

2021 MS1 INTRO Summer Research Program

Mentors and Projects

Agmon, Aric, PhD, Department of Neuroscience

- We study how neurons in the cerebral cortex "talk" with each other, how these neural networks give rise to behavior, and how they change as a result of learning new behaviors. Potential projects range from morphological/microscopical analysis of neurons and synapses, to transfecting neurons with fluorescent proteins and sensors, to training mice to perform challenging behavioral tasks.

Barnett, John, PhD, Department of Microbiology, Immunology, and Cell Biology

- Determination of possible immune pathology caused by administration of a drug proposed for treatment of bone lesions caused by rheumatoid arthritis. My laboratory is developing a new small molecule drug to be used to prevent bone erosion that is caused by RA. We are at a step where we need to document any detrimental effects of this drug on the immune response at doses and dosing frequency that will be used clinically. We will focus on the ability of treated mice to mount a robust immune response. These data will be integrated with other data being collected by a contract research organization for presentation to the FDA for approval of the drug to begin clinical trials.

Bernstein, Malayna, PhD, Department of Learning Sciences and Human Development

Hodder, Sally, MD, WVCTSI, Department of Medicine

- A project investigating women's perspectives on opioid misuse and harm reduction. Mentees will be trained in qualitative data analysis and will code transcripts of interviews with women in rural areas of the state. Mentees will gain valuable experience in qualitative data analysis, as well as a greater understanding opioid misuse, addictions, and harm reduction in rural communities. Ideal candidates will have some background in the social sciences or humanities, but anyone with an interest in addictions and harm reduction who are skilled in close reading and careful analysis should consider applying.

Brown, Candice, PhD, Department of Neuroscience

- Title: Behavioral assessment of long-term cognitive impairment in ischemic stroke and sepsis
Description: Long-term cognitive and functional deficits are common in neurological disorders such as stroke and in systemic inflammatory conditions such as sepsis. However, the mechanisms that lead to these deficits are not well

understood. This project will use rodent behavior testing for longitudinal assessment of cognitive deficits and functional recovery in mouse models of ischemic stroke and/or sepsis.

Davis, Jillian, PhD, Department of Pathology, Anatomy, and Laboratory Medicine

- **Embryology Educational Video**
The developmental steps that take place between fertilization and establishing the general bauplan of the vertebrate body during the embryonic stage involve rapid, three-dimensionally complex, differential tissue growth. Understanding these processes is key in clinical education, because these steps provide critical insight into human structure, function, and pathology, yet there remains a lack of ideal educational models for helping students to visualize embryonic development. Students involved in this project will work with primary literature and existing educational materials to gain familiarity with embryology, develop plans for creating a 3D visualization tool, and implement the plans using claymation or digital animation. Interested students should have an interest in anatomy and in scientific communication; artistic and/or graphic skills will be tremendously beneficial.

Duenas, Omar, MD, Department of Obstetrics and Gynecology

- We are conducting several research projects related to women's health. Some of our projects involves analyzing our database of women with substance abuse. We are interested in perineatal and neonatal outcomes. In previous years, we have been focused in data collection and at this time, we are more in analyzing and adding new variables to our database. Other projects involve looking into surgical outcomes in gyn and urogynecologic surgery as well as cost-effectiveness analysis.

Driesschaert, Benoit, PhD, Department of Pharmaceutical Sciences

- **Development of oxygen microbubbles to boost radiation therapy**
Hypoxia is a hallmark of solid tumors responsible for resistance to radiotherapy. Indeed, oxygen is required to generate permanent DNA damage to the cancer cells during radiation therapy. Hypoxic tissues require as much as three times the radiation dose compared to tissues with normal oxygen levels. This project aims to develop polymeric microbubbles filled with oxygen that can be injected in vivo to raise the tumor oxygenation as a pre-treatment to radiotherapy.

Du, Jianhai, PhD, Department of Ophthalmology

- Identify metabolic signatures in retinal diseases

The students will investigate gene databases and/or perform metabolomics in samples from retinal diseases. The goal of this research is to identify cell-specific and disease-specific metabolic pathways.

Elliott, Meenal, PhD, Department of Microbiology, Immunology & Cell Biology

- Title: Salivary immune response against SARS-CoV-2
Description: Healthy adult humans mount a protective mucosal antibody response against respiratory viruses following an infection in the upper respiratory tract. Virus-neutralizing polymeric IgA1 and IgA2 antibodies characterized by the presence of secretory component (SC) in mucosal secretions is a hallmark of such an immune response. The elicitation of such antibodies against SARS-CoV-2, the causative agent of COVID-19, in mucosal secretions, would indicate that an individual may have developed the ability to limit viral spread to systemic organs. However, only a handful of studies to date have measured this important parameter. The current study aims to begin to fill this gap. Specifically, we will determine titres of IgA and IgM antibodies capable of binding the Spike protein and the Nucleoprotein of SARS-CoV-2 in a plate-based immunoassay. The positive samples will be further tested for capacity to block binding of the Receptor binding domain of the spike protein to the Angiotensin Converting Enzyme 2 (ACE-2), its target on human cells, in a competition immunoassay. Assays developed in this study will be very useful in measuring the development of protection against this virus following vaccination and to begin to make an informed estimation of when herd immunity may be established so life can go back to normal.

Ezequiel, Salido, MD/PhD, Department of Ophthalmology/Biochemistry

- Interphotoreceptor matrix and visual pathology: The extracellular environment between the photoreceptors and the Retinal Pigment Epithelium (RPE) is referred to as the Interphotoreceptor Matrix (IPM). The IPM has two unique, highly conserved proteoglycans, the Interphotoreceptor Matrix Proteoglycan 1 and 2 (IMPG1 and IMPG2). Mutations in IMPG1-2 are linked to retinitis pigmentosa (RP). The role of IMPG1-2 in the retina and the mechanisms underlying visual impairments are elusive. Therefore, the goal of this project is to elucidate the role of IMPG in vision and understand the distinctive pathophysiological mechanisms that lead to IMPG-linked visual impairments. Mice lacking both IMPG1-2 exhibited immunoresponse and degeneration with no significant functional or structural changes at five months. Nevertheless, RNAseq gene set analysis indicates immunoresponse, apoptosis, hypoxia, and metabolic disbalance, suggesting a role of IMPG1-2 on photoreceptor health. We hypothesize that specific mutations in IMPG1-2 associated with RP phenotype are due to a lack of essential functions of IMPG1-2. We will study the role of

IMPGs on photoreceptor health using hypoxia and light stressors combined with metabolic analysis. This project focuses on the central aspects of the extracellular matrix structure and its function. The findings from the proposed research will shed light on the mechanisms that affect the photoreceptor extracellular matrix and their link to blinding diseases.

Feinberg, Judith, MD, Department of Behavioral Medicine/Infectious Diseases

- An NIH-funded study to evaluate the effect of fentanyl test strips on drug-taking behavior that is conducted at the Health Right syringe services program.

Franko, Jennifer, PhD, Department of Microbiology, Immunology, and Cell Biology

- Mechanisms-mediating sex-specific immune activation
While the female immune system confers greater protection against infectious challenge, females are 10X more likely to develop an autoimmune disease than males. While sex hormones are known to contribute, at least in part, to these differences – we do not believe they are the whole story and have been investigating the collaborative influence of hormones, sex chromosome complements and the gut microbiome on immune responses. Students will use animal models to investigate to delineate the underlying the cause of such dimorphisms by the evaluating differences in immune cell function, gene expression profiles and microbiome composition.

Gritsenko, Valeriya, PhD, Department of Human Performance

- The project will focus on analysis of human motion capture and muscle activity data. The student will learn signal processing techniques and computer simulations. The outcomes will help advance the understanding of the neural mechanisms for the control of movement.

Hayanga, J.W. Awori, MD, Department of Cardiovascular and Thoracic Surgery

- An exploration of the causes of mortality in patients on ECMO during a pandemic

Hussain, Salik, PhD, Department of Physiology and Pharmacology

- “Mechanistic basis of lung function decline by environmental exposures”
Environmental exposures (ozone, particulate matter, nanoparticles) induced changes in lung function will be assessed using state of the art airway physiology measurements in rodents and role of innate immune pathways will be evaluated.

Ivanov, Alexey, PhD, Department of Biochemistry

- 1. Negative control of EMT by epithelial-specific transcription factors.
EMT promotes cancer cell invasion, metastasis and drug resistance. Primary breast tumors largely maintain inherent epithelial status. However, cancer cells on the tumor periphery are believed to undergo partial EMT and disseminate to distant organs. The goal of this project is to define the roles of several transcription factors responsible for the maintenance of the epithelial state in suppression of EMT.
- 2. Role of the TGF-beta pathway in partial EMT and drug resistance of triple-negative breast cancer.
Transforming growth factor beta (TGF-beta) acts as a tumor suppressor at the early stages of cancer development. Cancer cells evolve various mechanisms to overcome TGF-beta inhibitory effects, including silencing and mutation of TGF-beta receptors or silencing and deletion of TGF-beta target genes involved in growth suppression. The latter mechanism is often observed in triple-negative breast cancer (TNBC). TNBC cells show increased TGF-beta signaling leading to partial EMT and resistance to certain drug therapies. The goal of this project is to investigate if pharmacological inhibition of the TGF-beta pathway combined with standard cancer therapy will improve drug response in vitro.
- 3. Optimization of environmental detection of respiratory human viruses.
Recent COVID-19 pandemic caused significant hurdles for public health and global economy. The aim of this project is to optimize methods for detection of RNA viruses in the air. The project does not involve handling of infectious hazardous viruses. Instead, recombinant laboratory viral vectors will be used as surrogates to fine-tune air collection methods and PCR-based detection of viral genomes.

Kelly, Kim, PhD, MS, Department of Pharmaceutical Systems and Policy

- Genetics Services in Appalachia.
This project aims to improve the availability of genetic counseling services to individuals in rural Appalachia. We are engaging in research to help understand the barriers to the provision of services and how to improve services. Depending on the skills of the student, opportunities include interviewing, data management and analysis, and developing reports.

Kidd, Kacie, MD, Department of Pediatrics

- Parenting a Gender-Diverse Child: A Qualitative Study. The data collection is nearly complete so this would be a focused training experience on qualitative data analysis and writing.

Lambert, H. Wayne, PhD, Department of Pathology, Anatomy and Laboratory Medicine

- Investigating cribra orbitalia in the orbit of human crania (skulls).
- Cribra orbitalia is an osteological phenomenon leading to porosities (openings/pores) in the orbital roof within human skulls. The etiology of cribra orbitalia remains unclear, though many researchers have posited childhood nutritional stress, such as infection, bone marrow expansion due to antecedent anemia, or vitamin deficiencies. Recently, work in our laboratory identified the appearance of cribra orbitalia may be vascular in nature. Further research has led us to believe that cribra orbitalia is bony evidence of a vascular anatomical variation; in which case, the presence of variant vascular foramina, the meningo-orbital foramen, might provide an improved understanding regarding the potential relationship between vascular variation within the orbit and cribra orbitalia. This research project will be looking at the meningo-orbital foramen to gain an understanding of cribra orbitalia and the hemodynamics that may be involved. This research will involve studying the human crania (skulls) within our osteological collection as well as the collection at the Cleveland Museum of Natural History. Other projects concerning anatomical variability will be pursued through dissection of whole body, cadaveric donors.

Lindsey, Brock, MD, Department of Orthopaedics

- Effects of cytokine-loaded PLGA nanoparticles in vitro and in vivo. Briefly, PLGA nanoparticles loaded with various cytokines will be produced and evaluated in cell culture and in a mouse model.

Lockman, Paul, PhD, Department of Pharmaceutical Sciences

- Use of Focused Ultrasound to Improve Chemotherapy Distribution into Brain Metastases
The blood-brain barrier (BBB) is a major anatomical and physiological barrier that limits the passage of drugs into brain. Central nervous system tumors can impair the BBB by changing the microenvironment surrounding the tumor mass. This leads to the formation of a leaky barrier surrounding the tumor known as the blood-tumor barrier (BTB). Despite the change in its integrity, the BBB/BTB remains highly effective in preventing effective delivery of chemotherapy into brain tumors. Focused ultrasound is a unique non-invasive technique that can transiently disrupt the BBB and increase accumulation of drugs within targeted areas of the brain. This project will use a human MRI and Focused Ultrasound

device to open the BBB in a preclinical mouse model of brain cancer. Distribution of drugs as well as effect of the therapy will be studied.

Luchey, Adam, MD, FACS Department of Urology

- Will be evaluating the results and complications of different techniques using MRI/US fusion biopsies to detect prostate cancer.

Olfert, Mark, PhD, Department of Human Performance - Exercise Physiology

- Cardiovascular outcomes associated with acute and chronic vaping (electronic cigarettes).

Petrone, Ashley, PhD, Department of Pathology, Anatomy, and Laboratory Medicine

- The Role of Leukocytes in Acute Ischemic Stroke and Other Neurological Conditions: Clinical Data Reviews

Rudisill, Toni, PhD, Department of Epidemiology

- Research Experience in Injury Epidemiology. Clinical trial investigating the effects of cannabidiol on driver performance.

Sherman, Jonathan H., MD, Department of Neurosurgery

- Neurorehabilitation incorporating XR Technology. The proposed research looks to incorporate MindMaze's telemedicine platform to benefit VA patient's treated at WVU Medicine in need of at home physiotherapy. FDA cleared MindMotion™'s game-based digital therapies have benefited more than 3,300 patients in 90 leading centers around the world. Created to promote the kind of movements a patient would typically practice with a physiotherapist, the system is completely customizable to each individual's needs and progress. So it can be used in acute inpatient settings, outpatient clinics and even at home. MindMotion™ GO offers full-body motion capture through optical markerless technology, real-time feedback on the quality of movement and a hardware peripheral to train hand dexterity. Not to mention, a comprehensive telemedicine service, through a HIPAA-compliant web service. The student will work with the research team as we validate this incorporation of XR technology into neurorehabilitation.

Singh, Shailendra, MD, Department of Gastroenterology/Advanced Endoscopy

- Migration rates of sutured vs non-sutured esophageal stent placement: A randomized control trial
- Endoscopic Bariatric Therapies: Outcomes of endoscopic bariatric therapy for the treatment of obesity and related comorbidities.

Sraj, Shafic, MD, Department of Orthopedics

- Comparing the incidence and severity of flare reaction following steroid injection for trigger finger release- A randomized Controlled Trial

Umer, Amna, PhD, Department of Pediatrics

- Numerous maternal and infant health topics. Current research examining substance use during pregnancy and infant outcomes.

Wan, Edwin, PhD, Department of Microbiology, Immunology, and Cell Biology

- Immune-mediated post-stroke inflammation of the brain. Post-stroke inflammation and damage of the brain are controlled by a complex interaction between the CNS-resident cells (neurons, microglia, astrocytes, etc) and the peripheral immune cells (macrophages, neutrophils, T cells etc) that migrate to the brain. The cellular events and molecular signals for controlling immune cell migration is not fully understood. We use mouse models to investigate cell-cell interaction at the meninges following ischemic stroke induction.

Yakovenko, Sergiy, PhD, Department of Human Performance

- Brain-machine interfaces for high-density electrode arrays for closed-loop recording and stimulation.

Zdilla, Matthew, DC, Department of Pathology, Anatomy, and Laboratory Medicine

- Improving the Surgical Approach to Trigeminal Neuralgia through Geometric Morphometric Analysis: Students involved in this project will perform detailed anatomical analysis of the infratemporal fossa, cranial base, and middle cranial fossa. They will gain experience in advanced dissection methods as well as 3D scanning, modeling, and image analysis. They will assess metric and non-metric human anatomical variation. Students will learn geometric morphometric techniques for shape analysis including landmark acquisition, Procrustes analysis, PCA, CVA, and partial least squares analysis. Students will also gain experience in the authorship and publication process. This project is particularly appealing to medical students interested in entering into surgery, pain medicine, or radiology.