big data in health informatics, covering data capturing, storing, sharing, analyzing, searching, and decision support. Specifically, numerous techniques and algorithms in machine learning are categorized and compared. **Data Analytics**

Christine Lisetti, Ph.D. Associate Professor

Dr. Lisetti's personal health informatics research group is building virtual health coach avatars that help at-risk individuals by delivering behavior change interventions for wellbeing. The group works on an-NSF funded project to build socially and culturally competent health avatars that converse with patients via multimodal communication, e.g. facial expressions, gestures, speech with intonation, about at-risk behaviors, e.g. excessive drinking and lack of exercise. The work involves creating computational models of empathic communication using artificial intelligence techniques to determine the user's emotional and social cues in real time, and health communication research to model how to respond to these social cues verbally and non-verbally. **Data Analytics**

Giri Narasimhan, Ph.D. Professor

Dr. Narasimhan's work focuses on problems from the field of bioinformatics, biotechnology, data mining and information retrieval. His group has developed novel algorithms and applied them to biological networks, microbial networks and microbiome analysis. Additional projects focus on medical image processing, data mining and knowledge discovery relating to electronic medical records. **Data Analytics**

Nipesh Pradhananga, Ph.D. Assistant Professor

Dr. Pradhananga is improving construction safety through an oculus virtual reality headset that simulates the operation of heavy construction equipment. A 360-degree camera on hardhats worn on construction sites helps researchers study workers' field of view and analyze potential risks in their gazing pattern. Virtual reality exposes subjects to virtual hazardous situations on construction sites – in the safety of a lab – and measures their physiological responses with sensing devices. **Data Analytics**

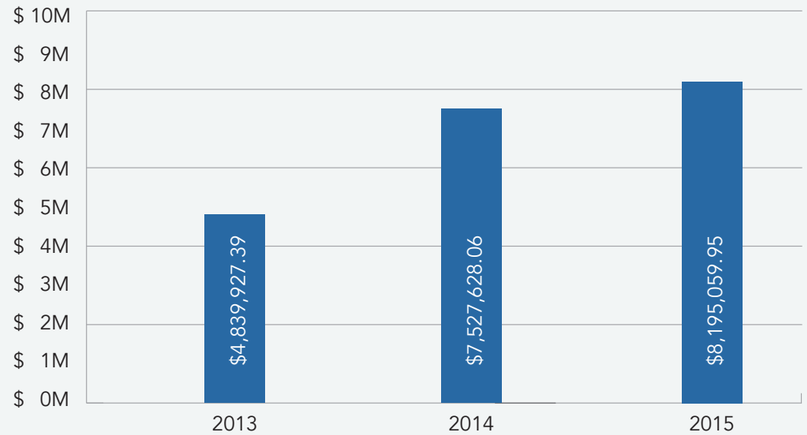
Naphtali D. Rishe, Ph.D. Professor

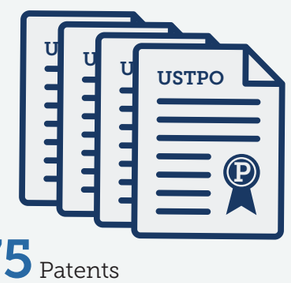
Dr. Naphtali Rishe's health information technology research group is developing a cloud-based system to run big data algorithms using geospatial data and publically available medical data, to assist the development of the field of precision medicine by combining clinical, genetic, and geospatial data. The group works on funded projects on nanomedicine, big data analytics of mass spectrometry, and on tropical medicine. Additionally, Dr. Rishe's team is funded by NSF for research on Ebola and by Sanofi Pasteur for geo-analytics of dengue. **Data Analytics**

[CEC Research Highlights]

* Numbers reflect broader scope of research

Research Expenditures





Faculty Fellows

George S. Dulikravich
ASME, AAM, RAeS, AIAA

Sitharama S. Iyengar
NAI, ACM, AAAS, IEEE

Arvind Agarwal
ASM

Shekhar Bhansali
NAI

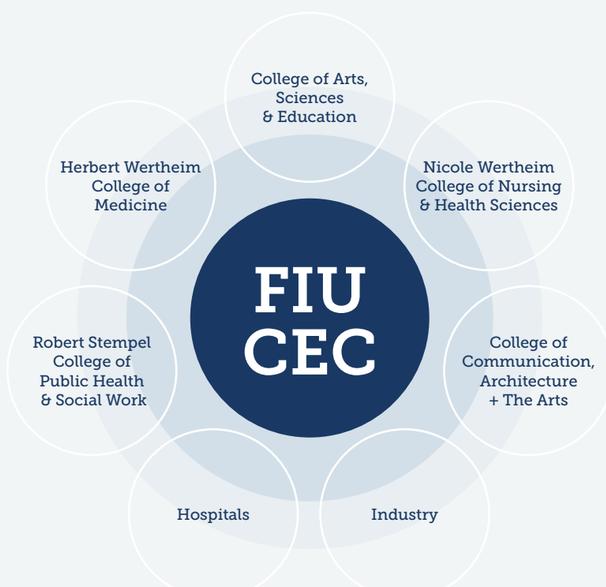
Kinzy Jones
ISHM

Ranu Jung
AIMBE

Sakhrat Khizroev
NAI

Anthony McGoron
AIMBE

Sharan Ramaswamy
AHA



[Tomorrow's Engineers]

Recent Top Graduates in Biomedical Engineering

Name	Program	Current Position
Alicia Fernandez-Fernandez	Ph.D.	Associate professor, Physical Therapy Dept. at Nova Southeastern University
Yalin Ti	Ph.D.	China clinical research manager, GE Healthcare
Yinchen Song	Ph.D.	Clinical neurophysiologist, biomedical engineer, research scientist, Dartmouth College
Bradley Fernald	M.S.	Director of product management at Synaptive Medical
Elizabeth Gallardo	B.S.	Ph.D. student at Harvard John A. Paulson School of Engineering and Applied Sciences
Maria Peña	B.S.	Quality Systems Specialist at Medtronics

Dr. Len Pinchuk, member of National Academy of Engineering, founder of Innovia LLC, and member of FIU BME Academic Advisory Board, on why BME students matter:

*"**A BME education often underlies the key to success in the medical device industry. I can confirm this from personal experience and therefore intend to continue to hire BME students due to the interdisciplinary nature of the education.** I was the first student to obtain a master's degree in BME from the University of Miami and then was awarded my Ph.D., interdisciplinary in chemistry, engineering, and medicine as there was no BME Ph.D. at the time. Upon graduation in 1983, I was immediately hired by Cordis Corporation to lead a synthetic vascular graft project. I attribute my interdisciplinary approach to the solution, which involved a comprehensive knowledge of chemistry, polymer chemistry and cardiovascular physiology, to my BME coursework. We overcame a major hurdle in the project by understanding the nature of the interface between the synthetic graft and tissue. The vascular graft development program later led to the development of the first stent-grafts used to bypass abdominal aortic aneurysms. My inventions can be traced back to my BME roots and include the angioplasty balloon, numerous stents, biomaterials and a novel device to stent in the eye to stop the progression of glaucoma. I have been informed that my inventions have saved the lives of over 100 million patients and the economic impact has exceeded $100 billion. I also hire BME students from FIU. One in particular is currently very much involved in a minimally invasive glaucoma surgery project. In fact, my company developed this device and procedure, and was just acquired for a milestone driven purchase price that could reach $700 million. In closing, I would also note that local medical device companies with which I am involved often hire BME students due to their interdisciplinary education."*

Dr. Obdulio Piloto, founder and CEO of Entopsis, on his relationship with FIU BME:

We have lots of ties to the FIU BME group!

- **>90%** of all interns we've supported are from **BME**
- **50%** of Entopsis employees are, or were, **BME** students due to their excellent skills and willingness to learn
- Our first hire was a **BME** student, who will become the CEO of our latest spun-out company

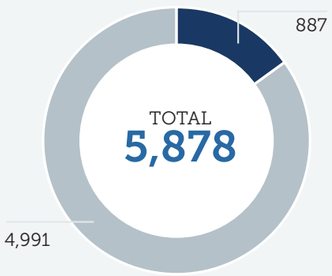
The Department of Defense anticipates a

27%

increase in BME jobs through 2025, which is most among all engineering disciplines

[Student Demographics]

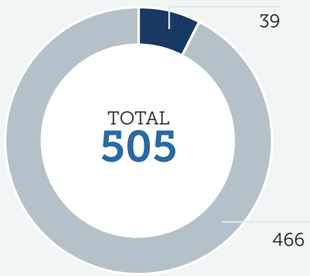
College-Wide Enrollment



Graduate

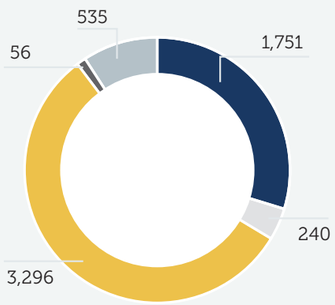
Undergraduate

Biomedical Engineering Enrollment



#1 BME Bachelor's degrees to Hispanic students according to 2015 ASEE

College-Wide Ethnicity



Graduate Hispanic

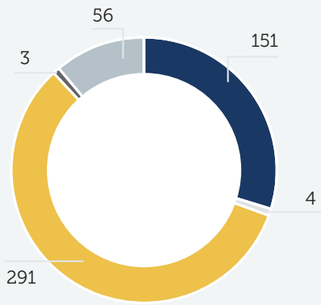
Undergraduate Hispanic

Graduate African American

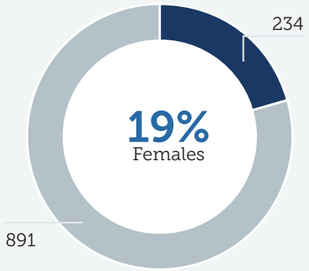
Undergraduate African American

Other

Biomedical Engineering Ethnicity



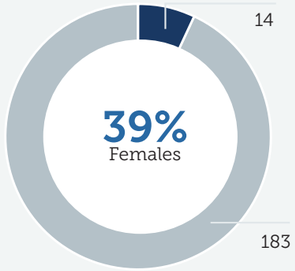
College-Wide Females



Graduate

Undergraduate

Biomedical Engineering Females

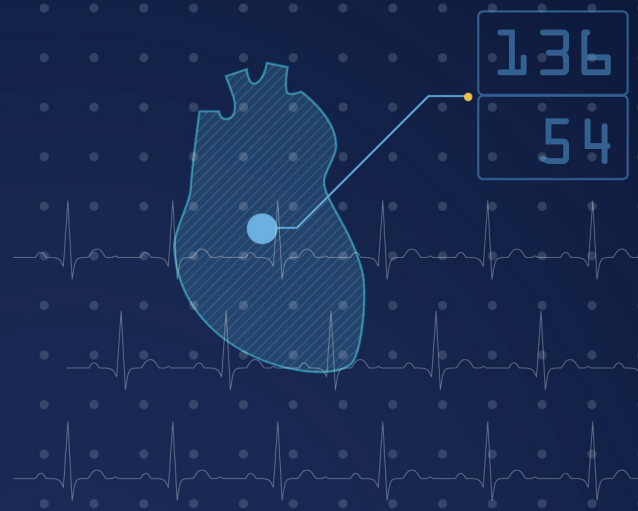


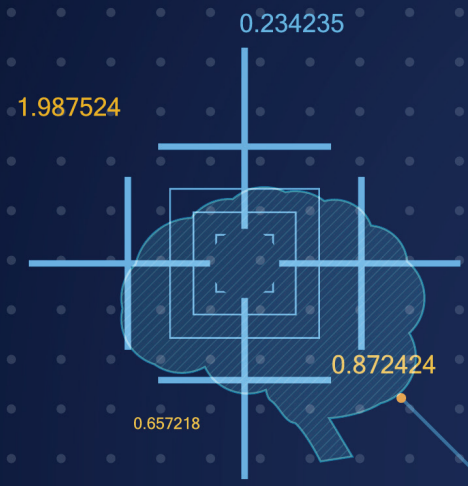
100% Honors College BME Retention & Graduation Rate from 2010 - 2014

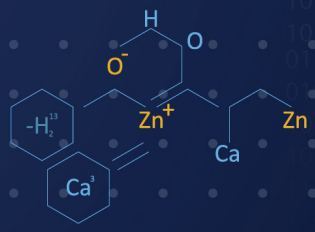
Responding to NAE's Grand Challenges: FIU CEC Accomplishments

- Developed new light-based (biophotonic) diagnostic tools to image the eyes to ascertain retinopathy and determine the status of wound healing
- Designed biophotonic tools for early detection of anal and cervical cancers, and brain tumors
- Established tools for assessing motor function using wearable sensors
- Creating point-of-care sensors to identify biomarkers of Alzheimer's and stress
- Pioneered multi-scale computational models to provide insight for physiological and pathophysiological function from the cell, to the tissue, to the whole organ level in particular to understand changes in microcirculation
- Designed computational neuroscience models to understand changes in motor neuron function after spinal cord injury
- Developed computational models to understand brain thermodynamics to guide cryopreservation of tissue
- Identifying nano-electro-magnetic particles that specifically target ovarian cancer cells through changes in the electrical properties of the cell membrane and release of anticancer drugs specifically to the cancer cells
- Exploring nano-scale materials as combined drug delivery vehicles and imaging sensor theranostics when targeting cancerous tumors in the visceral organs and the brain
- Additional work on nano-electro-magnetic particles can provide deep brain stimulation at selected sites without any external or transcranial connections
- Developing direct neural interfaces to decode neural activity of the brain to control prostheses
- Utilizing imaging and EEGs to understand neural activity patterns for motor control and tasks such as meditation
- Exploring use of functional near-infrared spectroscopy to study brain activity underlying motor function in adults with cerebral palsy
- Using EEGs, direct brain recording, multiple imaging modalities, and transcranial magnetic stimulation to understand the cause of epileptic seizures and diagnose and treat them
- Designing implantable interfaces between the nervous system and prostheses that have tactile sensory capabilities to restore sensation to people with limb loss
- Pioneering neuroprostheses and utilizing robotics to restore neural patterns after brain and spinal cord injury, and promote neuroplasticity
- Created cloud-based applications to run big data algorithms that combine geospatial and publically available medical data for deriving knowledge about disease development
- Utilizing augmented reality to assess affective learning
- Established big medical data-enabled technology to reduce the radiation exposure in medical imaging to improve healthcare safety

RESEARCH







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