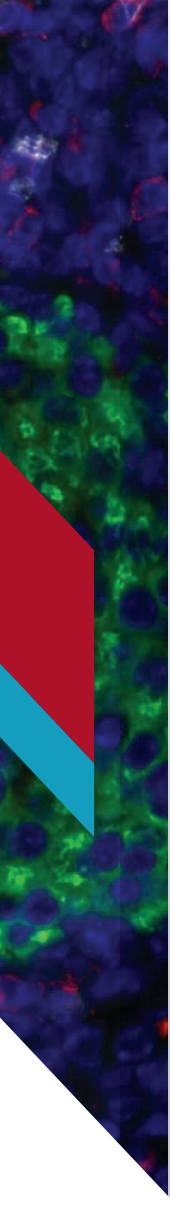


University of Nebraska Medical Center

The Mary and Dick Holland Regenerative Medicine Program

2018 Regenerative Medicine Symposium

Thursday, May 24, 2018

Scott Conference Center

6450 Pine Street, Omaha, NE

2018 Symposium Program

3:30 p.m.	**Arrival of Guests**
3:35 p.m.	**Opening Comments –** *Nora Sarvetnick, Ph.D.*
3:40 p.m.	**Session One Comments –** *Alexey Kamenskiy, Ph.D., Chair*
3:45–4:00 p.m.	**Presenter 1 –** *Iraklis Pipinos, M.D.*
4:05–4:20 p.m.	**Presenter 2 –** *Forrest Kievit, Ph.D.*
4:25–4:40 p.m.	**Presenter 3 –** *Hyung Joon Kim, Ph.D.*
4:45–5:00 p.m.	**Presenter 4 –** *Ali Tamayol, Ph.D.*
5:05–5:45 p.m.	**Poster Presentations and hors d' oeuvres**
5:45–6:25 p.m.	**Dinner**
6:25 p.m.	**Session Two Comments –** *Angela Pannier, Ph.D., Chair*
6:30–6:45 p.m.	**Presenter 5 –** *Hanjun Wang, M.D.*
6:50–7:05 p.m.	**Presenter 6 –** *Rebecca Wachs, Ph.D.*
7:10–7:25 p.m.	**Presenter 7 –** *Ryan Pedrigi, Ph.D.*
7:30–7:45 p.m.	**Presenter 8 –** *Sung-Ho Huh, Ph.D.*
7:50 p.m.	**Closing Comments –** *Nora Sarvetnick, Ph.D.*

2018 Symposium Chairs

Alexey Kamenskiy, Ph.D.

Session One Chair
Associate Professor Department of Surgery
University of Nebraska Medical Center

Dr. Kamenskiy is a mechanical engineer and an Associate Professor in the Department of Surgery, University of Nebraska Medical Center. His research is focused on experimental and computational vascular mechanobiology, vascular pathophysiology and ageing, devices and materials for open and endovascular repair, and non-compressible hemorrhage control. His laboratory, Collaboration for Advanced Surgical and Engineering Applications (CASEA), has built one of the largest databases of human artery mechanical, structural, and demographic characteristics in the world. His data has been acquired from more than 500 human subjects of all ages. Dr. Kamenskiy closely collaborates with vascular surgeons in using patient data, human cadavers, swine, bench-top tools, and computational models to unravel complex pathophysiology of human vasculature, and develop new devices and materials for improved clinical outcomes. His research is funded by the NIH, DoD, and private industry. Dr. Kamenskiy holds several patents on vascular devices and is a member of multiple NIH and DoD study sections.

Angela Pannier, Ph.D.

Session Two Chair
Associate Professor
Department of Biological Systems Engineering
University of Nebraska–Lincoln

Dr. Pannier is an Associate Professor and William E. Brooks Leadership Fellow in the Department of Biological Systems Engineering at the University of Nebraska-Lincoln. Her lab focuses on developing biomaterials for tissue engineering models of development and nonviral gene delivery systems for stem cell, gene therapy, and DNA vaccination applications. Her primary research interest is in using molecular profiling, modeling, and high-throughput techniques to understand the basic biology underlying successful gene delivery and translating that understanding to drug priming strategies that can enhance gene therapies. She is the recipient of a NSF CAREER award and American Heart Association Scientist Development Grant, as well as a 2017 NIH Director's New Innovator Award.

2018 Syposium Presenters

Iraklis I. Pipinos, M.D., F.A.C.S.

Professor
Department of Surgery
University of Nebraska Medical Center

"Understanding the Pathophysiology of Peripheral Artery Disease as a Prelude to Developing Regenerative Therapies"

Dr. Pipinos is a Professor of Surgery at the University of Nebraska Medical Center. The major focus of his laboratory is the development of regenerative medicine strategies for skeletal muscle tissue in the legs of patients suffering from peripheral arterial disease (PAD). PAD afflicts 5% of the US population older than 55 years of age and develops along with hardening (atherosclerosis) of the arteries of the legs. PAD is a chronic condition that decreases the blood supply to the legs producing significant damage to the muscle and ultimately to their gait.

Pipinos laboratory evaluates the mechanisms of claudication in PAD and results from their research can ultimately improve patient prognosis and produce significant new diagnostic and treatment strategies for the care of claudicating patients. Their research group is involved in multiple projects and involve the combined efforts of biomechanists, life scientists, biomedical engineers, physicians, veterinarians, and a strong technical support staff.

Forrest Kievit, Ph.D.

Assistant Professor
Biological Systems Engineering Department
University of Nebraska-Lincoln

"Nanoparticles for Delivery to and Treatment of Neurological Disorders"

Dr. Kievit earned his Ph.D. in the Materials Science and Engineering Department at the University of Washington, followed by postdoctoral and research faculty positions in the Department of Neurological Surgery and Center for Integrative Brain Research at Seattle Children's Research Institute prior to joining the Biological Systems Engineering Department at the University of Nebraska-Lincoln as an Assistant Professor in 2016. His group's research focuses on engineering nanoparticle-based strategies for solving current problems in neuroscience with an overall goal of eventually translating nanomedicine into clinical use. Kievit lab has developed several different nanoparticles that can accumulate and be retained within brain cancer and TBI. Delivery into the brain can be monitored through a combination of fluorescence and magnetic resonance imaging. Their research has shown therapeutic efficacy in brain cancer through nanoparticle-mediated siRNA delivery to inhibit DNA repair specifically within brain cancer cells for sensitization to radiation therapy observed in vitro and a genetic mouse model of brain cancer. They have also shown therapeutic efficacy in TBI through nanoparticle-mediated reduction in the spread of reactive oxygen species beyond the primary injury and shown through histopathology and behavioral studies in mice with brain injuries. These findings illustrate that nanoparticle treatment strategies for these neurological disorders could provide a more effective path for improving long-term patient outcome.

2018 Syposium Presenters

Hyung Joon Kim, Ph.D.

Assistant Professor
Department of Psychiatry
University of Nebraska Medical Center

"Studying the Human Brain Using Microfluidics"

Dr. Kim is an Assistant Professor in the Department of Psychiatry and a member of the Holland Regenerative Medicine Program at University of Nebraska Medical Center. The Kim laboratory has a long-standing pursuit to decipher the pathophysiology of human brain diseases using engineering disciplines and stem cell biology. Neuronal, glial cells and their niche factors are essential components of the functional integrity of the brain in healthy normal and disease states. By manipulating cellular and niche components in microfluidics, Dr. Kim has focused on the signaling in axon and dendrite, quantitative imaging of mitochondrial dynamics of neurons, in vitro model of myelination, the migration deficit of schizophrenia patients-derived human neurons, the role of secretory molecule in the neurogenesis, and the microRNA-regulated adult neurogenesis. Despite the widespread interest in human induced pluripotent stem cell (hiPSC)-based modeling of brain disease, a suitable in vitro platform to recapitulate the pathophysiological condition in human brain diseases at the molecular, cellular, and circuit levels. His research pursues to create a microphysiological system (MPS) of brain by using hiPSC biology and small-scale fabrication. His MPS will represent the functional connectivity and metabolism in the brain, which can be utilized in discovering the potential therapeutic targets for the neurodegenerative and psychiatric disorders.

Ali Tamayol, Ph.D.

Assistant Professor
Laboratory for Innovative Microtechnologies and Biomechanics Mechanical and Materials Engineering
University of Nebraska-Lincoln

"Physiological Inspired Bioinks for Engineering of Musculoskeletal Tissues"

Dr.Tamayol is an Assistant Professor in the Department of Mechanical & Materials Engineering at the University of Nebraska-Lincoln. He was an Instructor of Medicine at Harvard Medical School before moving to Lincoln. His research involves design, fabrication, and characterization of microsystems and fibrous materials for emerging engineering applications such as tissue engineering, regenerative medicine, and wearable devices. Three-dimensional (3D) printers have been a major source of advancements in many areas of engineering and technology development. The ability of 3D printing to create acellular and cell-laden scaffolds with pre-designed patterns, architecture and distribution of cells and biological factors has fueled important research directed at solving challenges in the field of tissue engineering and regenerative medicine. Bioinks are a crucial component of 3D bioprinting. In addition, to their biocompatibility, the biological activity of the utilized bioink is important in the proper function of the printed tissue. Incorporation of growth factors is one way of improving the biological activity of bioink. Platelet rich plasma (PRP) mimics the physiological response to injuries and has been shown to be release biologically active proteins and growth factors over several days and has been widely used as a treatment for musculoskeletal disorders. One important aspect that can positively affect the function of muscle cells is mimicking the electrical properties of native muscle, where cell-cell interaction allows fast propagation of signals throughout the tissue and synchronized contraction essential for body movement. He have formed a highly conductive alginate-based hydrogel, which is easy to spin into fibers. The hydrogel is then used to fabricate core-shell fibers in which the core is formed from the highly conductive hydrogel, while the shell is made from a biocompatible hybrid hydrogel of gelatin methacryloyl (GelMA)/alginate that contains cells. Furthermore, these fibers have been used for culturing muscle cells and it has been shown that they could support the growth and reorganization of muscle cells with an aligned structure.

2018 Syposium Presenters

Hanjun Wang, M.D.

Assistant Professor
Department of Cellular and Integrative Physiology
University of Nebraska Medical Center

"Neural Inflammation and Sensory Dysfunction in Cardiovascular Diseases"

Dr. Wang is an Assistant Professor in the Department of Anesthesiology and courtesy Assistant Professor in the Department of Cellular and Integrative Physiology at the University of Nebraska Medical Center. The focus of Dr. Wang's laboratory has been on the somatic/visceral sensory control of cardiovascular adjustments at rest and during exercise in both healthy and cardiovascular diseases including 1) Muscle Afferent Dysfunction in cardiovascular diseases such as heart failure and peripheral arterial disease; 2) Pulmonary spinal afferent dysfunction in heart failure and respiratory diseases and 3) Cardiac sensory afferent dysfunction in heart failure and hypertension. His research focuses on how organ damage could cause macrophage filtration into peripheral sensory nervous system in various cardiovascular diseases. He is also interested in learning how macrophage interacts with dorsal root ganglia neurons and causes sensory dysfunction in these diseases.

Rebecca Wachs, Ph.D.

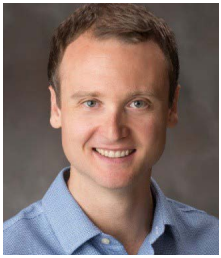
Assistant Professor
Department of Biological Systems Engineering
Institute of Agriculture and Natural Resources
College of Engineering
University of Nebraska–Lincoln

"Naturally-Derived Scaffolds for Low Back Pain"

Dr. Wachs is an Assistant Professor in the College of Engineering at the University of Nebraska-Lincoln. Her research is mainly focused on low back pain. Low back pain is a problem that the majority of the population will experience at some point in their lifetime. Disc degeneration is the leading cause of low back pain due to loss of disc height, compression of nerve roots, and pain. Current clinical treatments restore the disc height and immobilize the injured disc level by bony fusion. This treatment is costly and invasive, and does not directly address the degeneration.

The ultimate goal of her research is to engineer naturally derived tissue scaffolds capable of restoring disc height and regenerate the disc. To do this, her lab is developing gentle tissue decellularization techniques for notochordal porcine disc that preserves desired matrix proteins and immunomodulatory factors. These matrices should have the potential to restore disc height, modulate the immune response towards regeneration, and drive progenitor cell fate.

2018 Syposium Presenters



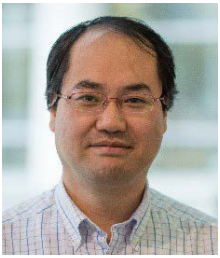
Ryan Pedrigi, Ph.D.

Assistant Professor
Department of Mechanical and Materials Engineering
College of Engineering
University of Nebraska–Lincoln

"The Role of Biomechanics in the Prediction and Treatment of Heart Disease"

Dr. Pedrigi is the Director of the Translational Mechanobiology Lab, a multidisciplinary research group that employs experimental and computational techniques to characterize the role of disturbed tissue mechanics in promoting dysfunctional cellular behaviors during disease development. The goal is to translate an understanding of mechanobiological mechanisms of disease to the clinic through the development of new therapies, medical devices, and prognostic indicators of disease initiation and progression. The main application area of the group is atherosclerosis, the principal pathology in heart disease. Work in this area focuses on characterizing the relationship between the disturbed arterial mechanical environment, pro- atherogenic endothelial cell behaviors, and the development of advanced atherosclerotic plaques. Ultimately, this work seeks to develop mechanical biomarkers of plaque progression and engineer new therapies based on mechanobiology that target dysfunctional endothelial cells.

Other interests of the group include ophthalmology, wound healing, regenerative medicine, and tissue engineering.



Sung-Ho Huh, Ph.D.

Assistant Professor
Munroe-Meyer Institute
Developmental Neurosciences
University of Nebraska Medical Center

"Role of Fibroblast Growth Factor Signaling During Renal Development"

Dr. Huh is an Assistant Professor at the Munroe Meyer Institute of Developmental Neuroscience and a member of the Holland Regenerative Medicine Program at the University of Nebraska Medical Center. His laboratory is interested in researching organ development and regeneration using mice as model system. Huh lab uses molecular, genetic, biochemical and physiological approach to understand the role of the growth factor signaling including FGF signaling and Wnt signaling during organogenesis focusing in inner ear and kidney development. Using gene knockout and conditional knockout technology, Huh lab generated mutant mice with defects in inner ear and kidney. By studying those mutants, Huh lab will identify molecules required for sensory and nephron development and maintenance. This information will be utilized to develop new therapies for hearing loss and kidney diseases.

For all attendees, free parking is available in lot 9,
directly across the street from Scott Conference Center.
Parking in other lots may result in a fine or towing of vehicle.

For questions or concerns, please contact:

Tara Szymanski-Bird | tara.szymanskibird@unmc.edu | 402-559-7584

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