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Biomedical Engineering

BIOMEDICAL ENGINEERING

UNDERGRADUATE RESEARCH CELEBRATION

FALL 2022

DISCOVER | DESIGN | DEVELOP | DELIVER

Presented through the generous support of the Wallace H. Coulter Foundation.

FIU | Engineering & Computing

Biomedical Engineering

13th Annual
UNDERGRADUATE RESEARCH CELEBRATION

September 30, 2022

8:30-9:00 AM	Breakfast (Panther Pit)
9:00 -10:00 AM	Seminar by Dr. Mary-Ann Mycek (EC 2300)
10:00-10:30 AM	Short Break
10:30 AM-12:30 PM	Students Poster Session (Panther Pit)
12:30-2:00 PM	Lunch and Networking with Students (Panther Pit)
2:00-3:30 PM	Panel Discussion (EC 2300)
3:30-4:00 PM	Awards & CURE Induction Ceremony (EC 2300)
4:00-5:00 PM	Reception (EC 2300)

Department of Biomedical Engineering (BME) bme.fiu.edu | @fiubiomed

MESSAGE FROM THE CHAIR

Congratulations Biomedical Engineering Undergraduate Researchers!

Today marks a milestone in your undergraduate education, where you showcase your self-motivated contributions to research. You set a great example to all, that learning does not end in the classroom and research is a vital component of your undergraduate experience.

I am delighted that there has been a steady increase in the number of undergraduate students participating in research. Each of you has a vital role in your research projects, no matter how big or small your contributions are. The Undergraduate Celebration presentations reflect your ability to work both individually and in teams, to converge information and ideas to discover the unknown, and to find innovative solutions. During this special day, we also recognize our outstanding students in the Coulter Undergraduate Research Excellence (CURE) Program. The BME Wallace H. Coulter endowment allows us to support students in the CURE Program as they participate in a tiered research experience alongside a faculty mentor and participate in career development workshops.

As you move forward in your undergraduate education, continue motivating yourself and others around you to enhance your knowledge, remain inquisitive, and continue to grow in all aspects of learning.

Thank you to all our BME Alumni for their active participation in our Undergraduate Celebration and for sharing their real-life experience as medical students, graduate students, academicians, or industry/corporate members. This truly reflects your enthusiasm to give back to the next generation of biomedical engineers!

Best wishes for continued success,

Jorge Riera Diaz, Ph.D.
Associate Professor, Interim Chair of Biomedical Engineering

KEYNOTE SPEAKER

Mary-Ann Mycek, Ph.D.
Interim Chair, Department of Biomedical Engineering
Professor of Biomedical Engineering
College of Engineering & Medical School
University of Michigan

OPTICAL DIAGNOSTICS FOR PANCREATIC DISEASE DETECTION

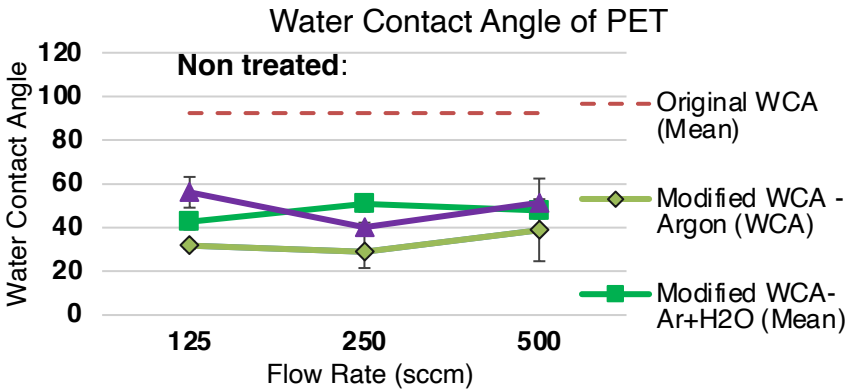
ABSTRACT: Prof. Mary-Ann Mycek's research program in biomedical photonics involves developing and applying methods of optical science and engineering to probe and quantify the living systems found in biology and medicine. This presentation will describe a multidisciplinary, translational research project employing clinical optical diagnostic technologies and computational modeling of light propagation in human tissues for improved detection of pancreatic disease.

BRIEF BIO: Dr. Mary-Ann Mycek is the Interim Chair of the Biomedical Engineering Department in the College of Engineering and Medical School at the University of Michigan. She is also a Professor of Biomedical Engineering, as well as a member of the Applied Physics Graduate Program and the Michigan Center for Integrative Research in Critical Care.
She received her Ph.D. in Physics from U.C. Berkeley, where she specialized in condensed matter physics and ultrafast optical spectroscopy, before pursuing postdoctoral training in laser medicine at Massachusetts General Hospital and Harvard Medical School. She was an Assistant Professor of Physics & Astronomy at Dartmouth College before joining the University of Michigan. Her translational research program in biomedical photonics involves using light for non- and minimally invasive tissue diagnostics.

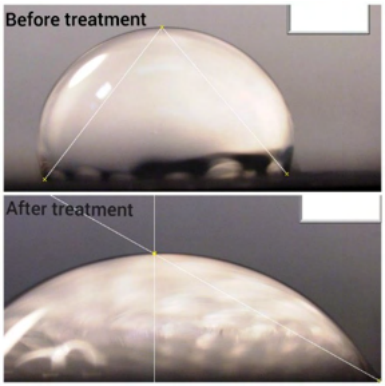
Surface Treatment of Polyester Fabric with Atmospheric Pressure Plasma

Authors: Srujana Yellapragada, Yuki Takino, Sukma Wahyu Fitriani, Akimitsu Hatta
Faculty Advisor: Akimitsu Hatta, Ph.D. (Department of Electronic and Photonic Systems, Kochi University of Technology)

Polyethylene Terephthalate (PET) fabric, a recycled synthetic fiber, has been frequently studied to innovate increased usage in both the clothing and medical industry. Some include ways to dye the fabric so that it can be commercially used for the purpose of environmental conservation from frequent discard of nonrecyclable fabric. Some biomedical applications involve the application of plasma treatment to reduce bacteria adhesion and improve anti-bacterial properties on the fabric. However, neither have been successful due to a lack of understanding of the surface modification of PET fabric to enable such properties. The hypothesis is that hydrophobicity is an issue in this study. The goal is to modify the surface of PET cloth to obtain a hydrophilic property through atmospheric-pressure plasma surface modification. Dielectric barrier discharge (DBD) plasma irradiation is a technique involving the electrical discharge between two electrodes separated by an insulating barrier. At a constant peak voltage, the smoothly flowing argon gas is turned into plasma, and the plasma is applied to the PET cloth surface. New functional groups are made or altered and attached to the surface layer which changes the character of the membrane but not its bulk properties. This study analyzes and reports on changes in surface hydrophobicity. This process tested three parameters followed by water contact angle, XPS, and FTIR analysis. PET fabric successfully gains a hydrophilic property through plasma treatment along with consistency in results of surface modification from FTIR and XPS. However slight differences in results still do appear which must be further analyzed.



WCA measurements of three parameters.

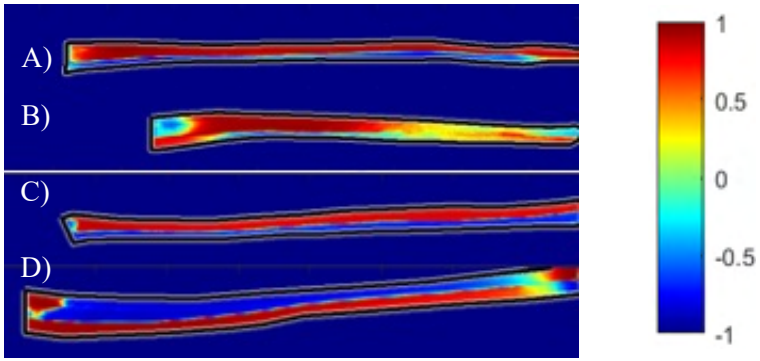


Optical microscopic image of water droplet on PET fabric before/after surface modification.

Near-infrared Imaging Detects Altered Flow Patterns due to Vascular Calcification in Chronic Kidney Disease

Authors: Faiza Nazir, Daniela Leizaola, Valentina Dargam, Kevin Leiva, Anuradha Godavarty, Joshua Hutcheson
Faculty Advisor: Anuradha Godavarty, Ph.D.; Joshua Hutcheson, Ph.D.

Chronic kidney disease (CKD) is an impairment of the kidney function for over 3 months. Because the kidneys operate insufficiently, uremic toxins circulating in the blood lead to stress on the cardiovascular system. Thus, CKD patients are at a higher risk of developing cardiovascular disease. In particular, patients with CKD often exhibit vascular calcification, the formation of bone-like mineral in the arterial wall. Vascular calcification is the most significant predictor of 5-year mortality in CKD patients. Calcified arteries can impact peripheral blood flow. The focus of this study was to compare the changes in effective hemoglobin concentration in the tail of mice with and without CKD-induced calcification. Six mice with CKD and no calcification and 5 mice with CKD and high phosphate (CKD+HP) to induce calcification were imaged using non-contact near infrared optical scanner (NIROS) to dynamically image mice tails in response to an occlusion stimulus. Pearson's correlation coefficient was calculated, and flow correlation maps were generated from the dynamic tissue oxygenation maps. Oxygenation flow correlation maps allowed the identification of flow pattern differences before and after the onset of calcification. The correlation from Week 6 to Week 12 in the mice with calcification displayed a shift from a stronger to a weaker flow correlation. In contrast, the mice without calcification displayed minimal change in correlation. The weaker correlation (or asynchronous flow patterns) observed in mice with calcification highlights the possible effect of calcification on peripheral oxygenation flow. Future works involve segmentation of positively correlating flow patterns for region comparison.

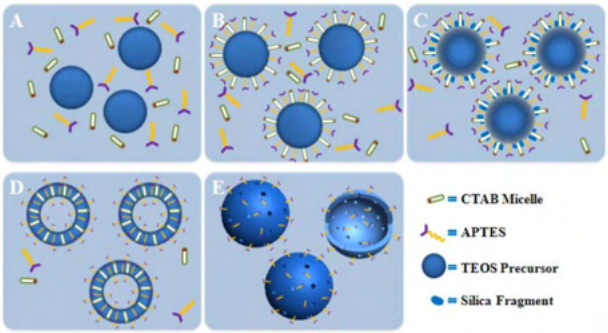


Comparison of oxygenation flow correlation maps from a PCC of 0.69 in A) Week 6 to 0.49 in B) Week 12 in a CKD mouse without calcification to a CKD mouse with induced calcification from a PCC of 0.67 in C) Week 6 to -0.2 in D) Week 12.

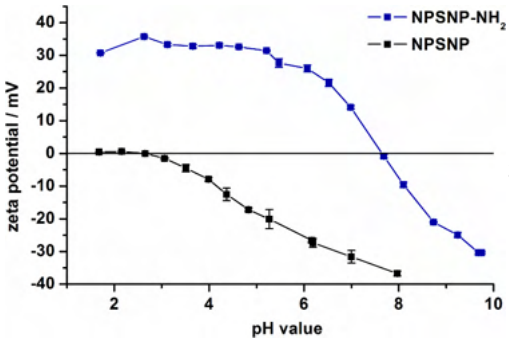
Amine Functionalization of Mesoporous Silica Nanoparticles

Authors: Lina Sabkhangulova, Srujana Yellapragada, Angelica Garcia del Rio, Anthony McGoron
Faculty Advisor: Anthony McGoron, Ph.D.

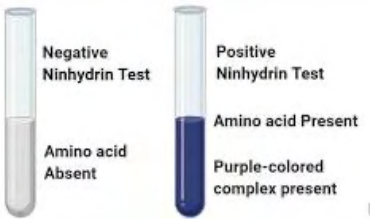
Our goal is to obtain amine functionalization in mesoporous silica nanoparticles and quantify the coverage using the ninhydrin test as well as zeta potential. MSNs have been proven to have an impressive ability to deliver a wide range of cargos, such as cancer drugs and DNA through its high porous volume and easy surface functionalization, while avoiding toxicity-related damage to healthy cells. Functionalization enhances the properties and characteristics of silica nanoparticles through surface modification. More specifically amine functional groups are used to attach other chemical moieties (such as anti-bodies, imaging agents, drugs, poly-ethylene glycol or other coatings) to improve the delivery and tracking of the nanoparticles. Presence of amine groups affects the pH at which zeta potential is near neutral charge shifting the isoelectric point of the pH vs. zeta potential curve upward and therefore transforming the relationship of zeta potential and pH. Therefore, analyzing the relationship between zetapotential at each pH condition is used as an indirect way in determining whether the amine groups from our source, APTES, have been successfully attached to the silica nanoparticles. To further test the presence of amine groups, the ninhydrin test method was performed providing various results including a Ruhemann's purple color of the test solution indicating presence of amine groups or a clear color as our negative result.



Multifunctional porous silica nanoparticles.



Relationship of zetapotential and pH.

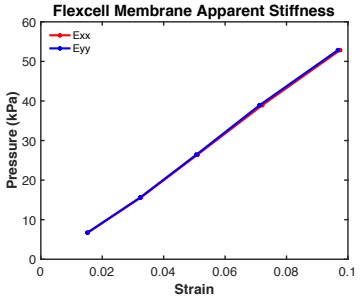


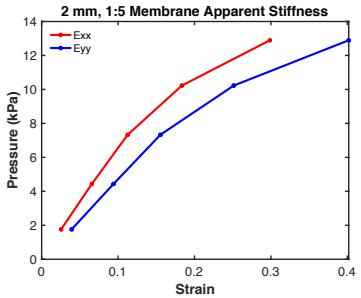
Ninhydrin Test Observations.

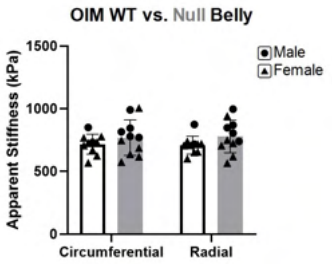
Optimization of Polydimethylsiloxane Membranes for Microscopic Tissue Tensile Mechanical Testing

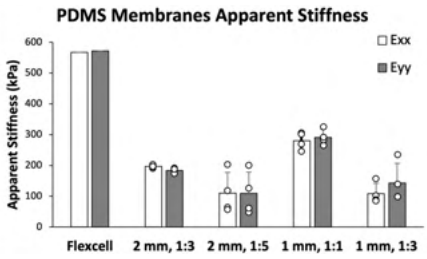
Authors: Andrea Rivera, Daniel Chaparro, Joshua Hutcheson
Faculty Advisor: Joshua Hutcheson, Ph.D.

The aortic valve opens and closes about 3 billion times in a lifetime. To respond to the high mechanically active environment, aortic valve tissue function is determined by a finely tuned structure that dictate appropriate mechanical properties. Investigating the mechanical properties of aortic valves is essential to understanding physiology and changes that lead to disease. Mouse models are an increasingly popular method of investigating human aortic valve pathogenesis. Our lab has previously shown that mouse aortic valve leaflet (MAVL) tensile properties can be measured by attaching the tissues to an elastomer, applying equiaxial loads and calculating tissue deformations. However, the stiff elastomer used previously can mask subtle differences in tissue properties. Therefore, a biomaterial that is more compatible with the elastic modulus of mouse aortic valve leaflets is necessary to improve the sensitivity of the analysis. By manipulating the mass ratios in a mix of commercially available elastomers, Sylgard 184 and 527, we manufactured polydimethylsiloxane (PDMS) membranes of varying thicknesses with a tunable elastic modulus. After applying equiaxial loads to the membranes and calculating their strain, their apparent stiffness ranged from 109 kPa to 290 kPa, an elastic modulus that is softer than the standard Flexcell PDMS membranes (570 kPa). We hypothesize that these membranes will improve the analysis of the orthotropic tensile properties of MAVL.





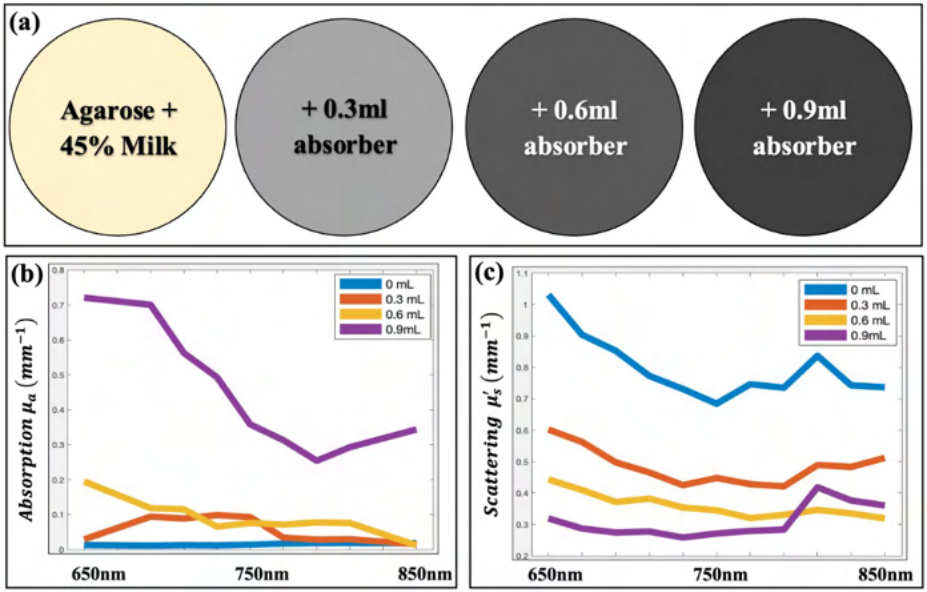




Estimating Optical Properties Using a Single Sphere Integrating System

Authors: Noble Amadi, Kacie Kaile, Edwin A. Robledo, Andres Rodriguez, Anuradha Godavarty
Faculty Advisor: Anuradha Godavarty, Ph.D.

Knowing the optical properties of a medium is a first step toward device design and measurement interpretation. The objective of this study is to estimate the optical properties in phantoms with increasing absorber. Phantoms are prepared using agarose in a 45% milk solution as the scattering agent and India Ink (0 – 0.2% of the total phantom solution) as the absorbing agent. A near infrared (NIR) light source was used to illuminate the four phantoms and a spectrometer was used in conjunction with an integrating sphere to obtain reflection and transmission through each phantom. An existing Inverse Adding Doubling (IAD) program was used to estimate the optical properties for each sample between 650-850 nm. The resulting absorption and scattering coefficients were compared across the NIR spectrum and across the four phantoms. The estimated absorption coefficients increased in samples as the concentration of absorber increased. On the other hand, the estimated scattering coefficients decreased distinctly upon initial addition of the absorber (between 0-0.06%) and continued to decrease slightly as the concentration of absorber was increased. In future, the system needs to be calibrated to obtain absolute measurement of optical properties towards validation of an in-house Smartphone Oxygenation Tool (SPOT). The estimated optical properties from this system will be used for future modeling of light distribution and energy deposition in phantoms compared with the measured diffuse reflectance using SPOT device.

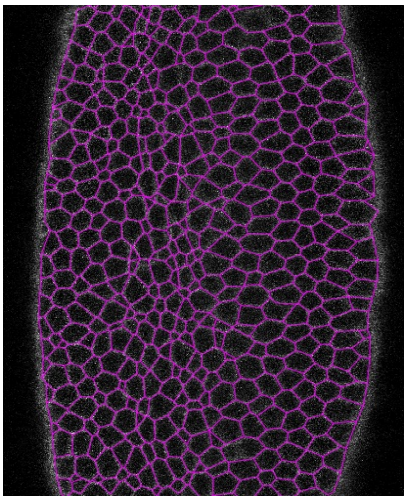


(a): Agarose-based phantoms with increasing absorber concentration; (b): Absorption coefficient spectrum across phantoms; (c): Scattering coefficient spectrum across phantoms.

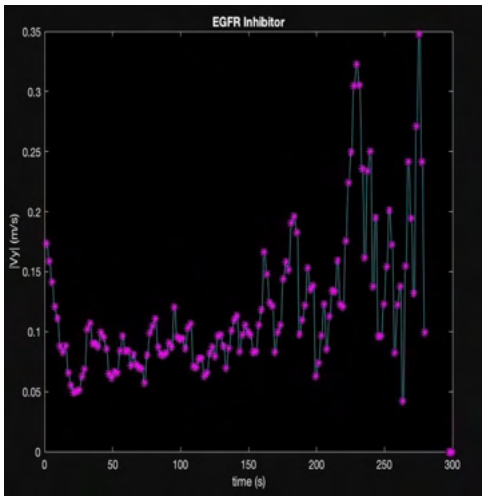
Ectoderm Morphogenetic Flow of D. Melanogaster Embryos During Ventral Furrow Formation

Authors: Fernando Melara Barahona, Joshua Hutcheson
Faculty Advisor: Joshua Hutcheson, Ph.D.

During morphogenesis, epithelial tissues must be folded and remodeled into three-dimensional shapes. In Drosophila melanogaster embryo development, mesodermal cells flow towards the ventral midline and invaginate following the constriction of their apical cortex. The neighboring ectodermal cells then flow and proceed to close over the now invaginated mesoderm cells. Although mechanisms such as F-actin turnover and EGF receptor signaling have been used to explain cell regulatory and assembly properties during tissue remodeling, the mechanisms that specify and coordinate cellular morphogenetic flow along the ectoderm of D. Melanogaster embryonic cells are still unknown. To understand this dynamic system, we used both imaging and computational analysis of the ectoderm cell movement by developing a pipeline program capable of tracking cell movement and mathematically describing cell shape for ectoderm cells neighboring the mesoderm in both control and drug-treated embryos. Ectoderm cells were tracked using bandpass filters that could approximate cells as polygons. The centroid coordinates of each cell were then used to map the cell movement and to create velocity gradient plots throughout the ectoderm. Applying this framework to control and drug-treated embryos, we thereby propose a mathematical model capable of describing embryonic fluid dynamics and examining morphogenetic coordination of ectoderm cells.



Cell shape approximation.

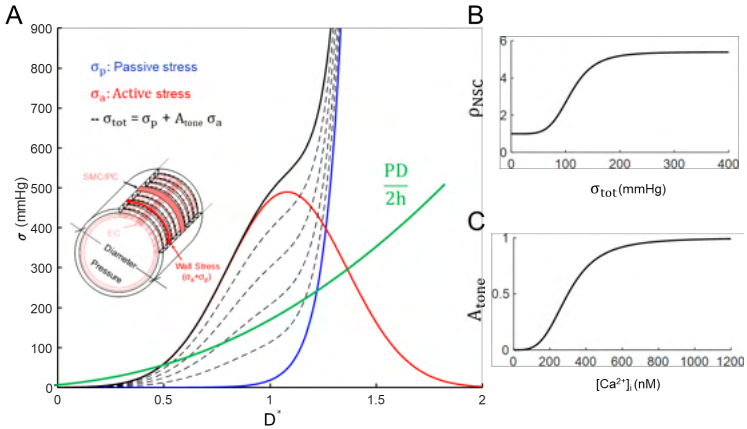


Drug-induced ectoderm tissue dynamics.

A Biomechanics Model for Cerebral Microcirculatory Vessels

Authors: Maria Andere, Nikolaos Tsoukias
Faculty Advisor: Nikolaos Tsoukias, Ph.D.

Cerebral blood flow (CBF) regulation relies on several complex processes that range from microscale cellular signaling pathways to vessel biomechanics and tissue scale hemodynamics. Through neurovascular coupling, which translates neural activity into local changes in vessel diameter, oxygen and nutrient delivery can be regulated to meet the brain's metabolic demands. Disruption of these vascular autoregulatory processes is linked to pathological conditions like small vessel disease of the brain and Alzheimer's. To better understand CBF control and microvascular contributions to neurological disorders, we aim to develop a multiscale model that integrates cell electrophysiology, vessel biomechanics and tissue hemodynamics. Single cell models describe voltage and calcium dynamics in cells that can be coupled to form vascular segments and networks. These dynamics influence vessel biomechanics through the regulation of vessel diameter in response to vasoactive mediators and mechanical stimuli. These models can be coupled with tissue hemodynamics to predict pressure and flow redistribution throughout the network, which in turn feeds back on cell electrophysiology and mechanical responses. I plan to provide a biomechanics model of the brain microvasculature that translates changes in calcium levels in pericytes or smooth muscle cells to changes in vessel diameter. The current model accounts for passive stress, due to the vascular wall's elastic properties, and active stress, which results from the vessel's contractile apparatus. Through parameter optimization and fitting of experimental data, this model will serve as the basis for developing a bottom-up approach to link underlying cell-level mechanisms to the regulation of cerebral perfusion at the macroscale.

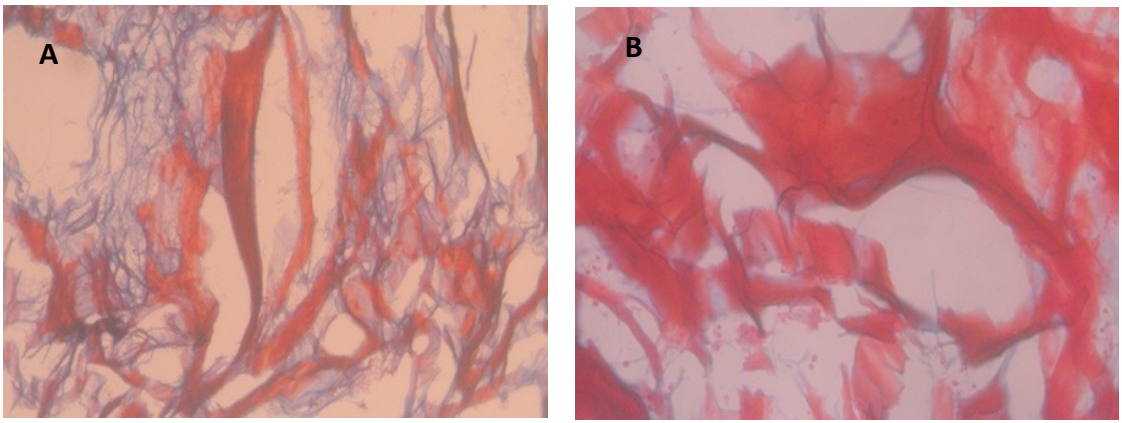


A model of microvascular biomechanics. A) Vessel wall stress-strain relationship in a smooth muscle cell/pericyte B) NSC channel activity (ρ_{NSC}) as a function of vessel wall stress (σ_{tot}). C) Smooth muscle cell/pericyte activation (A_{tone}) as a function of calcium concentration $[Ca^{2+}]_i$.

Histological and Durability Assessment of Elastin-Rich Engineered Valves Versus the Raw Bio-Scaffold It is Deposited on

Authors: Oriana Marrone Mantovani, Claudia Ponce, Sharan Ramaswamy
Faculty Advisor: Sharan Ramaswamy, Ph.D.

Congenital heart valve defects in children have limited treatment options due to the unavailability of valves for their replacement and the inability for prosthetic valves to support somatic growth. Elastin is an ECM protein known to promote chemotaxis, which directs relevant-cell migration into tissues during injury and repair, enabling tissue remodeling events. The CV-PEUTIC's laboratory has generated allogeneic elastin coating on the surface of PSIS bio-scaffolds for potentially facilitating accelerated regeneration and supporting somatic growth. We thus hypothesized that (1) the secretion of collagen from VICs will be increased when seeded onto elastin-rich bio-scaffolds as compared to the raw porcine bio-scaffolds and that (2) the elastin-rich bio-scaffolds will possess the same 3-month durability as the raw porcine bio-scaffolds, which have been previously proved to be durable for this period. This finding is important given that 3 moths is sufficient time for the elastin-rich valves to promote chemotaxis. To prove that our elastin-rich valves have enhanced regenerative properties, we histologically assessed the amount of collagen present in the engineered tissue layer secreted by the VICs of both bio-scaffolds and the results showed that considerably more collagen was secreted when seeded and cultured on the elastin-rich valves. Next, we will utilize an accelerated wear tester to test the durability of both bio-scaffolds and confirm that the durability of our elastin-rich valve scaffolds remains as good as the raw PSIS bio-scaffolds, and it is sufficient to facilitate accelerated valve regeneration and subsequent integration in the host in which the valve replacement will occur.

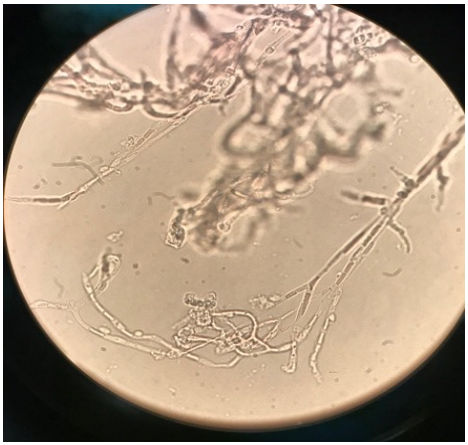


(A) Elastin-rich Valve representation and (B) Raw PSIS Valve representation (40x magnification) using Trichrome stain, showing collagen in blue color.

An Ex Vivo Capillary-Arteriolar Preparation to Investigate Neurovascular Coupling

Authors: Katherine Nicole Lopez, Nikolaos Tsoukias
Faculty Advisor: Nikolaos Tsoukias, Ph.D.

Blood flow regulation is essential for normal brain function and for suppling oxygen and nutrients to active neurons. Signaling mechanisms known as neurovascular coupling (NVC) link neural activity to changes in cerebral blood flow. NVC is compromised in different pathological states including Alzheimer's disease and Dementia. Even though there is an increased understanding of NVC, there is still contradictory findings that limits full comprehension of brain function in health and disease. New evidence suggests direct communication between neurons and the smallest of blood vessels (i.e. capillaries) in addition to the well documented signaling between neurons and feeding arteries. To expand on these recent findings, we aim to adapt and extend a first of its kind capillary-arteriolar ex vivo preparation developed by our collaborators at the University of Vermont. We will develop a protocol for isolating large capillary networks attached to feeding arterioles (i.e., parenchymal arterioles) and investigate the electrical properties of the capillary network and how signals communicate along this microvascular network between capillaries and arterioles. We will use adult mice, 2-3 months old (C57BL6; wild type) and mice carry a germline knockout of the Kir2.1 gene. Transgenic mice will result from crossing Cre mice under an endothelial specific promoter (Cadherin5) with homozygous mice carrying a floxed allele of the KIR gene. The presence of LoxP and Cre recombinase will be confirmed through genotyping the offspring. Mice will be euthanize using CO_2 inhalation. Isolated brains will be placed in Calcium-free aCSF solution. We will perform microsurgery to isolate middle cerebral arteries and parenchymal tissue containing capillary networks and develop proper protocols to clean up the capillary network and pressurize the preparation.

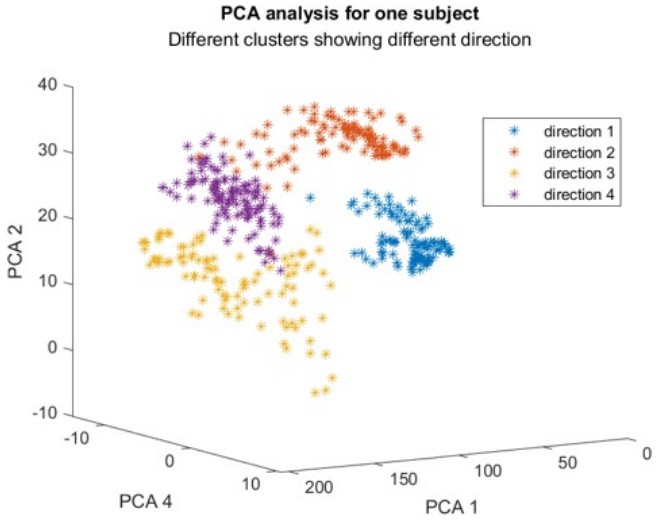


Isolated capillary network stemming from the middle cerebral artery of a mouse.

Neural PCA of jaBCI Study

Authors: Maral Daneshyan, Zachary Danziger
Faculty Advisor: Zachary Danziger, Ph.D.

Brain-computer interface (BCI) is an approach that analyzes brain signals and translates them into commands using decoders, used mainly for people with paralysis. However, the progress of optimizing a decoder has been slow-paced due to the small number of qualified and willing participants. Our goal is to create a system that can support a large number of participants for a greater statistical power in the analysis of the decoder studies. Typically, BCI systems are tested through invasive methods via placing electrodes in the brain; however, we have developed a new noninvasive way of simulating a BCI study, called jaBCI. This system emulates neural signals from hand posture using an emulator trained by collecting data from a macaque. During the calibration task of our ongoing jaBCI study, a cursor position is correlated to the emulated neural data using four different hand postures. To verify the reliability of this emulator, this calibration data has been analyzed by lowering the high dimensionality of our simulated neural data using principal component analysis. The results have shown differentiation in neural data for different hand postures in each person. Based on our preliminary analysis, better differentiation of the neural data is random between different decoder groups. Suggesting that the performance of subjects is predominantly dependent on the decoder used rather than the quality of the calibration. To further validate the reliability of our emulator, the neural data gathered from the performance task of the jaBCI study will be compared to real human neural data.

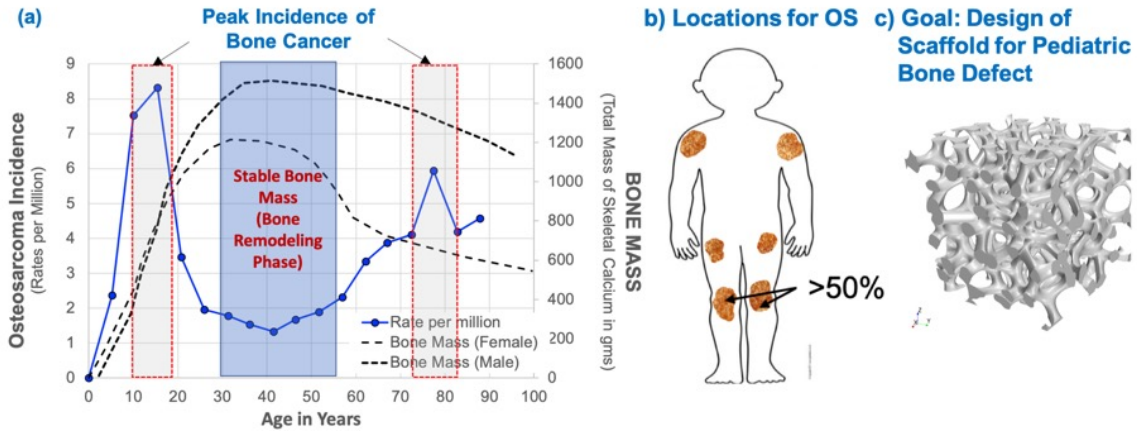


Differentiation of neural data in different hand postures of one subject using PCA.

Synthesis of Bone Scaffold for Pediatric Bone Defects Using 3D Printing

Authors: Acaydia Campbell, Katrina Jabech, Amy Ramos-Homs (MME), Anamika Prasad
Faculty Advisor: Anamika Prasad, Ph.D.

Primary bone cancer such as Osteosarcoma incidents spikes in the growing age (10-19) of life and primarily affects load-carrying long bones such as the femur. For such young patients, limb-sparing treatments are preferred compared to amputation from a quality-of-life perspective. One example of limb-sparing surgery is Extracorporeal Radiation Therapy (ECRT). This treatment is done by removing the entire bone with the tumor, removing the tumor from the bone, irradiating the bone for sterilization from any remaining cancer cells, and then re-implanting it back into the patient's body. When analyzing the bone quality of patients pre- and post-irradiation, it was found that most patients experienced a decrease in the degree of mineralization and a suggested modification in collagen structure due to an increase in enzymatic trivalent cross-linking. Post-operative care will be affected by such changes in bone quality and require specialized scaffolds to fill the gap created post tumor excision. Beyond osteosarcoma, bone replacement in young patients either due to damage from trauma or noncancerous lesions also poses a similar challenge when a static plate, implants, or filler placed in young adults fails to address the needs of the growing bone. Due to the above challenges and needs for addressing bone tissue replacement in changed bone structure or growing bones, we plan to work towards design and synthesis of a bone scaffold that can supports the attachment of cells on the surface of the bone to actively support bone modeling processes under structural changes of growing bones.

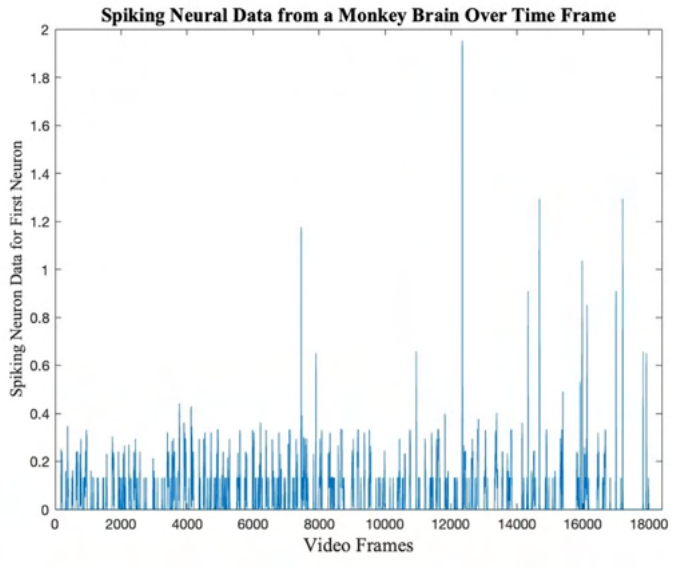


(a) Peak incidence of bone cancer, (b) Location of osteosarcoma as affecting long bones, and (c) Project goal to create 3D scaffold for pediatric bone defects.

Investigating the Neural Basis of Naturalistic Hand Movements

Authors: Hary Usaquen, Zachary Danziger
Faculty Advisor: Zachary Danziger, Ph.D.

Identification of the neural correlates that underlie the generation of movements has long been a focus of interest in the neuroscience literature. Comprehension of the neural basis behind movement would provide insight into neurodegenerative diseases and is of particular interest to brain-computer interfaces (BCI). Consequently, the existing literature on the neural correlates of motion has mainly focused on studying movements in a narrow-constrained context, leaving the neural basis for naturalistic unconstrained movements largely uninvestigated. To investigate the fundamentals of integration between the motor system and sensory feedback, as well as, how motor commands are being generated from an excessive quantity of goal-achieving movements, it is necessary to study movement generation in an unconstrained context. In the ANIL Lab, previously recorded neural activity coming from the primary motor cortex of a monkey's brain was used to enhance the methods to gather data from the monkey by ensuring the data collected comes from moments of high kinematic activity. The neural data of interest was collected by markerless tracking of the finger joints of the monkey's hand while the monkey touched, reach, and non-touched an object. Then, the recorded neural spiking activities were used to visualize the neural behavior occurring over the previously identified instances of time. All these methods aim to answer these neuroscience questions that could lead to identifying a) the neural representation of haptic feedback in the primary motor cortex of a monkey's brain, and b) the neural dynamics of a natural static hand.

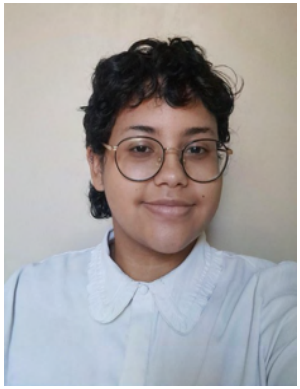


Spiking neural data from a monkey's brain over time frame.

Follow-up Study on Carpometacarpal Osteoarthritis Treatment Using Saddle Hemiarthroplasty

Authors: Sophia Poirier, Cynthia "Cyrus" Almestica, Brandon Gardner, Jorge L. Orbay
Faculty Advisor: Brandon Gardner, M.D./Ph.D. (Skeletal Dynamics and the Miami Hand & Upper Extremity Institute)

Carpometacarpal (CMC) arthritis of the first digit is a common, debilitating disease affecting nearly 39% of women and 33.1% men by 80 years of age. CMC arthritis has many risk factors including increased BMI, connective tissue disease, white ethnicity, and female sex. While non-surgical treatment options are recommended for all newly diagnosed cases of CMC arthroplasty, there are an increasing number of surgical procedures to provide symptomatic relief, improve life quality index and improve function. CMC hemiarthroplasty is a relatively new and increasingly common treatment with little information published about mid to long-term outcomes.

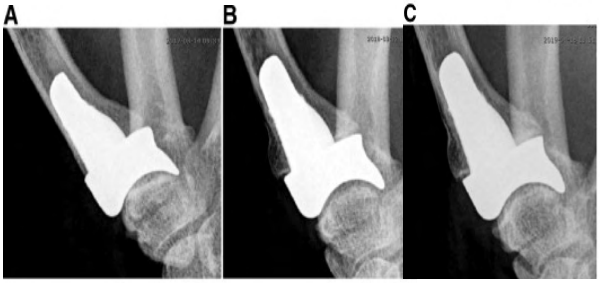


To determine the long-term effects on patients with CMC hemiarthroplasty using the Visual Analog Scale (VAS) and disabilities of the arm, shoulder and hand (DASH) and compare its results with competitors implants after 3-6 years.

The study used the Stablyx Arthroplasty System which includes a stabilized cobalt-chrome saddle shaped hemiarthroplasty. It is an inserted press fit and has a titanium plasma spray coating. Surgery was performed using a volar approach. An initial follow-up study was conducted at 24 months after the hemiarthroplasty. Patients reported a low pain index of 0.06 of 10 at rest and 0.34 of 10 during activity with DASH scores averaging 2.37 of 100.

Thumb CMC saddle hemiarthroplasty follows close to native joint kinematics and load transfer while avoiding use of a trapezial component and low revision rate; to Making the saddle hemiarthroplasty a viable option for thumb CMC osteoarthritis. The current follow-up study follows about 70 patients to determine if the saddle hemiarthroplasty holds up after 3-6 years post surgery.

Stabilized press-fit saddle shaped hemiarthroplasty introduced in the Stablyx Arthroplasty System (2013).

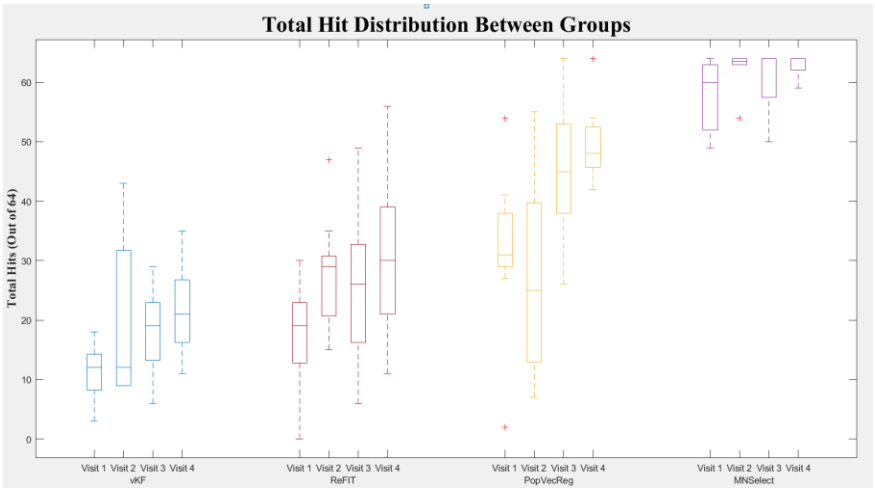


(A) Immediate post op after saddle hemiarthroplasty. The implant seems to contact the bone surface in 2 places. (B) One-year post op, the trapezium is more congruent and the dense surface line less distinct. (C) Two years post op, the trapezial surface is congruent and a new thin surface line more distinct.

Decoder Analysis for Brain Computer Interface Model

Authors: Paulwin Arancherry, Zachary Danziger
Faculty Advisor: Zachary Danziger, Ph.D.

Decoders play a crucial role in deciphering brain signals into meaningful commands to control external devices for Brain Computer Interfaces (BCI). However, due to its highly invasive nature, researchers are reluctant in testing BCI decoders on human subjects. To address this, the Applied Neural Interface lab developed a brain model based on a Macaque's neural activity. Using a CyberGlove, which captures hand kinematics, in conjunction with the emulator, we were able to assess the efficacy of four decoders: the Velocity Kalman Filter (VKF), Recalibrated Feedback Intention-Trained Kalman filter (ReFIT), Population vector, and Multinomial Select. VKF predicts the velocity of an object based on its previous and current stance, whereas the ReFIT takes VKF's prediction and refits its trajectory to the target position. Population vector takes a traditional approach by taking into account the neurons with the greatest number of spikes and gives precedence to the corresponding direction. Multinominal Select dissects neurons into different segments and translates them into different directions, making it non-continuous. The study randomly assigned participants to one of four decoders and required them to complete a cursor objective in a MATLAB GUI. The task involved users moving a cursor to 64 targets on the screen and the success rate was measured using a hit rate system. We hope to identify across 4 sessions: the highest performing decoder and examine their learnability and adaptiveness. Preliminary analysis of the decoder study projects the Multinomial Select as performing the best, followed by Population Vector.

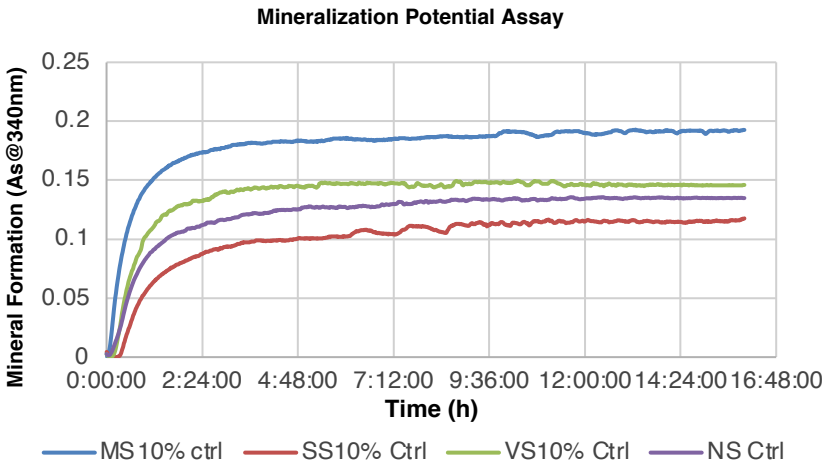


Average decoder performance based on target hits across four sessions.

Mechanical Stretch Regimen Influences Calcifying Potential of Liberated Extracellular Vesicles from Vascular Smooth Muscle Cells

Authors: Basil Usama Hamed, Mohammad Shaver, Joshua Hutcheson
Faculty Advisor: Joshua Hutcheson, Ph.D.

Hypertension-induced mechanical stress on vascular smooth muscle cells (VSMCs) is a known risk factor for vascular remodeling. A specific class of extracellular vesicles (EVs) released by vascular smooth muscle cells (VSMCs) initiates vascular calcification, the most significant predictor of cardiovascular morbidity. Despite the observed correlation between hypertension and calcification, the role of mechanics in calcifying EV formation from VSMCs has not been reported. We used a Flexcell FX-5000T culture system to apply three different mechanical stretch profiles to VSMCs, including monotonic (10% amplitude, 0.5 Hz,72 h), variable (7.5-12.5% amplitude with a mean of 10%, 0.5 Hz, 72 h), and static stretch (10% amplitude, 72 h). Non-stretched VSMCs were used as controls. Mineralization potential of EVs was measured by incubating EVs in phosphate solution and measuring light scattering by mineral at 340nm. The results indicate that compared to non-stretched VSMCs, monotonic stretch led to a 1.2-fold increase in EV calcification potential. The EVs from VSMCs exposed to static and variable stretch had similar calcification potential as those from control samples. These studies provide new insight into the effect of mechanical stimulation on EV calcifying potential.

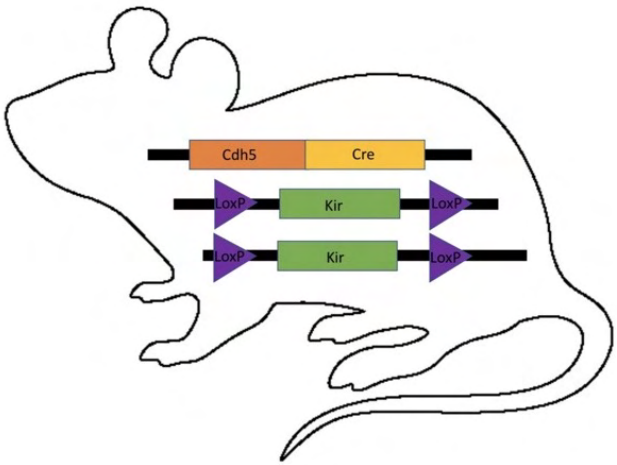


Mineral formation can be detected by light absorption at 340nm. Following the prescribed stretch regimen, collected EVs were incubated with phosphate and absorption measurements were collected over the course of 16 hours. The data suggest higher mineralization by EVs from VSMCs subjected to monotonic 10% stretch.

Develop a Transgenic Mouse Model to Examine the Role of Inward Rectifying K^+ Channel in Cerebral Capillaries

Authors: Tiffany Moreno, Nikolaos Tsoukias
Faculty Advisor: Nikolaos Tsoukias, Ph.D.

The communication between active neurons and the vasculature, termed neurovascular coupling (NVC), enables local increases in cerebral blood flow (CBF) to allow for the delivery of oxygen and nutrients to areas of brain activity. This process is essential for survival and its disruption is associated with brain disorders. It is also the physiological basis for neuroimaging modalities such as fMRI. The communicating cells and chemical messengers involved in NVC are still under debate with the majority of research efforts focusing on mediators released onto nearby arterioles. Interestingly, recent evidence suggests that in addition to arterioles, capillaries may also mediate NVC. Inwardly rectifying K^+ channels (Kir) in capillary Endothelial Cells (cEC) can sense neuronal released K^+ and induce hyperpolarization and rapid dilations of the upstream feeding arterioles. In this study we aim to establish an EC specific Kir knockout mouse (ECKir-KO) for investigations of this signaling pathway. The KO mouse will be developed using the Cre-LoxP system. Cre recombinase recognizes two repeated LoxP sites, excises the LoxP flanked (floxed) DNA, and inactivates a gene of interest, in this case Kir. We will crossbreed a mouse with LoxP insertions around exon 2 of Kir gene (donated by collaborators at the University of Vermont), with a commercially available mouse, expressing CRE under an endothelial-specific promoter, Cdh5 (Tg(Cdh5-cre)1Spe; Jackson Labs). A homozygous LoxP mouse with CRE activity will result after two generations of breeding and will provide the EC-specific Kir KO mouse model. Each generation of mice will be genotyped through Polymerase Chain Reaction (PCR) and Gel Electrophoresis.

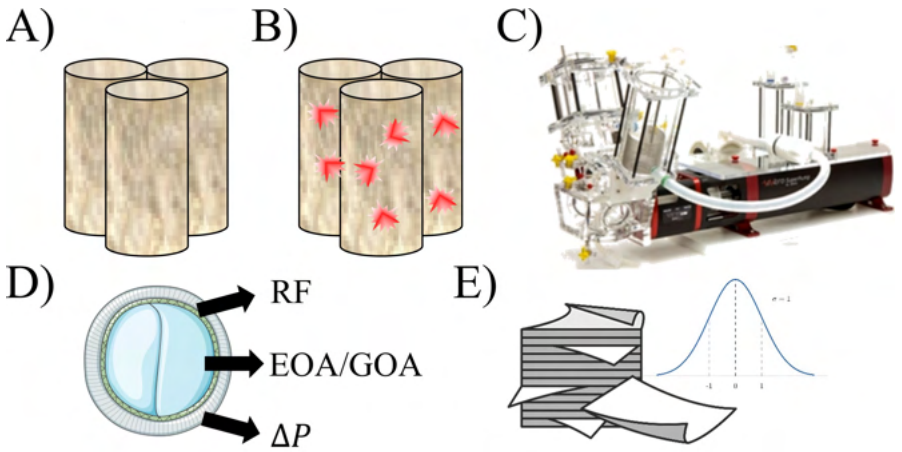


A homozygous LoxP mouse with CRE activity will result after two generations of breeding and will provide the EC-specific Kir KO mouse model.

Hydrodynamics of Human Calcified Engineered Tissue Valves

Authors: Jacobus Carstens, Asad Mirza, Andres Rodriguez, Sharan Ramaswamy
Faculty Advisor: Sharan Ramaswamy, Ph.D.

Aortic valve calcification is one of the most studied valve diseases and represents the most frequent cardiovascular disease after arterial hypertension and coronary artery disease. Despite advances in valve repair and replacement prosthetic devices, therapeutic discovery is still lacking owing to the inability for animal models to mimic the human response. Hence therapeutic treatment of this disease requires first having a human tissue model system that mimics the native response to an emerging therapy. We hereby propose calcifying tubular bio-scaffolds, made of porcine small intestinal submucosa (PSIS) by seeding them with human valvular interstitial cells (VIC's) followed by tissue culture in calcification-inducing media. Next, we will proceed to test their functionality as an aortic valve, through hydrodynamic parameters assessment, which includes the valve's effective orifice area (EOA), transvalvular pressure gradient and regurgitation fraction to quantify if we are accurately inducing severe aortic valve calcification, which can then be used as a model system if validated via this testing. Findings for the calcified valve will be compared to an untreated control group which is essentially the raw, PSIS tubular bio-scaffold. Expected results for severe calcification would be a reduction in valve performance that agrees with literature findings of similar calcified aortic valves that necessitated replacement with an artificial valve. Creation of a working severely calcified human tissue model will thereby allow for the added investigation of emerging treatment options, to better manage valve disease and by learning from the human valve tissue response, to delay the need for a valve replacement.

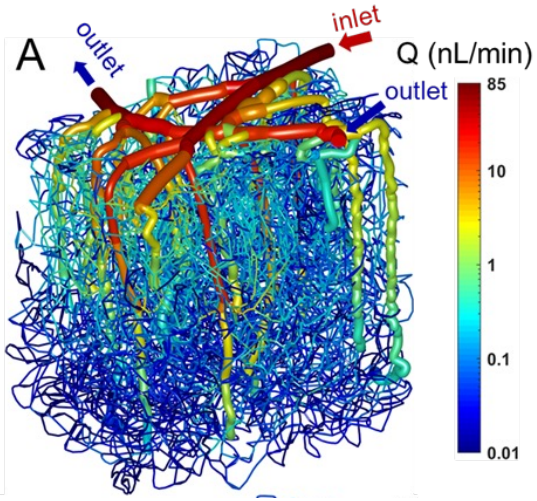


Proposed methodology: A) VIC's seeded PSIS valves B) Calcification protocol C) Hydrodynamic testing D) Assess valve metrics E) Compare with literature findings.

Mathematical Modeling of Hemodynamics in a Dynamically Changing Cerebral Microvascular Network

Authors: Michelle Wiese, Nikolaos Tsoukias
Faculty Advisor: Nikolaos Tsoukias, Ph.D.

The cerebral vasculature network contains a thousand miles of blood vessels, all with the capacity to change their diameter, altering blood flow. Local perfusion is controlled by neuronal activity, a process termed Neurovascular Coupling (NVC). Cerebral blood flow (CBF) and NVC are altered in neurodegenerative disorders and NVC underlies functional imaging modalities, such as fMRI. We aim to model CBF control mechanisms allowing us the opportunity to better understand NVC, and the contribution of the microvasculature to brain function. We will utilize realistic reconstructions of the mouse cerebral vasculature that contain tens of thousands of vessel segments. Network angioarchitecture will be represented using principles of graph theory, with vessel junctions corresponding to nodes and vessel segments corresponding to edges, using an adjacency matrix. Hemodynamic simulations will predict pressure (P), flow (Q) and Hematocrit (Hct) distributions along the network. In each vascular segment, flow is calculated using the Hagen-Poiseuille equation, the pressure gradient along the segment, and an effective hydrodynamic resistance that depends on length, diameter, and local Hct. Conservation of blood flow and RBC flux is enforced at each network bifurcation point. The rheological properties of RBCs and the non-continuum nature of blood is incorporated via empirical formulas accounting for the Fahraeus-Lindqvist and plasma skimming effects. My aim is to extend a previous computational code to account for dynamic changes in vessel diameters upon neuronal activity and determine the impact of arteriolar (smooth muscle) and capillary constriction (pericytes) for network blood flow coordination.

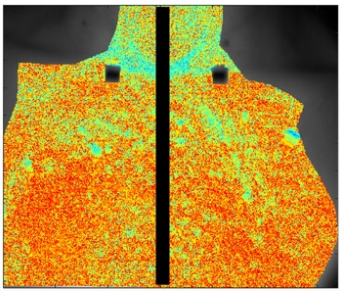


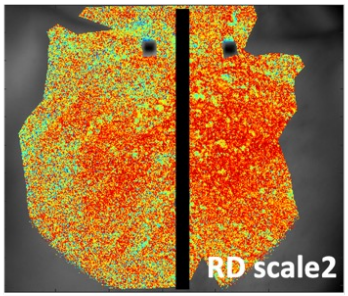
Blood flow simulations in microvascular networks.
Model simulation depicting blood flow distribution in a reconstructed cerebral vascular network.

Assessment of Oxygenated Flow Patterns in Breast Cancer Subjects Undergoing Radiation Therapy

Authors: Sydni Spencer, Kevin Leiva, Edwin A. Robledo, Corina Beiner, Maria Amelia Rodrigues, Marcio Fagundes, Joseph Panoff, Michael Chuong, Wensong Wu, Anuradha Godavarty
Faculty Advisor: Anuradha Godavarty, Ph.D.

Breast cancer accounts for around 30% of the cancers diagnosed in women each year. Of the patients that undergo radiation therapy (RT) as treatment, 95% develop radiation dermatitis (RD). Clinicians diagnose RD based on visual inspection and comparison to the Common Toxicity Criteria for Adverse Events (CTCAE) scale to determine the grade of RD. However, visually identifiable changes due to RD occur after the underlying physiological changes occur. The objective of this study was to assess how oxygenated flow changes in response to radiation therapy in breast cancer patients. A near-infrared optical scanner (NIROS) was used to image subjects performing a breath-hold stimulus across weeks of treatment. The modified Beer-Lambert Law was applied to calculate spatio-temporal oxygenation maps of hemoglobin-based changes in terms of effective oxygen saturation (ΔStO2). Dynamic ΔStO2 maps were further processed to create flow correlation maps using a Pearson's correlation-based approach. The flow changes were compared to the RD grading scale via qualitative and quantitative assessment of the correlation maps. It was found that the synchronicity of the oxygenated flow pattern distinctly varied across the initial, final, and follow up weeks of treatment. It was further observed that, in the presence of radiation dermatitis, there was increased contrast in the flow synchrony between the contralateral chest walls. This indicates that radiation therapy impacts the ability of vasculature to respond to an oxygenation altering stimulus. These quantitative methods for observing changes in oxygenated flow in irradiated breast tissue can potentially be used to monitor the onset of RD.





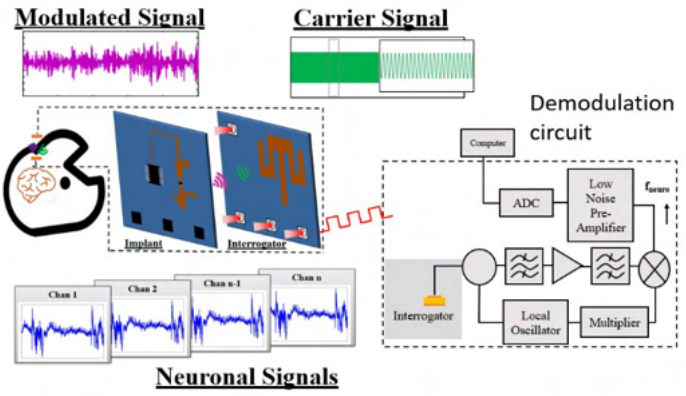
Week 1 Week 5

Oxygenation correlation maps of oxygen saturation (ΔStO2) in a breast cancer subject prior to the radiation therapy treatment (week 1) and the final week of the treatment (week 5).

Battery-less and Wireless Multichannel System for Minipigs Neuronal Recordings

Authors: Daniel Parrado, Melany Gutierrez- Hernandez, Farnoush Shafiei, Jorge Riera Diaz, John L. Volakis
Faculty Advisor: Jorge Riera Diaz, Ph.D.; John L. Volakis, Ph.D.

Neural signals contain essential information to assess brain function and diagnose neurological disorders. Wireless implanted systems are often employed for neuronal recording. However, the existing technologies require batteries that may lead to brain heating and possible damage of the nervous tissue. To overcome the limitations of battery-operated implantable systems, a minimally invasive, passive wireless neurosensing system (mWiNS) for multichannel neuropotential recording based on the RF backscattering technique has been proposed by our team. The system comprises an exterior interrogator and an implanted neuropotential recorder composed of an impedance matching network and a multiplexer. The system has been validated in vivo measurements on Wistar rats (C. Moncion, et. al., Biosensor and Bioelectronics, vol. 213, 114455, 2022). However, since the size of the proposed system is relatively big (5cm x 5cm) compared with a rat's brain, measurements were performed on an open brain surgery, placing the electrodes in the rats' brain while a fabricated phantom with the skin properties was positioned between the implant and interrogator. In this study, we propose to perform in vivo measurements (eight-channels) of the neural activity in minipigs with the neuropotential recorder fully-implanted under the animal's skin. Two different types of electrodes will be employed (4 channel strip electrodes, and 4 channel stereo electrodes). Somatosensory evoked potentials will be recorded in both scenarios, static and freely movement. The neuropotential recorder will be further miniaturized using multilaminar dielectric printing (www.nano-di.com). We will also develop the technology for RF genesis and transmission from the interrogators.



Wireless Neurosensing System (WiNS).

Göttingen Minipigs (adapted from https://minipigs.dk/).

Histological Assessment of Scar Tissue Reduction After its Induction in Human Cardiac Fibroblast and Macrophage 3-Dimensional Co-Culture Following Treatment with Stem Cell-Derived Exosomes

Authors: Pranavi Arman, Amanda Ibarra, Ana Pena Diaz, Claudia Iannini, Hugo Duenas, Manuel Perez, Sharan Ramaswamy
Faculty Advisor: Sharan Ramaswamy, Ph.D.

Myocardial infarction arising from cardiovascular disease causes damage to cardiac tissues. Inflammation at the infarction site is caused by the immune system's response to aid reperfusion and repair tissues. Due to this inflammation, fibrous scar tissue forms. Scar tissue prevents the rupture of the heart wall but reduces the heart's function: to contract and pump blood. Stem cell-derived exosomes may potentially be used as a treatment to reduce scar tissue formation by reducing inflammatory markers: decreasing pro-inflammatory and increasing anti-inflammatory cytokines. We have been performing cocultures of human cardiac fibroblasts and macrophages. Next, we will seed these cells onto an FDA-approved cardiac patch (CorPatch, Cormatrix Inc. Roswell, GA). The secreted engineered tissues will then be treated with our stem cell-derived exosomes, along with an untreated control group. Histological assessment of the coculture-secreted tissues onto the cardiac patch material, treated and untreated, will be completed to observe differences in the formed scar tissue. This histological assessment focuses on Hematoxylin and Eosin (H&E) staining, which will be conducted to observe the properties of the tissue's cells and irregularities indicating scar tissue development, as depicted in the referenced images. Additional verification using cytokine panel assessment will quantify changes in specific cytokines that increased or decreased scar tissues. Immunostaining will establish the scar tissues' specific phenotype(s) and identify its specific cellular distribution of cardiac fibroblasts, macrophages and stem cell-derived exosomes. If substantiated with these results, a novel treatment using stem cell-derived exosomes could be implemented to minimize scar tissue formation, following cardiovascular repair surgeries.

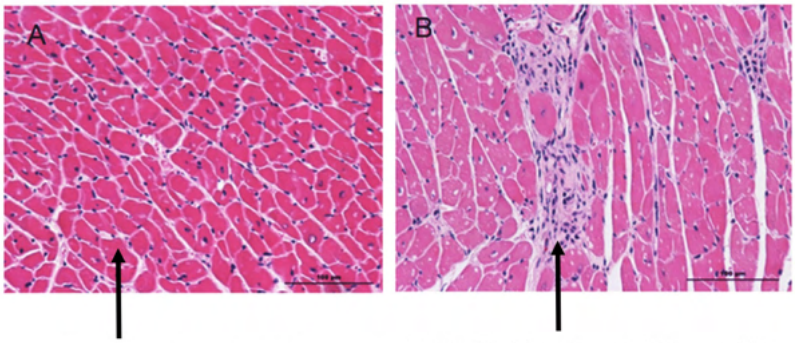


Image (A): Normal cardiac tissue

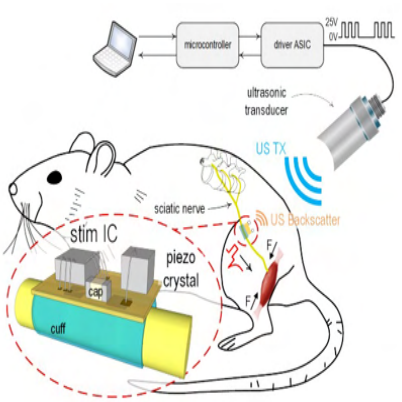
Image (B): Fibrous scar tissue resulting from myocardial infarction reperfusion

Reference Images of the H&E Staining of cardiac tissue: Image A shows normal cardiac tissue. Image B shows cardiac tissue with fibrous scar tissue formed due to myocardial infarction reperfusion. Note. H&E staining images of heart tissue samples. From "Endoplasmic reticulum stress response in spontaneously hypertensive rats is affected by myocardial ischemia reperfusion injury," by X. F. Guo and X. J. Yang, 2015, Experimental and therapeutic medicine, 9(2), 319–326 (https://doi.org/10.3892/etm.2014.2094). Licensed under CC by 3.0.

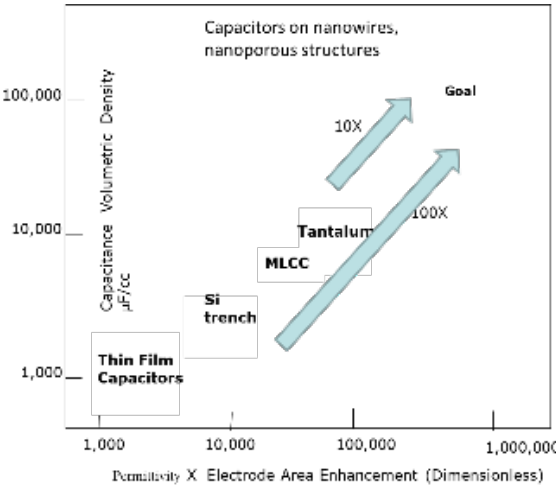
Embedded Power Storage in Thin Flexible Bioelectronic Systems

Authors: Jeremiah Smith, Alex Giles, Reshmi Banerjee, Raj Pulugurtha
Faculty Advisor: Raj Pulugurtha, Ph.D.

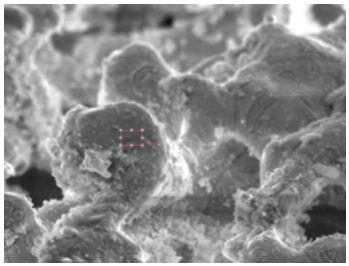
With space and surgical constraints in bioelectronic implants, batteries are getting replaced by capacitors more often than before. Capacitors store charge and deliver current with stable voltage supply. Current bioelectronic implants utilize thick ceramic or tantalum capacitors. We seek to replace them with thin embedded film capacitors for miniaturization and better performance. Our strategy is to utilize nano-porous electrodes and form conformal hafnia coatings through a dip-coating process. The process chemistry is studied through initial solution synthesis and dip-coating process conditions. This process allows for a uniform and adherent film layer of the hafnium. Solution molarity and number of coatings determine the quality of the films. By extending this process on sintered metal electrodes, we are targeting to deliver stable currents of 10 mA and above with kHz pulses and millisecond durations. The poster will review state-of-the-art capacitor synthesis and process developed studies.



Courtesy: Ka You Li (UC Berkeley)



Capacitors are key storage components in tiny electronic implants. Nanocapacitors meet the goals.

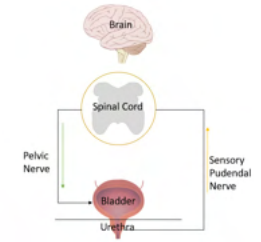


Initial process study of hafnia coatings on porous electrodes.

Effect of Lidocaine on Pudendal Nerve, Voiding Efficiency and Bladder Contraction

Authors: Maria Eduarda Gomes Vallilo, Zachary Danziger
Faculty Advisor: Zachary Danziger, Ph.D.

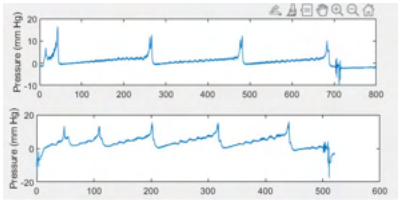
It is common for elderly people to suffer from nerve deterioration. In the lower urinary tract physiology, the deterioration of the pudendal nerve could lead to under activity of the bladder. The pudendal nerve connects the urethra to the spinal cord, and the brain. When a void happens, two main reflexes occur the Augmenting reflex and the Micturition reflex. The Augmenting Reflex is triggered by fluid entering the urethra that activates a reflex on the afferents of the pudendal nerve, leading to a bladder contraction mediated through the pelvic nerve. However, when the pudendal nerve of older rats deteriorates, voiding efficiency decreases, which is likely due to not proper function of the Augmenting Reflex. The Micturition reflex, on the other hand, is triggered when there are high levels of pelvic afferent activity, leading to a pelvic nerve-mediated bladder contraction. This experiment intends to learn more in-depth about the absence of the augmenting reflex on voiding efficiency by observing the differences in voiding as a result of urethral anesthetization. Female Sprague Dawley rats were used in the experiment between the age range of 80-120 days. That sample was first sedated inhaling isoflurane and then anesthetized with 1.2 g/0.2 kg s.c. of urethane. The bladder was catheterized, and the electromyography of the muscle response was measured by inserting bare silver wires into the external urethral sphincter. The bladder capacity was first measured by running four control fills to then run three to five blocks of four voids of serial cystometry. The urethra was catheterized and anesthetized by infusing lidocaine to determine the before and after effect of the substance on the voiding efficiency. This experiment shows a decrease in voiding efficiency through the anesthetization of the urethra using lidocaine. It can be reaffirmed by looking over the data table by comparing the values for the voiding efficiency for the control and lidocaine groups and revalidated with voiding efficiency values gathered by Chih-Wei Peng in his article, “Role of pudendal afferents in voiding efficiency in the rat.” To sum up, the lidocaine effect on the sensory pudendal nerve displays the importance of the absence of the augmenting reflex which impacts bladder contractions and voiding efficiency.



Map illustrating the connections of the pudendal and pelvic nerves to the lower urinary tract, spinal cord, and brain.

	VE Average	Standard Deviation	Peng’s VE Average
Control	0.999417	0.00441568	1
Lidocaine	0.6994973	0.21984001	0.3993660855784

Comparison of voiding efficiency (VE) for control and lidocaine group of my experiment and Chih-Wei Peng’s experiment for his article “Role of pudendal afferents in voiding efficiency in the rat.”

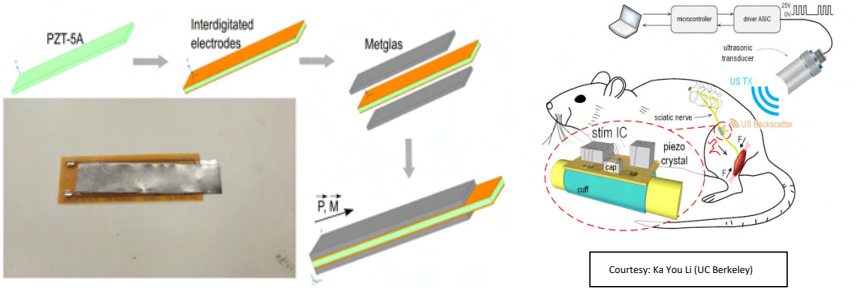


On the top, bladder pressure during voids for the control group. On the bottom, lidocaine effect on bladder pressure during voids.

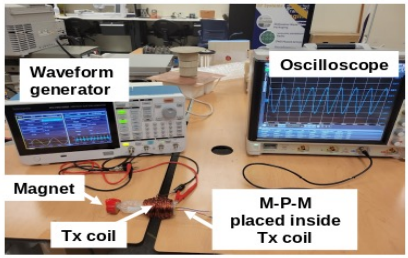
Wireless Power Transfer to Bioelectronic Implants with Integrated Flex Thin-film Transducers

Authors: Jonathan Cohen-Melamed, Mateo Fischer, Veeru Jaiswal, Raj Pulugurtha
Faculty Advisor: Raj Pulugurtha, Ph.D.

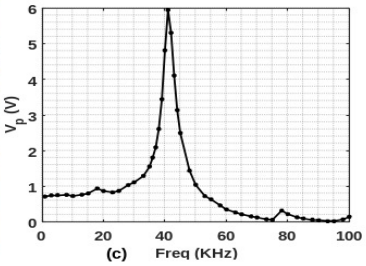
Wireless power with Multiphysics coupling techniques provides new avenues to realize miniaturized bioelectronics. We seek to utilize multiferroic films to achieve such wireless power of implants. A simple way to realize such system is through plating magnetostrictive films on flexible piezoelectric polymers. My research focuses on electroplating alloys to achieve high-quality magnetic films. These are then applied to multiferroic power telemetry. In order to improve the performance, it is also beneficial to electroplate the films under magnetic bias to achieve high magnetostriction. My research led to an innovative way to plate magnetic films on silverized PVDF to form a new class of multiferroic films. I will also review parametric analysis to estimate the impact of material, geometry and input magnetic fields on the final output power. The final goal is then to integrate the power telemetry with storage capacitors and stimulation chips. The telemetric interface and sensor devices are packaged in a flexible substrate with 3D interconnections, leading to miniaturized solutions. I will describe new ways to integrate the devices in flexible substrates with thin conductive adhesives. Power analysis requirements and piezo-magnetostrictive solutions for these specific scenarios is shown to illustrate the geometric compatibility towards emerging needs.



Multiferroic stacks fabricated with stacking.



(b)



(c)

Characterization of the wirelessly-received output voltage.

NEW FACULTY: DR. OLEKSII SHANDRA

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Traumatic brain injury (TBI) affects 2.8 million people in the U.S. every year. Sleep disturbances and epilepsy are common consequences of TBI. Epilepsy is a disease characterized by spontaneous, unprovoked, recurrent seizures and it has an integral connection with sleep. Sleep can affect the frequency, timing, duration of seizures, and sleep deprivation may trigger seizures in individuals with established epilepsy. Until recently, most of the research in sleep and epilepsy was neuro-centric, yet technological advances revealed that glial cells called astrocytes have many functions in the brain which may contribute to the development of sleep disturbances and epilepsy. The focus of my laboratory is to understand how altered interaction between astrocytes and neurons (i) leads to seizure generation, propagation, generalization, and termination; and (ii) how it affects the neurophysiology of sleep. My laboratory utilizes high-density EEG recordings, transcranial magnetic brain stimulation and intravital two-photon imaging techniques in rodent models of traumatic brain injury and acquired epilepsy to investigate: (i) Excitotoxic and metabolic abnormalities in the brain as a cause and/or consequence of seizures; (ii) Cellular and molecular processes involved in the neurobiology of sleep in health and disease; and (iii) Calcium signaling as a tool to understand the complex interplay between neurons and astrocytes in healthy and diseased brain. My laboratory utilizes several mouse models of post-traumatic epilepsy, semi-automated algorithms to analyze large-volume video-EEG datasets and a wide range of behavioral and histopathological assays. I am looking for undergraduate motivated students who are interested in contributing to this exciting research.

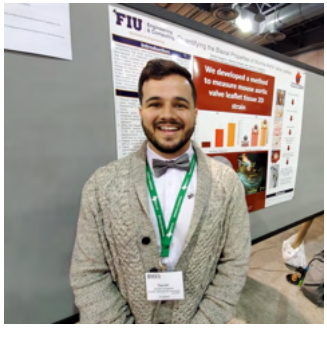
CURE PROGRAM

The Coulter Undergraduate Research Excellence (CURE) Program was established by support from the Biomedical Engineering Wallace H. Coulter Endowment. Through the CURE Program, biomedical engineering undergraduate students perform research under the supervision of a faculty mentor. The three-tiered program allows students to begin as volunteer “Trainees,” where they can learn more about working in a research laboratory. CURE Trainees attend laboratory meetings and shadow other researchers. After completing this volunteer phase, students can receive a stipend for their work in the “Researcher” and “Fellow” tiers. Students in these tiers receive an immersive research experience, which supplements didactic coursework. CURE Researchers work closely with their mentors to develop independent projects. CURE Fellows are expected to perform high level research and present findings at national research conferences. Funds are also provided through the CURE Program for career development activities. All CURE students take a pledge to achieve academic excellence, perform research and scholarly activities with integrity to promote global well-being, and serve as an ambassador for FIU Biomedical Engineering. Participation in the CURE Program allows students to learn technical skills in the laboratory while also strengthening abilities in critical thinking, communication, time management, and collaboration. CURE students are well-prepared to meet the challenges of life after graduation!

Presented through the generous support of the Wallace H. Coulter Foundation.

To Our Alumni/Panelists

Angelica Cobo, PhD is an engineer passionate about development of medical devices.

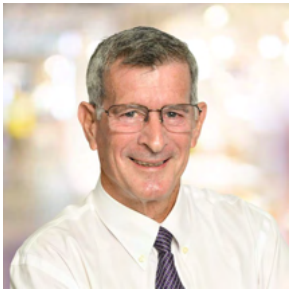


Daniel Chaparro, PhD focuses on aortic valve tissue mechanics and the involvement of neural crest derived cells in tissue homeostasis and disease.

Jorge Barter is an R&D Engineer at Cordis, a global leader in cardiovascular technologies.

Somafa Bailey is a Senior Quality Engineer at Medtronic in the Mechanical Circular Support division.

Manuela Tamayo holds a B.S. as well as a M.S. in Biomedical Engineering from Florida International University and she is certified as a project management professional (PMP) by PMI.



Ofer Amit, MSEM, CHRC.

Ofer has more than fifteen years of experience in establishing and managing research programs in clinical and academic settings.

This academic event is made possible by the generous support of the Wallace H. Coulter Foundation. To learn more about the Wallace H. Coulter Foundation please visit whcf.org.

ABOUT OUR PROGRAM

The Department of Biomedical Engineering (BME) is part of the College of Engineering and Computing at FIU and is a prime resource for biomedical engineering education, training, research, and technology development. BME is an ever-evolving field that uses and applies engineering principles to the study of biology and medicine in order to improve health care.

Located in Miami, Florida, Florida International University, a Top 50 public university that is designated a Carnegie Highest Research (R1) and Carnegie Community Engaged institution is committed to high-quality teaching, state-of-the-art research and creative activity, and collaborative engagement with the local and global communities.

Our Biomedical Engineer department is ranked #1 for bachelor's degrees awarded to Hispanics and #6 for bachelor's degrees awarded to African Americans. Nationally, we are among the Top 20 to offer BS degrees, Top 65 for research expenditures, and considered in the Top 30 of the most popular in the country.* We are preparing a diverse community of biomedical engineers and are engaged in translation of research to health care applications through discovery, innovation, entrepreneurship, and community engagement.

*ASEE 2019, NSF HERD 2018, and College Factual 2020

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FIU Engineering & Computing
Biomedical Engineering

Department of Biomedical Engineering bme.fiu.edu

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