VIRGINIA TECH | WAKE FOREST UNIVERSITY

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

Funded Grad Student Opportunities

2021

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	3D Bioprinting and Regenerative Medicine
Position Need:	PhD/MS student(s), start anytime
Funding:	

Advisor:	**Your Name**
	Anthony Atala, MD Professor and Director, Wake Forest Institute for Regenerative Medicine Wake Forest University Medical Center Blvd. Winston-Salem, NC 27157 Phone: (336) 716-5701 Email: aatala@wakehealth.edu www.wfirm.org Wake Forest School of Medicine Institute for Regenerative Medicine

Specific Project Description:	3D bioprinting is being used in our laboratory to print cells, tissues, and organs. Various components are essential in allowing these technologies to move forward, including biomaterial specificity, bio-ink design and manufacturing, cell biology, hardware design and construction, and software development. The goal of this research is to manufacture tissue constructs that can be implanted in patients. We are working on many tissues with the bioprinting technology, including liver, heart, kidney, trachea, lung, muscle, cartilage, blood vessels and bone. This research involves using cells to engineer an implant, with the engineered bio-ink/biomaterials degrading as new tissue builds over time. We are currently building on our prior research where human tissues and organs have been engineered and implanted in patients, in an effort to expand the number of tissues available, and to scale up the technology through 3D printing. The various aspects of this project include: • To develop novel bio-inks and bio-materials • To develop novel hardware and software for bioprinting • To standardize cell culture and expansion conditions • To define the optimal bioprinting parameters • To bioprint tissues for in-vivo implantation

Other Notes:	

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	Body-on-a-Chip
Position Need:	PhD/MS student(s), start anytime
Funding:	

Advisor:	**Your Name**
	Anthony Atala, MD Professor and Director, Wake Forest Institute for Regenerative Medicine Wake Forest University Medical Center Blvd. Winston-Salem, NC 27157 Phone: (336) 716-5701 Email: aatala@wakehealth.edu www.wfirm.org Wake Forest School of Medicine Institute for Regenerative Medicine

Specific Project Description:	The Body on a Chip project is a federally funded effort to build a miniaturized system of human organs to model the body's responses to harmful agents and to develop potential therapies. Biomaterial-derived bio-inks are being designed and formulated as an extracellular matrix, and are combined with tissue specific human cells to 3D bio-print the organ structures. Miniature lab-engineered organ-like hearts, lungs, livers and blood vessels are placed on microchips and linked together via a system of circulating artificial blood substitutes through channels and sensors to provide online monitoring of individual organs and the overall organ system. The goal of the research is to accelerate the development of therapeutic agents by having a technology that better represents the human biological system, as compared to current methods of 2D culture systems or in vivo animal testing that may not accurately replicate the human response. The system can also be used to develop diseased tissue and organ models that can be used to study specific pathology, and can be explored for the advancement of personalized medicine therapeutics. •

Other Notes:	The project involves various aspects of research, including the design and creation of new biomaterials, cell characterization and culture, 3D printing, microchip construction and optimization, and bio-sensing design and analyses.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	Regenerative Medicine for the Wounded Warrior
Position Need:	PhD/MS student(s), start anytime
Funding:	

Advisor:	**Your Name**
	Anthony Atala, MD Professor and Director, Wake Forest Institute for Regenerative Medicine Wake Forest University Medical Center Blvd. Winston-Salem, NC 27157 Phone: (336) 716-5701 Email: aatala@wakehealth.edu www.wfirm.org Wake Forest School of Medicine Institute for Regenerative Medicine

Specific Project Description:	The Wake Forest Institute for Regenerative Medicine (WFIRM) has over A dozen projects in the development pipeline for our wounded warriors. Under a $75 Million federally funded program, the Armed Forces Institute of Regenerative Medicine, directed by Dr. Atala, aims to translate regenerative medicine technologies to our wounded warriors. Many technologies are under development affecting 5 major focus areas: Craniofacial, Extremities, Composite Tissue Allo-transplantation, Skin, and Genitourinary. These technologies include the development of biomaterials, cells, or both together, to achieve therapeutic targets in patients. A multi-disciplinary approach involving biomaterial sciences, nanotechnology, molecular and cell biology, physiology and pharmacology, is needed to create therapy constructs that could be developed or tissue engineered. This program has projects that cover the entire spectrum of technology development, including idea conception, experimental design, basic and applied sciences, in-vitro and in-vivo testing, proof-of-principle research, pre-clinical studies, process development, FDA regulatory filings, GMP manufacturing, quality assurance, and clinical trial design and execution.

Other Notes:	There is an opportunity to be involved in various areas, involving different tissue and organ targets, with a wide range of research projects.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

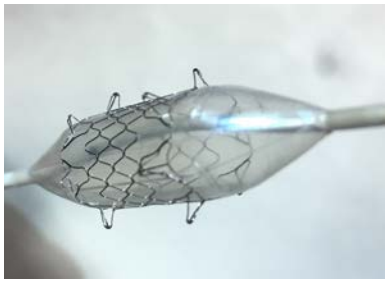
Location: **Wake Forest University**

Project Title: Wake Forest Innovations - Medical Device Design Fellowship
Position Need: 1 MS/PhD (PhD preferred), start May or August 2021
Funding: Funded via a GRA, contract in place

Advisor:

Philip Brown, PhD
Assistant Professor, Biomedical Engineering, WFU Campus
VT-WFU Center for Injury Biomechanics
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 120
Winston-Salem, NC 27101
phibrown@wakehealth.edu
www.CIB.vt.edu

Specific Project Description: Wake Forest Biomedical Engineering and Wake Forest Innovations Center for Technology Innovation and Commercialization Medical Device Unit work together to bring clinical inventions from idea to proof of concept to commercial product. There are several on-going projects with clinical inventors within orthopedics, neurosurgery, radiology, plastic surgery, interventional radiology, trauma, and many others. Past projects have included stents, surgical tools, orthopedic implants, trauma devices, safety hardware, imaging software, and wearable sensors. Students selected for this project will be heavily engaged in the design process, conceptualization, prototyping, evaluation, and management of multiple concurrent device development timelines.



Other Notes: This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

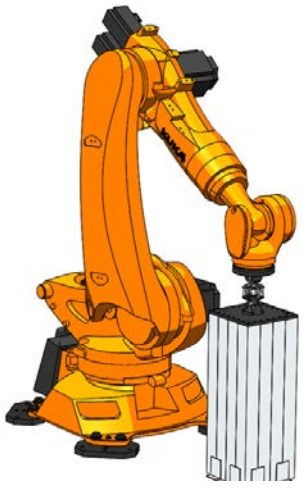
Project Title: Comparative Surgical Biomechanics
Position Need: 1 MS/PhD (PhD preferred), start May or August 2021
Funding: Funded via a GRA, contract in place

Advisor:

Philip Brown, PhD
Assistant Professor, Biomedical Engineering, WFU Campus
VT-WFU Center for Injury Biomechanics
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 120
Winston-Salem, NC 27101
phibrown@wakehealth.edu
www.CIB.vt.edu

Specific Project Description:

There are several opportunities within Biomedical Engineering and through collaborations with orthopedics, neurosurgery, plastic surgery, and others for the experimental validation and exploration of surgical techniques. These procedures are intended to preserve and/or restore physiological function. Our lab conducts surgical biomechanical experiments on new and standard surgical techniques of repairs to bones, ligaments, tendons, and joints. Students selected for this research area will be heavily engaged in experimental design, fixture design, tissue handling and dissection, instrumentation, material testing, data analysis, as well as maintaining professional partnerships with clinical faculty.



Other Notes:

This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

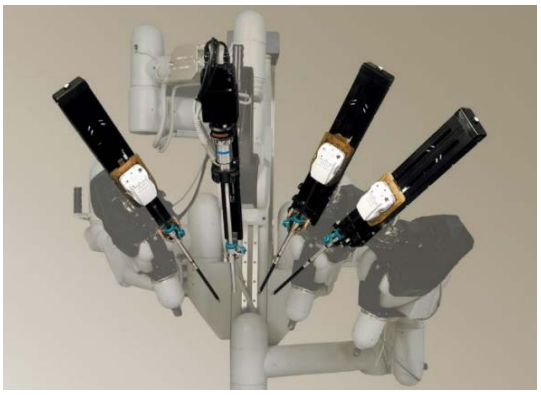
Location: **Wake Forest University**

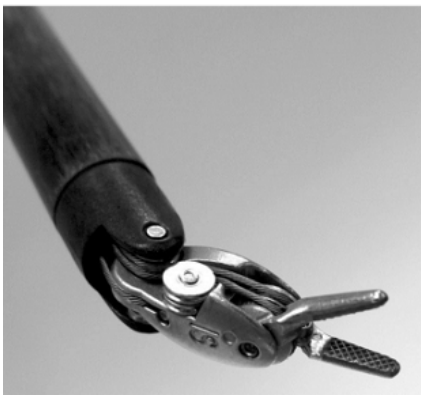
Project Title: Surgical Robotics Biomechanics
Position Need: 1 MS/PhD (PhD preferred), start May or August 2021
Funding: Funded via a GRA, contract in place

Advisor:

Philip Brown, PhD
Assistant Professor, Biomedical Engineering, WFU Campus
VT-WFU Center for Injury Biomechanics
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 120
Winston-Salem, NC 27101
phibrown@wakehealth.edu
www.CIB.vt.edu

Specific Project Description: Biomedical Engineering is fostering opportunities for collaborative research and technology development with physicians and industry partners. We have interest to investigate the following areas of surgical robotics: surgeon to robot interface, force feedback control, autonomous operations, robot tool and tissue interaction, laparoscopic tissue mechanics, surgical instrument design, visualization aids, augmented reality interfaces, training tissue surrogate development, analysis of training and surgical operation, artificial intelligence surgical aids, patient safety, operating room safety & efficiency.





Other Notes: This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Virginia Tech**

Project Title:	Irreversible Electroporation for treating Brain Cancer
Position Need:	2 PhDs, start ASAP
Funding:	Funded via a GRA, contract in place (NIH RO1, NIH PO1)

Advisor:	
	Rafael V. Davalos, PhD L. Preston Wade Professor and ASME Fellow Virginia Tech - Wake Forest University School of Biomedical Engineering and Sciences 329 ICTAS Building, Stanger Street MC 0298 Blacksburg, VA 24061 Phone: (540) 231-1979 Email: davalos@vt.edu **http://www.sbes.vt.edu/davalos/**

Specific Project Description:	Irreversible Electroporation (IRE) is a method we invented for non-thermal tissue ablation, with applications ranging from cancer treatment, treating arrhythmic regions of the heart, to tissue engineering. Short, but intense, electric pulses are delivered through small surgical probes placed into the targeted region that induce nanopores in the lipid bilayer, which leads to cell death. By tuning the pulse parameters to mitigate thermal effects, IRE affects only the lipid bilayer and preserves critical structures, making otherwise inoperable tumors treatable. Our technology has helped thousands of patients. It was given the Expedited Pathway Designation in 2018 for its ability to more than double the median survival of patients with pancreatic cancer. Recently, we invented a means to deliver high-frequency pulses for treating brain tumors. We have shown through microfluidic tumor constructs that these waveforms preferentially target malignant cells based on their biophysical morphology. Furthermore, we have found that this mode of therapy is ideally synergistic with adjuvant immunotherapy. We will deepen our understanding of the underlying biophysics using our microfluidic devices while helping canine patients using custom-designed surgical devices. In addition, this research will be instrumental in translating the technology for human clinical trials in ‘22.

Other Notes:	All candidates must have strong oral and written communication skills and be interested in collaborating with immunologists and clinicians. The research effort will be held in the Bioelectromechanical Systems Lab in Kelly Hall. Students will be expected to develop skills in biophysics and engineering such as design, prototyping, and numerical modeling.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Virginia Tech**

Project Title:	Mechanical Characterization of Soft Biological Systems
Position Need:	1 PhD, start ASAP
Funding:	Funded via a GRA

Advisor:	
	Raffaella De Vita, PhD Professor and Associate Department Head STRETCH Lab, Virginia Tech Department of Biomedical Engineering and Mechanics School of Biomedical Engineering and Sciences 335 Kelly Hall, Stanger Street MC 0298 Blacksburg, VA 24061 Phone: (540) 231-5904 Email: devita@vt.edu Lab Website: www.vtstretchlab.com

Specific Project Description:	Research in the STRETCH (Soft Tissue Research: Experiments, Theory, and Computations by Hokies) lab focuses on characterizing the mechanical properties of biological systems ranging from cellular components to tissues. In our lab, we place special emphasis on the development of new experimental methods and mathematical models that capture the mechanical behavior of these systems. Currently, we are working on quantifying the mechanical properties of the female pelvic organs and their major supportive structures (e.g., uterosacral ligaments and cardinal ligaments) by performing uniaxial, planar biaxial, and inflation tests. The collected mechanical data are then used to formulate constitutive equations for computer simulations. These organs and supportive structures are damaged during pregnancy leading to pelvic floor disorders (e.g., urinary incontinence, fecal incontinence, and prolapse) that affect one out of three women in the United States.

Other Notes:	The STRETCH lab is located in 310A Kelly Hall. The lab has state-of-the-art facilities and equipment that are used to characterize the mechanics of a variety of cells and tissues. Although the research interests in the lab are diverse and continuously evolve over time, the common thread that runs through much of the work in the STRETCH lab is the desire to advance fundamental and mechanistic knowledge of biological systems. This knowledge is crucial for the development of effective interventions to prevent and treat illness and disability.

2021 Faculty Advisor Request form for Graduate Student Position

Location: Virginia Tech

Project Title:	**Safety Through Disruption, National University Transportation Center**
Position Need:	Up to two students, starting summer or fall 2021
Funding:	Funded via a GRA with opportunities for summer employment

Advisor:	Zac Doerzaph, PhD
	Director, Center for Advanced Automotive Research and Safe-D Center Virginia Tech Transportation Institute Associated Professor, Dept. of Biomedical Engineering and Mechanics Blacksburg, VA 24061 Phone: (540) 231-1046 Email: zdoerzaph@vtti.vt.edu Lab Website: http://www.vtti.vt.edu/ and http://www.vtti.vt.edu/utc/safe-d/

Specific Project Description:	Disruptive technologies are changing transportation. The Safe-D Center **maximizes the safety benefits** of these disruptive technologies through targeted research that addresses the most pressing transportation safety questions. Safe-D provides an opportunity for students work alongside career transportation technology experts at the Virginia Tech Transportation Institute while obtaining their degree in the department of Biomedical Engineering and Mechanics. Selected GRAs will be involved in **cutting-edge research** focused on the development and evaluation of advanced vehicle and infrastructure applications relating to the safety of Automated Vehicles, Connected, Vehicles Transportation as a Service and Big Data Analytics. GRAs should anticipate a hands-on experience leveraging a combination of epidemiology, systems design, data mining, modeling, test track experiments, and field experiments using functional vehicles and system prototypes (see website links above). A strong skillset within engineering, data analysis, modeling, human capabilities, and writing is desired; however, the most important attribute of the GRA is a keen interest in developing and evaluating technological **solutions to mitigating the traffic fatality epidemic**.

Other Notes:	As the Grant's Director, Dr. Doerzaph is seeking GRAs to work alongside the Nation's top transportation safety faculty and students in focused teams following Agile management processes when feasible. Focus will involve human safety within the advanced vehicle and infrastructure systems, possibly including injury mechanisms; however, the work will be focused on prevention (i.e. avoiding collisions) rather than on crash worthiness (i.e. surviving collisions).

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	Exploring physics-based finite element analysis for BABT injury criteria development using human surrogates
Position Need:	
Funding:	

Advisor:	**Your Name**
	Scott Gayzik, PhD Associate Professor, Biomedical Engineering VT-WFU Center for Injury Biomechanics School of Biomedical Engineering and Sciences 575 N. Patterson Ave, Suite 120 Winston-Salem, NC 27101 sgayzik@wakehealth.edu www.CIB.vt.edu

Specific Project Description:	The objective of this research is to develop and validate a physics-based finite element animal model(s) (ovine and caprine species) to study behind armor blunt trauma (BABT). These models will be an important tool for evaluating countermeasures and developing computational injury criteria to better protect service members. The models will be used to provide insight and guidance on the risk of skeletal and soft tissue injuries including the development of injury criteria for rib, pulmonary and limited vascular and peripheral organ injury from BABT. The proposed project is the first of its kind to develop ovine and caprine FEA models for use in the study of BABT. Specifically the models will be used to develop finite element based BABT injury criteria.

Other Notes:	This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

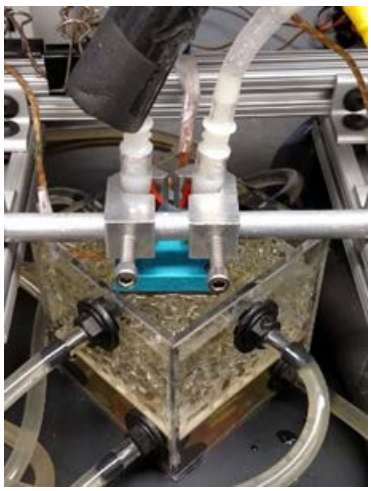
Location:	**Wake Forest University**
Project Title:	Development and Validation of a Brain Phantom for Therapeutic Cooling Devices
Position Need:	1 MS/PhD (PhD preferred), start August 2021
Funding:	Internal – WFU Innovations

Advisor:

Scott Gayzik, PhD
Associate Professor, Biomedical Engineering
VT-WFU Center for Injury Biomechanics
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 120
Winston-Salem, NC 27101
sgayzik@wakehealth.edu
www.CIB.vt.edu

Specific Project Description:

An emerging area of interest is the study of bio-heat transfer. In the CIB, we are interested in developing phantoms and models for treating pathology such as epilepsy and potentially TBI. This project will focus on designing biofidelic phantoms for use in thermal therapy design. The student will conduct experiments on a previously-developed brain phantom which simulates cooling therapy and develop it further using 3D printing technology. A modeling component is included as well, using an established finite difference model to optimize performance and calculate the predicted transient temperature response of both the phantom and the body.



Other Notes:

This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

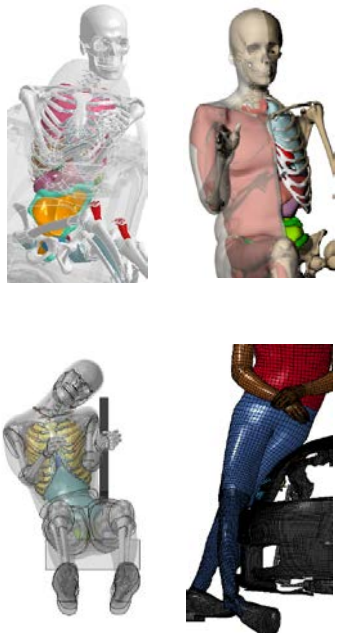
Project Title: Human Body Model Development for Trauma Research
Position Need: 1 MS/PhD (PhD preferred), start May or August 2021
Funding: Funded via a GRA, contract in place

Advisor:

Scott Gayzik, PhD
Associate Professor, Biomedical Engineering
VT-WFU Center for Injury Biomechanics
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 120
Winston-Salem, NC 27101
sgayzik@wakehealth.edu
www.CIB.vt.edu

Specific Project Description:

Computational modeling is a growing component of injury biomechanics and trauma research. This project is a multi-center effort developing a next generation set of human body finite element models for enhanced injury prediction and prevention systems. The student will be responsible for assisting in model development tasks including scaling, postural adjustment, meshing, and contact algorithm development. Responsibilities will also include reporting FEA model analysis and results, running analyses on distributed computing environments, simulating validation procedures, performing literature reviews, and reporting related research efforts through written and oral status updates. The student(s) will gain valuable experience in fields of trauma research, computer modeling, and injury biomechanics.



Other Notes:

This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

Project Title: Standardizing Repositioning Methods for Virtual Assessment in Human Body Models

Position Need: 1 MS/PhD (PhD preferred), start May or August 2021

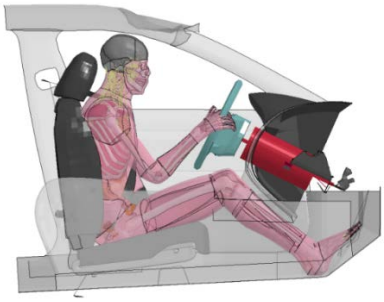
Funding: Funded via a GRA, contract in place

Advisor:

Scott Gayzik, PhD
Associate Professor, Biomedical Engineering
VT-WFU Center for Injury Biomechanics
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 120
Winston-Salem, NC 27101
sgayzik@wakehealth.edu
www.CIB.vt.edu

Specific Project Description:

Human body models (HBMs) have gained prominence in biomechanics literature over the last two decades, but there is little information available regarding the standardization of model positioning. It is well understood that deviations in initial positioning of human models can lead to deviations in outcomes for otherwise identical crash simulations, yet this effect is not well quantified. This project focuses on developing best practices (BPs) for simulation-based repositioning, gravity-settling, belting, and pre-test posture reporting of human body models. As human modeling takes on a greater role in the regulatory sphere, it is important to establish published BPs on how best to prepare HBMs for in-vehicle simulations.



Other Notes: This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

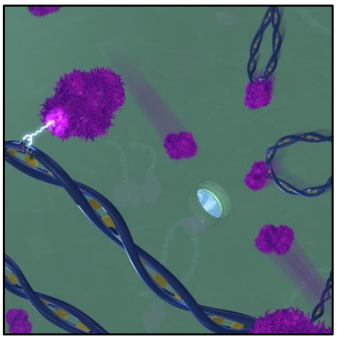
SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request Form for Graduate Student Position

Location: Wake Forest University

Project Title:	Analysis of nucleic acid biomarkers using solid-state nanopores
Position Need:	1 PhD, MS start August 2021
Funding:	funded through GRA, contract in place (NIH R33)

Advisor:	Adam Hall, PhD
	Assistant Professor, Biomedical Engineering, WFU Campus VT-WFU School of Biomedical Engineering and Sciences 575 N. Patterson Ave, Suite 120 Winston-Salem, NC 27101 arhall@wakehealth.edu **www.thehalllab.org**

Specific Project Description:	 The wide-ranging roles of nucleic acids make them valuable as molecular biomarkers for diverse diseases, from infection to cancer. While these molecules can be probed with some conventional techniques, current technologies have limitations in cost, speed, sensitivity, specificity, and/or versatility that challenge their integration into clinical care. Consequently, there is a need for new technologies for molecular analysis. In response, our laboratory is developing the emerging single molecule technology of solid-state nanopores: devices consisting of a single, nanometer-sized aperture fabricated in a synthetic membrane through which biomolecules can be threaded electrically and probed individually. In addition to conventional analysis with this platform, we have also demonstrated a novel assay that enables the selective detection and quantification of diverse features of nucleic acids, including sequence motifs and epigenetic modifications. The goal of this project will be to continue our development towards translation of SS-nanopores to clinically-relevant applications with a specific focus on cancer.

Other Notes:	This project is highly interdisciplinary, requiring the development of skills in biological and biochemical techniques, biophysics, device fabrication, chemistry, and programming. Past experience in one or more of these areas is preferred, but not required.

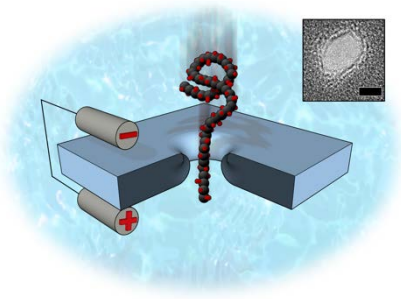
SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request Form for Graduate Student Position

Location: Wake Forest University

Project Title:	Solid-state nanopore analysis of biological sugars
Position Need:	1 PhD, MS start August 2021
Funding:	funded through GRA, contract in place (NIH R01)

Advisor:	Adam Hall, PhD
	Assistant Professor, Biomedical Engineering, WFU Campus VT-WFU School of Biomedical Engineering and Sciences 575 N. Patterson Ave, Suite 120 Winston-Salem, NC 27101 arhall@wakehealth.edu **www.thehalllab.org**

Specific Project Description:	 Hyaluronan (or hyaluronic acid, HA) is a key glycosaminoglycan (i.e. a linear anionic sugar polymer) that has diverse roles, including tissue structure definition and hydration, intrinsic immunity, and joint lubrication. HA can be found in all physiological fluids and tissues, where changes in its composition can either result from or be a direct cause of disease emergence, making it a potentially important bioindicator. However, current tools for analyzing HA have limitations in sensitivity and/or ability to discriminate critical size differences. To address this gap, we have developed solid-state (SS-) nanopore technology – electrical detection of single-molecules as they are driven through a nanoscopic pore – to achieve direct quantification and molecular weight determination of ultra-small amounts of HA (Rivas et al. *Nature Communications, 2018*). Using tools built entirely in our lab, we have demonstrated that a full size distribution can be obtained rapidly and with single-molecule precision from as little as *10 nanograms* of HA extracted from physiological samples. This project will apply our technology to examine the HA as a bioindicator of osteoarthritis and cancer.

Other Notes:	This project is highly interdisciplinary, requiring the development of skills in biological and biochemical techniques, biophysics, device fabrication, chemistry, and programming. Past experience in one or more of these areas is preferred, but not required.

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest School of Medicine**

Project Title: **Evaluating Gene Therapy Strategies to Treat Epilepsy Using a Novel Optogenetic Measure of Network Excitability and Seizure Susceptibility**

Position Need: **MS, start May or August 2021**

Funding: **NIH**

Advisor:

David Klorig
Instructor, Neurobiology and Anatomy, WFUHS Campus
Wake Forest University Health Sciences
Medical Center Blvd
Winston-salem, NC 27157
dklorig@wakehealth.edu
www.kloriglab.com

Specific Project Description: Gene therapy is an emerging treatment strategy that directly engages the machinery of the cell to correct dysfunction. Epilepsy is a debilitating disease and current pharmacological approaches do not work for all patients. Gene therapy has the potential to provide lasting relief with a single minimally-invasive treatment. A student working on this project will be helping to evaluated potassium channel based gene therapy for epilepsy using a recently developed method to track network excitability and seizure susceptibility in freely behaving mice. This project will involve recording and analyzing large quantities of neural data, with the opportunity to work on closed-loop brain-machine interfaces. Computational / programing experience will be helpful.

Other Notes: As a neurophysiologist, I use a variety of analytic techniques to study seizure susceptibility. My core technology involves activating specific populations of neurons optogenetically and measuring network-wide activity spread via a satellite recording array spread across known brain networks in mice. Additional tools include computational modeling and machine learning. My proximal goal is to understand why seizures occur, but my eventual goal is to map and characterize the various modes or states the brain can exist in (with an emphasis on sleep states) in order to uncover clues about how we learn and synthesize information in order to build our internal model of the world.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	Radiation-induced normal tissue injury and response
Position Need:	PhD student
Funding:	

Advisor:	Michael T. Munley, PhD, DABR, FAAPM
	Professor and Section Head – Physics, Radiation Oncology Professor, Biomedical Engineering Wake Forest School of Medicine Adjunct Professor, Physics Wake Forest University Medical Center Blvd. Winston-Salem, NC 27157 mmunley@wakehealth.edu

Specific Project Description:	Research opportunities exist that are focused upon radiation response modeling and advanced medical imaging techniques related to the treatment of patients with cancer. Current research efforts are concentrated on: i) developing models of normal tissue (lung and musculoskeletal) injury resulting from exposure to medical or space radiation and ii) determining the carcinogenic risk of medical procedures that utilize ionizing radiation. Other potential research areas are radiosurgery and radiation dosimetry.

Other Notes:	Introductory hands-on experience in clinical medical physics will also be obtained.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	**Airway Organoids for Disease and Toxicity Modeling and Countermeasure Development**
Position Need:	MS/PhD student(s) (PhD preferred), start Anytime
Funding:	NIH, DHHS

Advisor:	**Sean Murphy**
	Assistant Professor, Wake Forest Institute for Regenerative Medicine Wake Forest University Medical Center Blvd. Winston-Salem, NC 27157 semurphy@wakhealth.edu https://school.wakehealth.edu/Faculty/M/Sean-Vincent-Murphy

Specific Project Description:	Currently, in vitro and in vivo models are unable to fully replicate the structure and function of the human airway. While some progress has been made for disease modeling and drug discovery, current in vitro models are unable to reproduce the complex spatial morphology and allow biologically relevant cell-cell and cell-matrix interactions. There is a need for a new model to more fully represent the human airway. We have developed a multicellular bronchial airway organoid model that more accurately mimics the biological environment of the human upper airway compared to 2D culture. It not only contains primary airway cells that express markers similar to native lung, but also native extracellular matrix components found within the human lung. The model is capable of being integrated into a microfluidic device for disease and toxicity modeling for the future development of appropriate countermeasures. The goal of this research is to apply the multicellular biomimetic airway organoid as a more effective in vitro surrogate for airway disease modeling and therapy evaluation.

Other Notes:	https://newsroom.wakehealth.edu/News-Releases/2019/10/HHS-Awards-Major-Funding-Award-to-WFIRM https://school.wakehealth.edu/Research/Institutes-and-Centers/Wake-Forest-Institute-for-Regenerative-Medicine/Research/Military-Applications/Body-on-A-Chip https://school.wakehealth.edu/Research/Institutes-and-Centers/Wake-Forest-Institute-for-Regenerative-Medicine/Careers

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request Form for Graduate Student Position

Location:	Wake Forest School of Medicine, Institute for Regenerative Medicine	Richard H. Dean Building 391 Technology Way Winston-Salem, NC 27101

Project Title: Controlled delivery of therapeutic agents

Position Need: MS/PhD student(s) (MS preferred), start May or August 2021

Advisor:

Emmanuel C. Opara, PhD
Professor, Institute for Regenerative Medicine
Professor, Biomedical Engineering
Phone: (336) 713-1297
Email: eopara@wakehealth.edu

Project Description: We have recently described chemical methods to engineer polymeric alginate to make the resultant hydrogel resistant to acidic environment such as the stomach but sensitive to neutral-basic pH conditions as occur in the intestine. This characteristic feature makes the hydrogel a unique delivery vehicle for therapeutic biologics that need protection from the acids stomach but released in the intestine where the hydrogel degrades to release its payload. The release of the therapeutic agents in the small intestine where the absorption of orally ingested materials takes place enhances the bioavailability of such agents with the collateral effect of reducing therapeutic doses and eliminating unwanted side effects. In addition, safe delivery of certain therapeutic agents to the intestine makes it feasible to use unique biologics against intestinal cancers.

Other Notes: This research effort is being performed at the Wake Forest Institute for Regenerative Medicine (WFIRM), and you will have the opportunity to work on a range of projects that focus on the design and applications of biomaterials in drug delivery and tissue engineering for application in diabetes and other diseases.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request Form for Graduate Student Position

Location:	Wake Forest School of Medicine, Institute for Regenerative Medicine	Richard H. Dean Building 391 Technology Way Winston-Salem, NC 27101

Project Title: Bioengineering a bioartificial pancreas

Position Need: MS/PhD student(s) (MS preferred), start May or August 2021

Advisor:

Emmanuel C. Opara, PhD
Professor, Institute for Regenerative Medicine
Professor, Biomedical Engineering
Phone: (336) 713-1297
Email: eopara@wakehealth.edu

Project Description: The objective in this research is to design a bioengineered functional endocrine pancreas that is made with an encapsulation matrix that mimics the native microenvironment in which pancreatic islet cells are housed. The approach is to fabricate an alginate-based matrix whose stiffness resembles that of the native pancreatic scaffold and to embed in this matrix extracellular membrane (ECM) proteins that will provide all the biochemical and biological cues (collagen, laminin, fibronectin, integrins, and growth factors) that will support the encapsulated cells for long-term viability and function. This project involves both *in vitro* and *in vivo* experiments to test the viability of the engineered tissue.

Other Notes: This research effort is being performed at the Wake Forest Institute for Regenerative Medicine (WFIRM) and you will have the opportunity to work on a range of projects that focus on the applications of biomaterials and tissue engineering in diabetes and development of bioartificial organs.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2020 Faculty Advisor Request Form for Graduate Student Position

Location:	Wake Forest School of Medicine Institute for Regenerative Medicine	Richard H. Dean Building 391 Technology Way Winston-Salem, NC 27101

Project Title: Bioartificial Ovary for Cell-based Hormone Therapy

Position Need: MS/PhD student(s) (MS preferred), start May or August 2021

Advisor:

Emmanuel C. Opara, PhD
Professor, Institute for Regenerative Medicine
Professor, Biomedical Engineering
Phone: (336) 713-1297
Email: eopara@wakehealth.edu

Project Description: Although medications under the umbrella of hormone replacement therapy can compensate for the loss of ovarian hormone production, this treatment modality can result in higher-than-normal hormone levels and complications. My laboratory is working on a cell-based hormone therapy – essentially a bioartificial ovary to deliver sex hormones in a more natural manner than drugs. The project involves using donor ovarian cells that are "encapsulated" in the same fashion as the natural architecture of follicular cells with thin membranes that allow oxygen and nutrients to enter the tissue construct, but prevent immune factors that would cause the patient to reject the cells. In *in vitro* studies, we showed that the encapsulated cells secreted sex hormones, demonstrating for the first time that the hormone-producing units of ovaries can be engineered outside the body. In preliminary *in vivo* studies published recently, we have tested the encapsulated cells and shown high efficacy of the tissue constructs in the restoration of physiological levels of sex hormones as well as prevention of co-morbidities associated with ovarian failure.

Other Notes: This research effort is being performed at the Wake Forest Institute for Regenerative Medicine (WFIRM) and you will have the opportunity to work on a range of projects that focus on the applications of biomaterials and tissue engineering in diabetes and development of bioartificial organs.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Virginia Tech**

Project Title:	Naturalistic Driving Data Analyses – Various Projects
Position Need:	1 PhD, 1 Masters, start May or August 2021
Funding:	Funded via a GRA

Advisor:	**Miguel Perez, PhD**
	Associate Professor Department of Biomedical Engineering and Mechanics School of Biomedical Engineering and Sciences Virginia Tech Director, CDRAS Virginia Tech Transportation Institute 3500 Transportation Research Plaza Blacksburg, VA 24061 Phone: (540) 231-1537 Fax: (540) 231-1555 Email: mperez@vt.edu Website: https://www.vtti.vt.edu/research/cdras/index.php

Specific Project Description:	The Virginia Tech Transportation Institute houses over 90% of the naturalistic driving data in the world. We work with a variety of customers, both public and private, that are interested in leveraging those data to understand driver behavior, decisions, and actions. In turn, this understanding yields insights that can improve the safety and efficiency of surface transportation. Projects range from detailed investigations of particular drive behaviors while driving (e.g., texting), to analyses of causal factors for crashes, to understanding of occupant positioning pre-crash, to design of crash countermeasure systems, to examinations of crash pulses in particular crash scenarios, to (more recently) synthesizing data in ways that are useful for the design and operation of automated vehicles.

Other Notes:	VTTI continues to collect similar data on an ongoing basis, generally on vehicles with newer technologies. Most recently, this includes vehicles with on-board Level 2 automation technologies.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Virginia Tech**

Project Title:	TBD
Position Need:	PhD Students, start Fall 2021
Funding:	Funded via a GRA

Advisor:	
	Robin Queen, PhD Associate Professor, Virginia Tech Director, Granata Biomechanics Lab 300 Norris Hall, Blacksburg, VA 24061 Phone: (540) 231-3134 Email: rmqueen@vt.edu **http://www.beam.vt.edu/granatalab**

Specific Project Description:	Various projects in process. Here's an example of one: **Measuring landing mechanics during rehabilitation from an ACL reconstruction** Unfortunately, athletes returning to sport following ACL reconstruction surgery currently have a high risk for secondary injuries. In this project, we are measuring lower extremity mechanics during jump-landing tasks in various outpatient physical therapy clinics in Southwest Virginia. Our lab recently found that force sensing shoe insoles and 2D video analysis are valid and repeatable for assessing landing kinetics and kinematics, respectively. Our long term goal is to use these clinically feasible technologies to both help physical therapists train patients to land better and help surgeons decide if a patient is ready to return to sport.

Other Notes:	

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request Form for Graduate Student Position

Location: **Wake Forest University**

Project Title: Exploiting tissue engineered organoids for the study of liver fatty acid metabolism

Position Need: 1 MS or PhD start August 2021

Funding: TBD

Advisor:

Elaheh Rahbar, PhD
Assistant Professor, Biomedical Engineering, WFU Campus
Translational Trauma Research Lab
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 5300
Winston-Salem, NC 27101
Email: erahbar@wakehealth.edu

Specific Project Description:

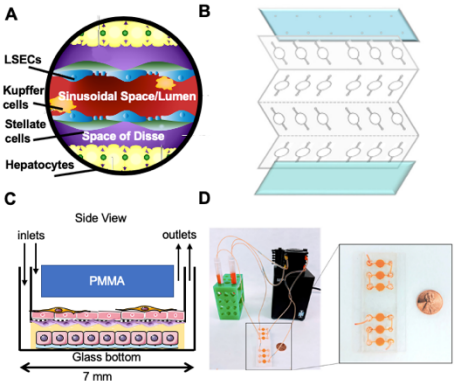


Fig. 1. a) Organization of cells in liver lobule, b) Schematic of low-cost microfluidic device for eMPS, c) Side view of eMPS with cells (width of bottom chamber is 200 um, upper chamber is 100 um, separated by semi-permeable membrane, and d) Photo of experimental setup with peristaltic pump (orange dye visualization).

Dietary PUFA supplements (e.g. fish oil) have been increasingly recommended for the reduction of inflammation and improving cell repair after injury. However, genetic variants associated with differential PUFA metabolic rates disproportionately affect African ancestral populations and this raises major concerns about a "one-size fits all" approach. This research plan will identify specific mechanisms in which dietary PUFAs modulate inflammation and cell repair after injury using a tissue engineered liver organoid platform.

In this project, the student will exploit a tissue engineered liver model to elucidate key gene-diet interactions linking dietary PUFAs to inflammation after injury. Experiments will be conducted to characterize the inflammatory, coagulation and metabolic changes following varying degrees of liver ischemia-reperfusion injuries.

Other Notes: This research effort will be a collaboration between BME, Regenerative Medicine and the Center for Precision Medicine at Wake Forest. The student will have the opportunity to work on a range of projects in the field of traumatic injury, 3D printing, tissue engineering, organoid development, and statistical modeling using -omic data.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request Form for Graduate Student Position

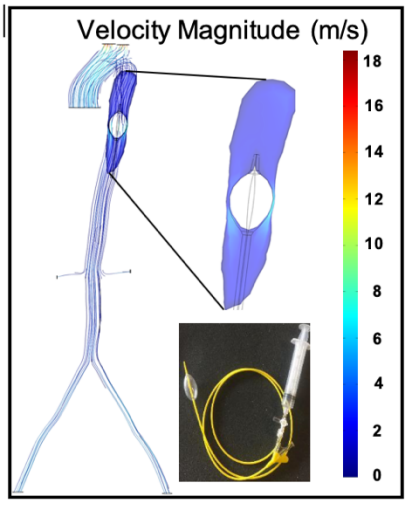
Location: **Wake Forest University**

Project Title: Computational Fluid Dynamic Modeling of Hemorrhage Control Devices
Position Need: 1 MS/PhD/Postdoc (PhD preferred), start June 2021
Funding: TBD

Advisor:

Elaheh Rahbar, PhD
Assistant Professor, Biomedical Engineering, WFU Campus
Translational Trauma Research Lab
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 530
Winston-Salem, NC 27101
Email: erahbar@wakehealth.edu

Specific Project Description:



Non-compressible hemorrhage, referring to regions of the body that cannot be tourniquet pose a serious threat to one's survival. To address this problem, Endovascular Aortic Control (EVAC) devices have been implemented to create a partial occlusion of the aortofemoral artery via inflation of a balloon catheter. However, these methods are of high risk, often resulting in significant ischemic injury and vascular collapse. This project, exploits CFD modeling to better understand the hemodynamics during hemorrhage and EVAC implementation.

The student will apply learned CFD and finite element skills to quantify key fluid mechanics properties (e.g. shear stress, blood pressure) in the aortofemoral region. This data will help inform improved designs of EVAC devices, ensuring the restoration of blood pressure and fluid flow, while delivering sufficient oxygen to mitigate ischemic injury.

Other Notes: This research effort will be a collaboration between BME, Center for Injury Biomechanics, and the Cardiovascular Surgery departments at Wake Forest. The student will have the opportunity to work on a range of projects in the field of traumatic injury, imaging, computational modeling, medical device testing and animal models. A strong background in fluid mechanics and finite element modeling is preferred.

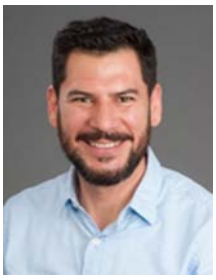
SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title: **Genome and complex image analysis in neuropathies and pain**
Position Need: **1 MS/PhD student**
Funding: **NIH R01 and internal grant**

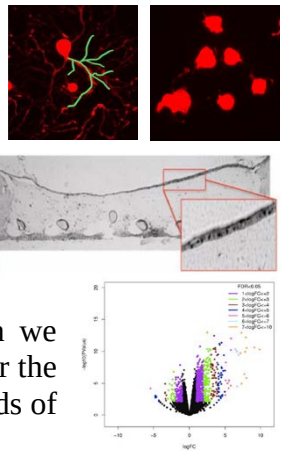
Advisor:



E. Alfonso Romero-Sandoval, MD, PhD
Associate Professor of Anesthesiology
Pain Mechanisms Laboratory
Wake Forest School of Medicine
1 Medical Center Blvd, Winston-Salem, NC 27157
Phone: 336-716-2725. Email: **eromeros@wakehealth.edu**

Specific Project Description:

My lab focuses on pain and inflammation after tissue damage, either by physical trauma (surgeries), pharmacologic treatments (chemotherapy) or metabolic conditions (diabetes). We utilize a wide range of techniques including behavioral assessments in small rodents, tissue collection from animals or human subjects (healthy or patients) for pathological or molecular biology assessments (immunohistochemistry, Western blot, ELISA, qPCR, etc.), cellular cultures, genetic manipulation, or clinical data analysis. We are currently using transcriptome analyses via bulk or single cells RNA sequencing. We are also collecting complex images from our in vitro or ex vivo studies to understand how neurons are damaged or how tissue heals after injury. These data sets are large, and we are constantly trying to develop innovative ways to analyze them in an effective and meaningful fashion (see images below). Our students and trainees are exposed to all these techniques and approaches, so they become very familiar with all aspects of the projects. My lab is part of the interdisciplinary and collaborative group of preclinical and clinical research faculty within the Pain Mechanisms Lab focused on translational pain research. The following images depict how sensory neurons (red) grow normally (left) ex vivo and how these neurite expansions (green) are altered by chemotherapeutic agents or the exposure to toxic immune cells (right). We also study wound healing using organotypic skin tisues. These images show how new epithelium grows and how its cellularity changes when we induce a genetic alteration in immune cells. When we alter the genotype of immune cells we produce changes in thousands of genes, as shown in this volcano plot image.



Other Notes: The research will be conducted in the Pain Mechanisms Lab, Hanes building, WF Baptist Medical Center

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: Wake Forest University

Project Title: Computational Assessment of Body Kinematics and Injury Risks for Astronauts during Landing/Launch in Various Environments

Position Need: MS or PhD, May or August 2021

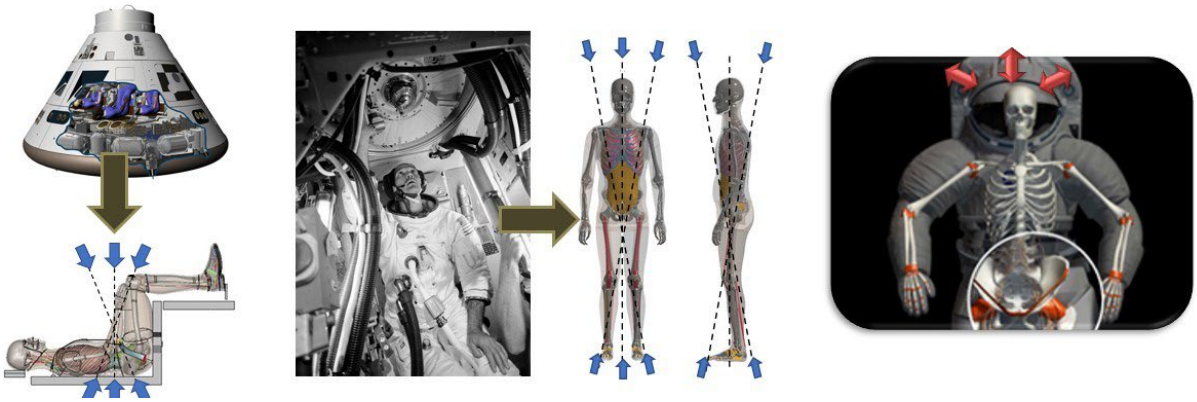
Support: NASA HRP Grant, Graduate Student Fellowship, Graduate School Funding

Advisor:

Joel D. Stitzel, PhD, pubmed, linkedin

Professor, Biomedical Engineering, WFU Campus
Center for Injury Biomechanics at WFU
575 N. Patterson Ave, Suite 530, Winston-Salem, NC 27101
jstitzel@wakehealth.edu, CIB at WFU

Landing on the Earth ***Landing on the Moon*** ***Dynamic Interaction***



Specific Project Description:

- We are using finite element (FE) human body model to assess body kinematics and associated injury risk for astronauts in different postures - standing and seated under dynamic loading conditions associated with lunar spaceflight landing and launch missions.
- We are also studying the effects of interactions between astronaut body regions and spaceflight equipment - spaceflight seat and mobility spacesuit on astronaut injury risks during space missions.
- The long term objective of this research is to improve astronaut safety during future space missions to Moon and Mars by identifying the optimal posture and space vehicle design to minimize injury risks.
  Reference - Ye, X., et al., 2019, J. Biomech Eng, PMID: 31701120

Other Notes: This research effort is on the Wake Forest Campus of the Center for Injury Biomechanics (CIB) with opportunities to work on a range of projects in the field of automobile, military, aerospace, and sports biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

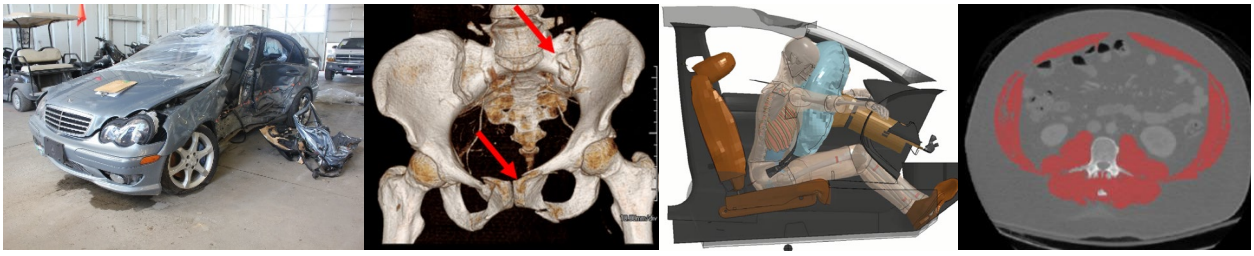
Location:	**Wake Forest University**

Project Title: Crash Injury Research and Engineering Network (CIREN)
Position Need: MS or PhD, May or August 2021
Support: Graduate Research Fellowship, National Highway Traffic Safety Administration (NHTSA), Graduate School Support

Advisor(s):

Joel D. Stitzel, PhD, pubmed, linkedin

Professor, Biomedical Engineering, WFU Campus
Center for Injury Biomechanics at WFU
575 N. Patterson Ave, Suite 530, Winston-Salem, NC 27101
jstitzel@wakehealth.edu, CIB at WFU



Specific Project Description:

- CIREN has been an ongoing project at WFUBMC since 2005. You'll work closely with faculty and team of expert staff investigators.
- Conducts detailed investigations of real-world motor vehicle crashes and determines mechanism and causation of occupant injuries to improve prevention, mitigation, and treatment of motor vehicle crash injuries.
- Involves collaboration and working closely with a broad range of medical specialties, including biomedical engineers, crash investigators, radiologists, orthopedic surgeons, and trauma surgeons.
- We also conduct finite element (FE) modeling reconstructions of CIREN crashes using the simplified GHBMC human body model and a simplified vehicle model. These reconstructions provide kinematic visualizations and injury analyses to supplement our investigations.
- CIREN is a research catalyst that can be used to conduct a wide range of motor vehicle trauma studies. A list of publications before 2016, many from our CIREN center, as well as general information about CIREN, can be found here.

Other Notes: This research effort is on the Wake Forest Campus of the Center for Injury Biomechanics (CIB) with opportunities to work on a range of projects in the field of automobile, military, aerospace, and sports biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

Project Title: Head Impact Exposure Quantification and Mitigation in Motorsports
Position Need: MS or PhD, May or August 2021
Support: Graduate Research Fellowship, NIH, Graduate School Support

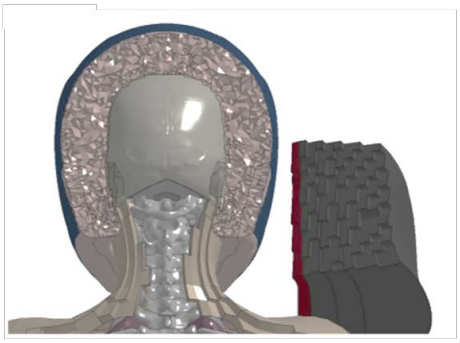
Advisor:

Joel D. Stitzel, PhD, pubmed, linkedin

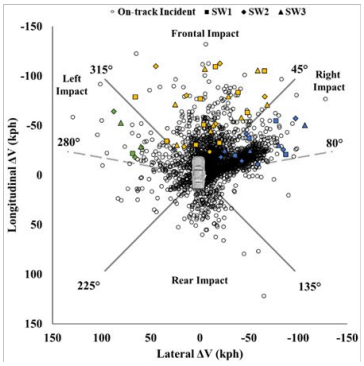
Professor, Biomedical Engineering, WFU Campus
Center for Injury Biomechanics at WFU
575 N. Patterson Ave, Suite 530, Winston-Salem, NC 27101
jstitzel@wakehealth.edu, CIB at WFU

Driver FE Model

FE Simulation for Driver Safety Optimization



Example On-Track Impacts



Specific Project Description:

- Pilot testing of individualized mouthpiece deployment in motorsports
- Analysis to quantify environmental and crash head kinematics
- Finite element (FE) modeling for injury risk assessment for drivers in crash scenarios
- FE simulation to optimize safety measures and driver comfort
- Injury risk assessment: Reference
- Optimization of safety measures: Reference

Other Notes: This research effort is on the Wake Forest Campus of the Center for Injury Biomechanics (CIB) with opportunities to work on a range of projects in the field of automobile, military, aerospace, and sports biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

Project Title: Quantifying Head Impact Exposure in Youth and Collegiate / Adult Soccer with Instrumented Mouthpiece

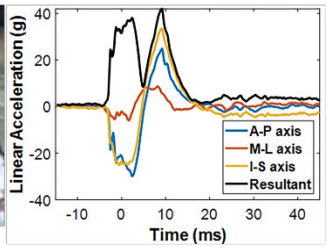
Position Need: MS or PhD, May or August 2021

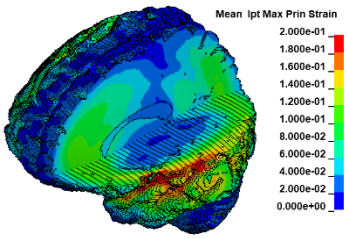
Support: Graduate Research Fellowship, NIH, Graduate School Support

Advisor:

Joel D. Stitzel, PhD, pubmed, linkedin

Professor, Biomedical Engineering, WFU Campus
Center for Injury Biomechanics at WFU
575 N. Patterson Ave, Suite 530, Winston-Salem, NC 27101
jstitzel@wakehealth.edu, CIB at WFU





Specific Project Description:

- Development, testing, and field deployment of an instrumented mouthguard in youth and collegiate soccer
- Analysis of on-field head impact data and time-synchronized video to assess on-field activity associated with measurements collected from the instrumented mouthpiece
- Finite element (FE) modeling of head impact data with a FE brain model to evaluate tissue-level stresses and strains
- Investigating potential modifiers of head impact exposure and concussion risk (e.g., drill types, athlete fatigue, header technique)
- The long term benefit of the research will be to assist equipment designers, researchers, and clinicians to better prevent, mitigate, identify, and treat injuries to help improve sport safety.
- Reference: Development, Validation, and Pilot Field Deployment of a Custom Mouthpiece for Head Impact Measurement

Other Notes: This research effort is on the Wake Forest Campus of the Center for Injury Biomechanics (CIB) with opportunities to work on a range of projects in the field of automobile, military, aerospace, and sports biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest University**

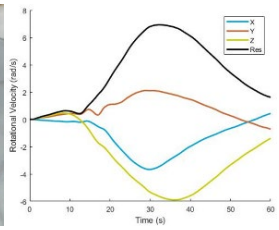
Project Title: Youth Hockey Head Impact Exposure Quantification with Instrumented Mouthguard

Position Need: MS or PhD, May or August 2021

Support: Graduate Research Fellowship, NIH, Graduate School Support

Advisor: Joel D. Stitzel, PhD, pubmed, linkedin

Professor, Biomedical Engineering, WFU Campus
Center for Injury Biomechanics at WFU
575 N. Patterson Ave, Suite 530, Winston-Salem, NC 27101
jstitzel@wakehealth.edu, CIB at WFU



Specific Project Description:

- Development, testing, and field deployment of an instrumented mouthguard in competitive youth ice hockey.
- On-ice head impact data and video will be analyzed to assess on-field activity associated with measurements collected from the instrumented mouthpiece.
- We also conduct finite element (FE) modeling of the data with a head FE model. The long-term benefit of the research will be to allow equipment designers, researchers, and clinicians to better prevent, mitigate, identify and treat injuries to help improve sport safety.
- American Academy of Neurology Sports Concussion Reference

Other Notes: This research effort is on the Wake Forest Campus of the Center for Injury Biomechanics (CIB) with opportunities to work on a range of projects in the field of automobile, military, aerospace, and sports biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

Project Title: Youth Gymnastics Head Impact Exposure and Environmental Kinematic Quantification with Instrumented Mouthpiece

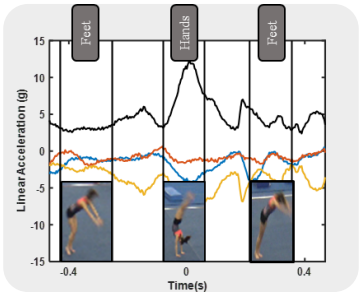
Position Need: MS or PhD, May or August 2021

Support: Graduate Research Fellowship, NIH, Graduate School Support

Advisor:

Joel D. Stitzel, PhD, pubmed, linkedin

Professor, Biomedical Engineering, WFU Campus
Center for Injury Biomechanics at WFU
575 N. Patterson Ave, Suite 530, Winston-Salem, NC 27101
jstitzel@wakehealth.edu, CIB at WFU



Specific Project Description:

- Development, testing, and field deployment of an instrumented mouthguard in youth gymnastics.
- Head impact data and video will be analyzed to assess skills and activities associated with measurements collected from the instrumented mouthpiece.
- We also collect measures of neurological function to assess changes that may result from performance of high-speed gymnastics skills. The long term benefit of the research will be to allow equipment designers, researchers, and clinicians to better prevent, mitigate, identify and treat injuries to help improve sport safety.
- Head Impact Exposure in Women's Artistic Gymnastics. Pritchard N.S., Urban J. Miller L. Stitzel J. *Presented at the 2020 Summer Biomechanics, Bioengineering, and Biotransport Conference.*

Other Notes: This research effort is on the Wake Forest Campus of the Center for Injury Biomechanics (CIB) with opportunities to work on a range of projects in the field of automobile, military, aerospace, and sports biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

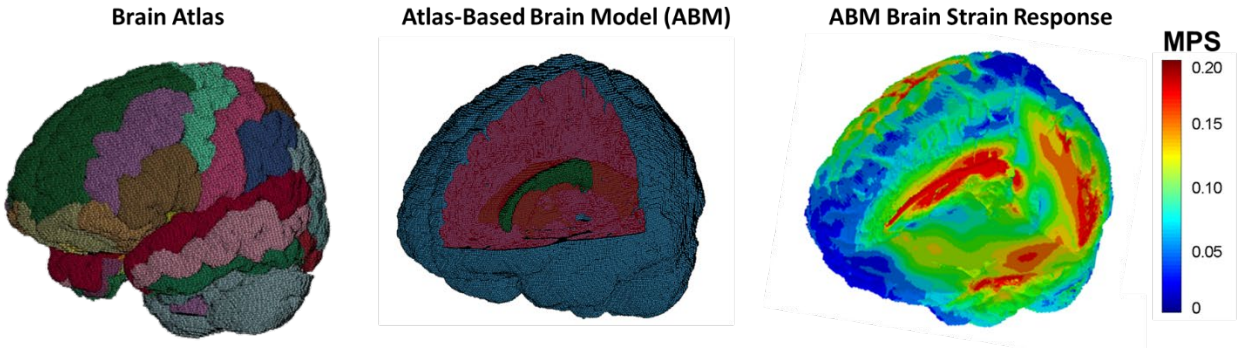
Location: **Wake Forest University**

Project Title: Quantifying Brain Response with the Atlas-Based Brain Model
Position Need: MS or PhD, May or August 2021
Support: Graduate Research Fellowship, NIH, Graduate School Support

Advisor:

Joel D. Stitzel, PhD, pubmed, linkedin

Professor, Biomedical Engineering, WFU Campus
Center for Injury Biomechanics at WFU
575 N. Patterson Ave, Suite 530, Winston-Salem, NC 27101
jstitzel@wakehealth.edu, CIB at WFU



Specific Project Description:

- Further validation of the atlas-based brain model (ABM)
- Improving the biofidelity of the brain-skull interface of the ABM and updating the brain material model
- Incorporating diffusion tensor imaging (DTI) tracts into model
- Simulating real-world head impacts collected from sports including football, hockey, soccer, gymnastics, and rugby
- The long term benefit of the research will be to allow equipment designers, researchers, and clinicians to better prevent, mitigate, identify and treat injuries to help improve sport safety.
- ABM development: Reference
- ABM application: Reference

Other Notes: This research effort is on the Wake Forest Campus of the Center for Injury Biomechanics (CIB) with opportunities to work on a range of projects in the field of automobile, military, aerospace, and sports biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**
Project Title:	**Transfer Learning based computable phenotype generation via clinical and Genomic Sequencing data**
Position Need:	**PhD student for May or August 2021**
Funding:	**National Foundation for Cancer Research**

Advisor:

Contact info:
Umit Topaloglu, PhD, FAMIA
Associate Professor of Cancer Biology and Biostatistics & Data Science, Wake Forest University School of Medicine,
Medical Center Boulevard, Winston-Salem, NC 27157
umit.topaloglu@wakehealth.edu

Wei Zhang PhD
Hanes and Willis Family Professor in Cancer
Wake Forest University School of Medicine,
Medical Center Boulevard, Winston-Salem, NC 27157
wezhang@wakehealth.edu

Specific Project Description:

As new Precision Medicine approaches are trying to comprehend the link between genes and the phenotypes, and an unprecedented amount of genomic data being generated, computational method already play substantial roles on the way genomic and multimodal biomedical data are analyzed. Consequently, such methods will result in better translation of genomic variants towards understanding phenotypes and real-world evidence. The computational phenotype predictions, particularly deep learning-based machine learning approaches, have hopes and promise of identifying potential linkages between disease groups and genetic variations to predict the outcome or response to treatment. However, while federated machine learning methods are gaining popularity recently, their application to electronic health records is relatively novel and require extensive research, particularly in areas to take advantage of recent developments in deep learning with large sample sizes. Therefore, we would like to develop and test a cloud-based informatics infrastructure to identify and integrate clinical data with the genomic data sets across the institutions that will leave the patient data in each institution without exchanging data, thereby minimizing patient data privacy concerns. Additionally, we will develop a model that will allow investigators train and test deep learning based predictive models and computable phenotypes utilizing the clinical and the sequencing data across multiple institutions in a privacy preserving fashion yet take advantage of large sample size from participating institutions.

Other Notes:

This work will provide great opportunity to learn and gain expertise on Deep Learning, Privacy Preserving AI on a large network, Computable Phenotypes, and Cloud Computing.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

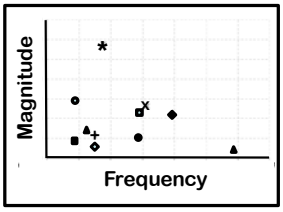
Location: **Wake Forest University**

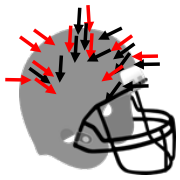
Project Title: Evidence-Based Intervention to Reduce Head Impact Exposure
Position Need: 1 MS/PhD (PhD preferred), start May or August 2021
Funding: Funded via a GRA, contract in place

Advisor:

Jillian Urban, PhD, MPH
Assistant Professor, Biomedical Engineering, WFU Campus
VT-WFU Center for Injury Biomechanics
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 120
Winston-Salem, NC 27101
jurban@wakehealth.edu
www.CIB.vt.edu

Specific Project Description:





The objective of this project is to develop and pilot test an evidence-based intervention to reduce head impact exposure in youth football, using a community-engaged approach. In this study, biomechanical data will be collected and quantified during team activities and used to inform discussions with stakeholders (coaches, parents, league officials) for the development of an intervention aimed to reduce head impact exposure in practices. The developed intervention will be pilot tested to evaluate the effectiveness of the intervention at reducing head impact exposure. This research project combines biomechanics and public health and will seek to improve head impact safety for young athletes participating in sports.

Other Notes: This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

Virginia Tech
Wake Forest University

School of **Biomedical Engineering and Sciences**

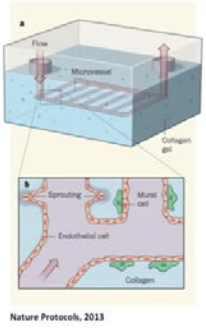
2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Virginia Tech**

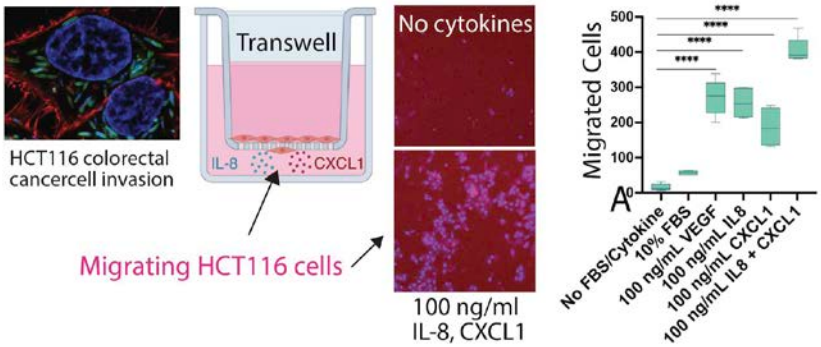
Project Title:	Targeting intracellular bacteria that drive cancer growth and metastasis
Position Need:	1 PhD student, starting August 2021
Funding:	Funded via GRA support, contract in place

Advisor:	Scott S. Verbridge, PhD
	Associate Professor Virginia Tech - Wake Forest University School of Biomedical Engineering and Sciences 330 Kelly Hall, 325 Stanger Street MC 0298 Blacksburg, VA 24061 Phone: (540) 231-6908 Email: sverb@vt.edu www.verbridgelab.org

Specific Project Description:



The work in the Verbridge lab broadly involves developing advanced tissue engineered models of the heterogeneous tumor microenvironment to analyze the role of tumor-tissue interactions in cancer progression and therapy response. One funded GRA position is currently available. This position will focus on developing microfabricated models (left, upper) of a vascularized tumor microenvironment (TME) containing infected malignant cells to analyze the dynamics of bacterial spread within tumor tissues. Major questions pertain to understanding how these bacteria influence complex cancer processes such as migration (below, right, as we recently published in a Science Signaling cover article, July, 2020).



Other Notes:	This work will be carried out in the Verbridge lab, but is also highly interdisciplinary, involving collaboration with researchers in Biochemistry, Chemical Engineering, Biological Sciences, Veterinary Medicine, and the Wake Forest Comprehensive Cancer Center. This project is supported by funding the NIH and NSF.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest School of Medicine**

Project Title: Point Spread Function Engineering for 3D Cell Imaging
Position Need: 1 PhD student (preferred) or 1 MS student, interested in optics
Funding: NIH (PS-ON U01 grant)

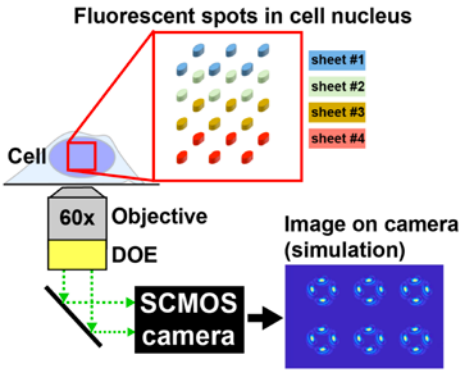
Advisors:

Pierre Vidi, PhD
Associate Professor
Wake Forest School of Medicine
Cancer Biology
(336) 716 7122
pvidi@wakehealth.edu

Keith Bonin, PhD
Professor
Wake Forest University
Physics Department
(336) 758-4962
bonin@wfu.edu

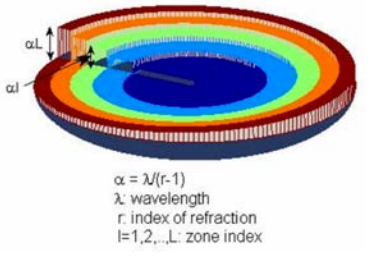
Specific Project Description:

Rapid 3D imaging enables accurate localization of macromolecules in live cells. Most current techniques scan through the sample to capture the 3rd dimension, with the limitation to consume time during which specimens suffer from photodamage.



Concept – PSF engineering to capture 3D information from 2D images

For this project, the student will apply a novel point spread function (PSF) engineering concept, initially developed for the detection of space debris, to fluorescence microscopy. A diffractive optical element (DOE) will be designed and fabricated to create a rotatable PSF in the image plane on the camera. This rPSF-DOE will transform circular spots in the sample into larger elliptically shaped spots on the camera (see schematic). The orientation of the ellipse will depend on the axial depth of the spot source, thus allowing us to extract x/y/z positions from a single image.



rPSF-DOE prototype schematic

The student will also develop algorithms for DOE optics computations and for data analyses (such as 3D spot tracking).

Note: This multidisciplinary project is part of the Physical Sciences - Oncology Network (PS-ON) program of the NCI (https://physics.cancer.gov)

Virginia Tech
Wake Forest University

School of **Biomedical Engineering and Sciences**

2021 Faculty Advisor Request Form for Graduate Student Position

Location: Wake Forest University School of Medicine

Project Title: Biomaterial Composites for Musculoskeletal, Nervous Tissue and Cardiovascular Repair

Position Need: 2 Ph.D. Start date May – August 2021

Advisor:

Professor, William D. Wagner, PhD., Fellow AHA
Department of Plastic and Reconstructive Surgery, Wake Forest University School of
ine
aculty, Department of Biomedical Engineering, School of Biomedical Engineering
iences WFU/VT
te Faculty, Center for Nanotechnology and Molecular Materials

al Center Boulevard
on Salem, NC 27157-1075
(336)716-2135
Email: wwagner@wakehealth.edu

Dr. Wagner's research involves a biomaterial-based approach for tissue repair and regeneration. He has produced biomaterials primarily for the cardiovascular, nervous, and musculoskeletal systems. His current projects include development, testing and use of elastomeric composite biomaterials and cryogels. His motto is "**We fabricate anything that will make our Health better**"

Specific Project Description: We have developed new polymeric and fibrous biomaterials useful to serve as substitutes for heart valves and arteries as well as bone and peripheral nerve repair. The bioengineered constructs will serve various surgical purposes and represent the next generation of products to be used clinically.

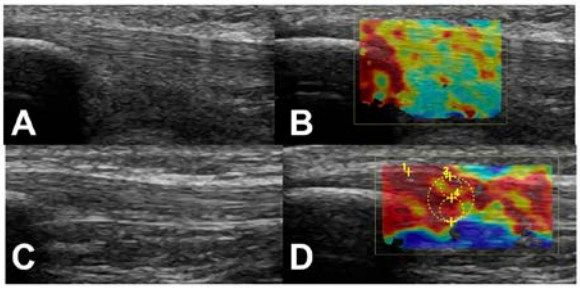
Dr. Wagner's research program has a long history of training that includes developing writing skills, applying for research grants, patenting new discoveries. Students are trained to conduct in vitro studies and if needed use animal models for preclinical trials. This research is located in the Plastic and Reconstructive Surgery Research Program and uses the extensive resources of the University including the Wake Forest Center for Nanotechnology and Molecular Materials, the Wake Forest Institute of Regenerative Medicine, and the Molecular and Translational Science Program.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Virginia Tech**

Project Title:	Machine Learning Analysis of Tendon Ultrasound Images
Position Need:	MS or PhD student, starting August 2021
Funding:	**GRA**

Advisor:	**Vincent Wang, Ph.D.**
	Kevin P. Granata Faculty Fellow Associate Professor Biomedical Engineering and Mechanics (BEAM) Lab location: 340 Kelly Hall, Virginia Tech Office Phone: 540-231-1771 E-mail: vmwang@vt.edu https://wanglab.beam.vt.edu/

Specific Project Description:	 Tendon injuries (e.g., to the patellar tendon, Achilles, or rotator cuff) are very common and can result in pain, swelling and decreased function. Diagnosis of tendinopathy is commonly based on a clinical examination supplemented by gray-scale ultrasonography (GS-US). As a high level of expertise is required for accurate detection of tissue pathology on GS-US, an objective tool that can aid in visual assessment of tendinopathy may facilitate clinical decision making. The aim of this project is to develop a machine learning algorithm (MLA) to classify GS-US images as diseased (tendinopathic) or non-diseased on the basis of image features. In addition to GS-US images, we will also acquire shear wave elastography (SWE) images which provide visual and quantitative assessments of shear modulus. The project will also investigate whether analysis of SWE images further increases the accuracy and reliability of our MLA. Our long-term goal is to develop an online tool which enables global users to upload tendon ultrasound images for rapid evaluation of injury status.

Other Notes:	Our lab group seeks a highly motivated graduate student with strong interests in machine learning, orthopedic imaging, and soft tissue biomechanics. The student will join an interdisciplinary, collaborative research team composed of engineers, computer scientists, and clinicians.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Virginia Tech**

Project Title:	Promoting Tendon Healing via Eccentric Muscle Loading
Position Need:	PhD student, starting August 2021
Funding:	**GRA**

Advisor:	**Vincent Wang, Ph.D.**
	Kevin P. Granata Faculty Fellow Associate Professor Biomedical Engineering and Mechanics (BEAM) Lab location: 340 Kelly Hall, Virginia Tech Office Phone: 540-231-1771 E-mail: vmwang@vt.edu https://wanglab.beam.vt.edu/

Specific Project Description:	Physical therapy (eccentric muscle loading, such as the "heel drop and raise" exercise) is among the few effective strategies to treat Achilles tendinopathy. However, neither the ideal "dose" of eccentric loading needed to achieve improved mechanical functionality nor the basic mechanisms by which the healing response occurs are well understood. This project will utilize a pre-clinical mouse model to elucidate the relative influence of load magnitude and exercise duration on the tendon healing response, as well as adaptation of the entire musculotendinous unit, using biomechanical, histologic, and gene expressions analyses. This project will generate novel data that can be used to inform effective clinical treatment strategies for tendinopathy.

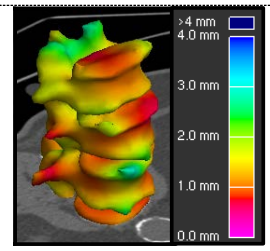
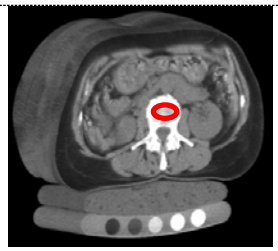
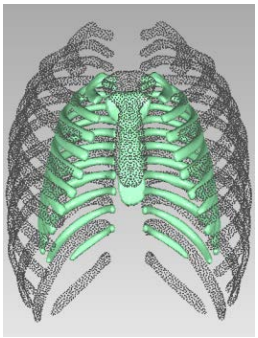
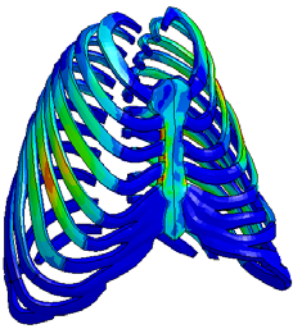
Other Notes:	Our lab group seeks a highly motivated graduate student with strong interests in soft tissue biomechanics and mechanobiology. The student will join an interdisciplinary, collaborative research team composed of engineers, physiologists and clinicians. Additional opportunities will be available to participate in related orthopedic biomechanics and imaging studies.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	Image-based Modeling of Anatomical Variation
Position Need:	MS, start May or August 2021
Funding:	Industry/Internal

Advisor:	**Ashley Weaver, PhD**
	Associate Professor, Biomedical Engineering, WFU Campus VT-WFU Center for Injury Biomechanics School of Biomedical Engineering and Sciences 575 N. Patterson Ave Winston-Salem, NC 27101 asweaver@wakehealth.edu www.CIB.vt.edu

Specific Project Description:	Anatomical variation such as cortical thickness, bone mineral density (BMD), and morphology is an important factor to consider in biomedical research. This research involves medical image analysis to characterize anatomical variation in the population, development of subject-specific and population-based anatomical models, and human body finite element modeling – with applications ranging from injury prediction, medical device design, and surgical planning. Radiological (CT/MRI) and modeling-based techniques will be used to create subject-specific and/or population-based models for particular patient demographics or disease states.	 *Cortical Thickness*	 *Bone Mineral Density*
		 *Geometry/Morphology*	 *Finite Element Modeling*

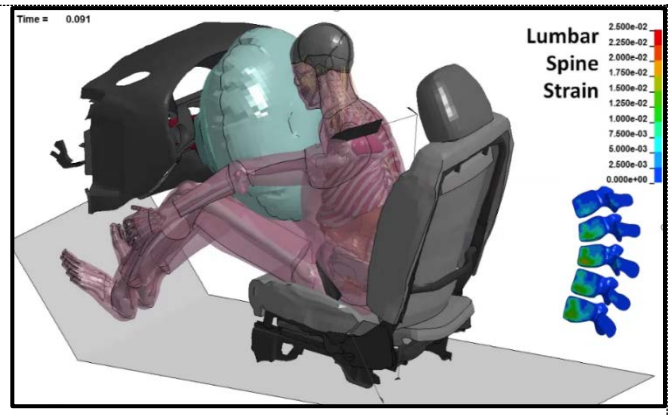
Other Notes:	This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	Lumbar Spine Injury Tolerance and Mechanisms in Motor Vehicle Crashes
Position Need:	MS or PhD, start May or August 2021
Funding:	Internal (External Funds Pending)

Advisor:	**Ashley Weaver, PhD**
	Associate Professor, Biomedical Engineering, WFU Campus VT-WFU Center for Injury Biomechanics School of Biomedical Engineering and Sciences 575 N. Patterson Ave Winston-Salem, NC 27101 asweaver@wakehealth.edu www.CIB.vt.edu

Specific Project Description:	 Motor vehicle crashes (MVCs) subject the lumbar spine to tension, compression, and flexion-extension moments. Since the combination of loads acting on the lumbar spine may influence injury tolerance and risk, there is a need for lumbar injury prediction criteria and models that account for multi-axis loading. Validated finite element models offer the opportunity to virtually reconstruct MVCs to determine the influence of occupant and vehicle factors on lumbar injury causation mechanisms. This project aims to improve the understanding of lumbar injury tolerance and the mechanisms of lumbar injury in MVCs by: 1) developing a composite lumbar injury criterion combining the axial forces and flexion-extension moments, 2) performing multi-scale validation of a human body finite element model at the vertebra, the functional spine unit, the lumbar column, and the whole body levels, and 3) conducting parametric finite element reconstructions of MVCs to determine the effect of lumbar bone mineral density, occupant posture, and seat structure on lumbar fracture mechanisms.

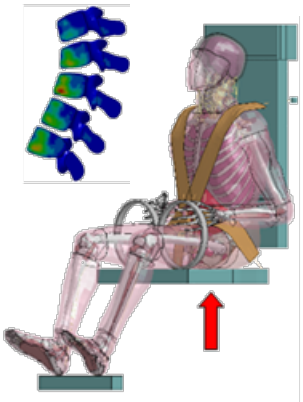
Other Notes:	This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	CT and MRI Modeling Assessment of Spine Anatomy and Injury Risk Following Long-Duration Spaceflight
Position Need:	MS, start May or August 2021
Funding:	NASA

Advisor:	**Ashley Weaver, PhD**
	Associate Professor, Biomedical Engineering, WFU Campus VT-WFU Center for Injury Biomechanics School of Biomedical Engineering and Sciences 575 N. Patterson Ave Winston-Salem, NC 27101 asweaver@wakehealth.edu www.CIB.vt.edu

Specific Project Description:	Prolonged exposure of astronauts to microgravity during long-duration spaceflight can degrade the musculoskeletal system, increasing the risk of structural failure of these tissues when they experience dynamic loads. This study will measure the degradation of astronauts' vertebrae and spinal muscles during missions aboard the International Space Station (ISS).  Changes in pre- and post-flight spine anatomy (vertebral morphology, cortex thickness, bone mineral density, muscle volume, and disc morphology) will be measured from existing astronaut quantitative computed tomography (qCT) and magnetic resonance imaging (MRI) scans, as well as from prospectively collected qCT and MRI scans from astronauts. Vertebral strength and injury risk will be quantified from simulations with a human body model altered to represent each astronaut's pre- and post-flight vertebrae and spinal musculature.

Other Notes:	This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

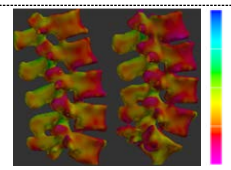
2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

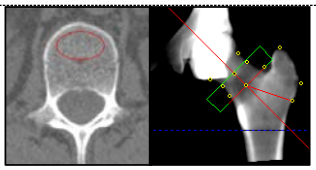
Project Title:	Osteoprotective Interventions for Older Adults Losing Weight
Position Need:	PhD or MS, start May or August 2021
Funding:	NIH

Advisor:	**Ashley Weaver, PhD**
	Associate Professor, Biomedical Engineering, WFU Campus VT-WFU Center for Injury Biomechanics School of Biomedical Engineering and Sciences 575 N. Patterson Ave Winston-Salem, NC 27101 asweaver@wakehealth.edu www.CIB.vt.edu

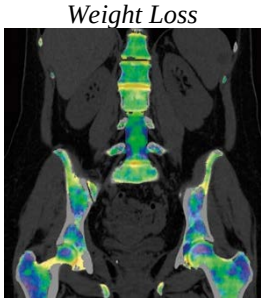
Specific Project Description:	Weight loss is controversial in older adults due to its association with bone loss and increased fracture risk. We are conducting several randomized controlled trials (RCTs) to test the effects of dietary (e.g. higher protein), exercise (e.g. resistance training), loading (e.g. weighted vest), and medication (e.g. bisphosphonates) interventions in preserving bone health in older adults as they lose weight. Our team analyzes computed tomography (CT) scans and creates subject-specific finite element (FE) models to assess changes in bone mineral density, bone thickness, bone marrow adiposity, and bone strength and fracture risk. These computational analyses produce data on the effectiveness of different interventions in protecting against bone loss and fracture in an aging population at high risk for fracture.



Cortical Thinning with Weight Loss

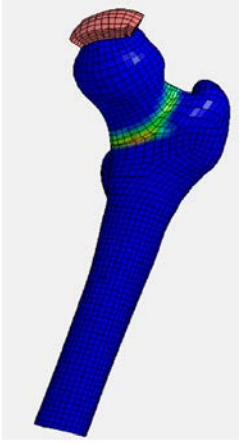


Bone Mineral Density Measurement



Bone Marrow Adiposity Measurement

FE Modeling for Bone Strength >> & Fracture Prediction



Other Notes:	This research effort will be in the Center for Injury Biomechanics (CIB) and you will have the opportunity to work on a range of projects in the field of automobile safety, military restraints, and sports biomechanics. The CIB has two primary research facilities. The first is in the WFU School of Medicine in Winston-Salem, NC and the second is at Virginia Tech. The research at the CIB combines experimental testing, computational modeling, and case analysis to investigate human injury biomechanics.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request Form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title: Imaging-driven biophysical modeling of cancer therapy response
Position Need: 1 PhD and 1 MS, start August 2021
Funding: NIH; faculty start-up funds

Advisor:

Jared Weis, PhD
Assistant Professor, Biomedical Engineering, WFU Campus
School of Biomedical Engineering and Sciences
575 N. Patterson Ave, Suite 530
Winston-Salem, NC 27101
jweis@wakehealth.edu
www.weislab.org

Specific Project Description:

The overall theme of research within the Weis lab is concentrated in developing and deploying computational modeling and non-invasive imaging methodologies to explore the nature of soft-tissue mechanics in cancer, with an emphasis on driving clinical therapeutic interventions. Research projects focus on the multi-disciplinary study of the multi-scale influences of mechanics in cancer progression and response to therapy, involving the development and validation of imaging-based biophysical modeling approaches that evaluate quantitative parameterization of cancer growth and therapy response properties based on observational imaging measurement data (MRI, CT, optical, etc.). Utilizing a mathematical modeling framework that incorporates mechanical signaling from the surrounding tissue microenvironment, predictions of the eventual response of cancer to therapy can be made with an overall goal of directing therapeutic intervention. The lab employs a hybrid experimental/computational approach towards imaging, modeling, and parameterization, and spans the length scale of cancer from preclinical *in vitro* cancer spheroid/organoid and *in vivo* cancer model systems to translational clinical-based investigations within the scope of several main projects:

- Multi-scale imaging data-driven biophysical modeling to predict the response of cancer to chemotherapy
- Mechanical stiffness imaging as a biomarker to evaluate and predict cancer therapeutic response
- Imaging-based biophysical modeling to diagnose tumor recurrence following stereotactic radiosurgery for brain metastasis

Virginia Tech
Wake Forest University
School of Biomedical Engineering and Sciences

2021 Faculty Advisor Request form for Graduate Student Position

Location:	**Wake Forest School of Medicine**

Project Title:	Development of intravascular cardiac devices to treat peripheral arterial disease
Position Need:	PhD students, start in August 2021
Funding:	Funded by NIH & Start-up Funds

Advisor:	Saami K. Yazdani, PhD
	Associate Professor **Wake Forest University** Department of Engineering 455 Vine Street | Winston-Salem, NC 27101 T: 336.702.1968 E: yazdanis@wfu.edu WFU site: https://engineering.wfu.edu/people/faculty/saami-yazdani/ sky lab site: www.biofluids.org

Specific Project Description:	Current strategies to prevent restenosis following endovascular treatment include the local delivery of anti-proliferative agents to inhibit vascular smooth muscle cell (VSMC) proliferation and migration. These agents, not specific to VSMC, are deposited on the luminal surface, and therefore, target endothelial cells and delay vascular healing. Cell-targeted therapies, (e.g. RNA aptamers), can potentially overcome these safety concerns by specifically binding to VSMC and inhibiting proliferation and migration. The purpose of our study is to therefore demonstrate the ability of a perfusion catheter to deliver cell-specific RNA aptamer inhibitors directly to the vessel wall. Our preliminary results demonstrate successful delivery of VSMC-specific RNA aptamers directly to the arterial medial layer via a novel perfusion catheter. We confirm that this novel approach inhibits neointimal growth in a clinically relevant pre-clinical model. Overall, this project will test the hypothesis that RNA aptamer delivered by a perfusion catheter directly into the medial layer will inhibit neointimal growth and accelerate re-endothelialization during the vascular healing process.

Other Notes:	This research will be conducted at Wake Downtown.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

Project Title: Image-guided delivery of brain tumor-targeted nano-drugs
Position Need: 1 MS/PhD, start August 2021
Funding: Funded via NIH R01

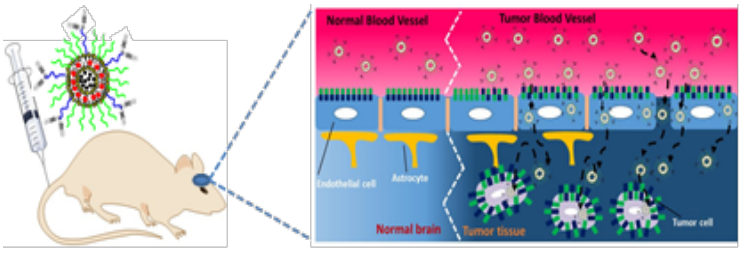
Advisor:

Dawen Zhao, MD, PhD
Associate Professor
Biomedical Engineering
Wells Fargo Faculty Scholar
WFU Campus
Medical Center Boulevard
Winston-Salem, NC 27157

Phone: 336-713-5783
Fax: 336-716-54921
Email: dawzhao@wakehealth.edu

Specific Project Description:

Malignant brain tumors are highly resistant to conventional multimodal therapies. Delivery of therapeutic agents to the brain tumor remains a major challenge partially due to the blood brain barrier (BBB). We have recently developed a brain tumor-targeted nanoplatform that enables the



encapsulated imaging contrast agents and/or anti-cancer therapeutic agents to penetrate across the BBB. In the present project, building upon this nanoplatform, we propose to develop nanohybrids of MRI contrast agents, complexed with effective chemotherapeutic agents, aiming to achieve simultaneous cancer treatment and imaging. The delivery, release kinetics and biodistribution of the nano-drugs can be assessed spatially and temporally based on the activatable or switchable MRI contrast. Various rodent models of brain tumors established at the lab are available for the image-guided drug delivery project funded by NIH.

Other Notes:

The graduate student will have the opportunity to work within a highly interactive team to conduct basic and translational research in the Department of Biomedical Engineering and Department of Cancer Biology of Wake Forest University School of Medicine.

SCHOOL OF BIOMEDICAL ENGINEERING AND SCIENCES

2021 Faculty Advisor Request form for Graduate Student Position

Location: **Wake Forest University**

Project Title: *In vivo* MRI of the brain tumor microenvironment
Position Need: 1 MS/PHD, starting August 2021
Funding: Funded via WFUHS Faculty Scholar

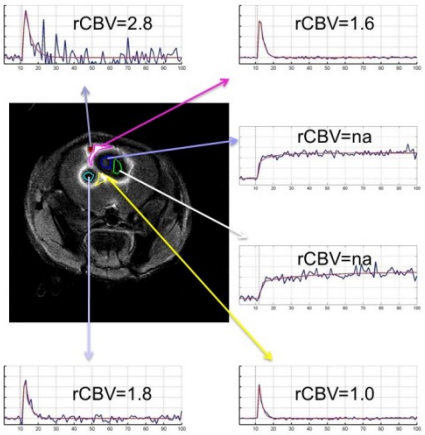
Advisor:

Dawen Zhao, MD, PhD
Associate Professor
Biomedical Engineering and Cancer Biology
Wells Fargo Faculty Scholar
Wake Forest School of Medicine
Medical Center Boulevard
Winston-Salem, NC 27157

Phone: 336-713-5783
Fax: 336-716-54921
Email: dawzhao@wakehealth.edu

Specific Project Description:

Malignant brain tumors are characterized by profound angiogenesis and intratumoral hypoxia and necrosis, which have been shown to correlate negatively with clinical outcome. The major goal of this project is to integrate multiple parameters of tumor hypoxia and vasculature acquired by multimodal MRI/optical imaging. The imaging findings will be correlated with histological and biological studies of tumor cell aggressiveness, vascular perfusion and permeability and hypoxia. Various rodent models including glioma and brain metastasis established at the lab are available for the project.



Other Notes:

The graduate student will have the opportunity to work within a highly interactive team to conduct basic and translational research in the Department of Biomedical Engineering and Department of Cancer Biology of Wake Forest University School of Medicine.