Meet the Faculty of the 2025 Summer Child Health Research Internship

University of Colorado School of Medicine, Department of Pediatrics
Children's Hospital Colorado

Contents

Jordan Abbott, MD, MA Allergy and Immunology

Lab Overview
The Abbott laboratory, led by Dr. Jordan Abbott, MD, specializes in pediatric clinical immunology. Dr. Abbott focuses on the biology and genetics of primary immunodeficiency diseases.

Research Areas and Current Projects
Current projects are examining the following aspects of the immune system: how defects in the AIRE protein affect central tolerance of T cells as they develop in the thymus, how regulatory T cells use CTLA-4 to regulate immune responses, and defects in B cell functions. In addition, there are a number of smaller projects whose aim is to understand novel genetic defects found in patients with immune disorders.

Learning Opportunities
Interns will be given a small project focused around 1 or 2 techniques. Typically, projects involve a combination of PCR, qPCR, genetic sequencing, and protein identification, but additional more advanced approaches can be used depending on the degree of proficiency. The project will be designed by Dr. Abbott to be completable in the timeframe of the internship, so that interns have a complete research experience including experimental design, techniques, record keeping, data analysis, and presentation. Interns will be credited for contributions to manuscripts and abstracts.

Celiac Disease Research Team

Edwin Liu, MD
Monique Germone, PhD, BCBA
Marisa Stahl, MD
Mary Shull, MD
Pooja Mehta, MD

Lab Overview
The Colorado Center for Celiac Disease has a clinical/translational research team led by Dr. Marisa Stahl. The team consists of five pediatric gastroenterologists, a pediatric psychologist, a dietitian, and a research assistant. Collaborators include the Sie Center for Down Syndrome, Barbara Davis Center for Diabetes, and national research consortiums. Our work focuses on mass screening for celiac disease, health behavior intervention for children and caregivers of families with celiac disease, and also new clinical and immunologic tools for celiac disease diagnosis.

Research Areas and Current Projects
The lab has three current research studies in various stages which allows a trainee to observe and participate in various stages of research projects. Topics of study are currently: program development with an emphasis on addressing food insecurity and stakeholder engagement, celiac disease general population screening, and psychosocial impact of celiac disease on the child and family.

Learning Opportunities
A research trainee will have access to current databases. The trainee has the opportunity to support ongoing projects or create a project of their own. Supports for the research trainee include a bi-weekly team meeting, access to a research assistant and statistician, and weekly meetings with the mentoring psychologist (Germone) and a chosen physician mentor(s). In addition to research, the intern will have the opportunity to shadow our innovative clinical work conducted by our multi-disciplinary team (gastroenterologist, nursing, dietitian, pediatric psychologist).

Ken Maclean, PhD Clinical Genetics and Metabolism

Lab Overview
The Maclean laboratory, led by Dr. Ken Maclean, PhD, is dedicated to studying the etiology and pathogenesis of cystathionine beta-synthase deficient homocystinuria (HCU), Down syndrome, and various hepatic disorders. Dr. Maclean's research employs a wide range of transcriptomic and proteomic platforms, combined with biochemical, behavioral, genetic, and molecular approaches. The lab primarily utilizes mouse models of these diseases to investigate pathogenic mechanisms and develop innovative treatment strategies.

Research Areas and Current Projects
The lab's primary focus is around HCU, for which the Maclean lab has created a novel transgenic mouse model. Through a combination of behavioral analysis, hippocampal microarrays, and proteomic analysis, the lab has revealed several novel pathogenic mechanisms. These discoveries have been subsequently confirmed in human HCU tissue samples, leading to the identification of a novel treatment for HCU. An FDA-funded clinical trial is currently underway at the Children's hospitals of Denver and Philadelphia to test this treatment.

Learning Opportunities
Interns in the Maclean lab will have the unique opportunity to actively participate in research aimed at unraveling the etiology and pathogenesis of HCU, Down syndrome, and hepatic disorders. They will work with cutting-edge research methodologies, including transcriptomics and proteomics, behavioral analyses, and molecular approaches, to study mouse models of these diseases. Interns will have opportunities to develop practical laboratory skills and contribute to advancing the understanding of pathogenic mechanisms. The projects offered in the Maclean lab typically allow the intern to contribute significantly and receive a co-authorship on a peer-reviewed publication.

Christine Vohwinkel, MD, PhD Critical Care

Lab Overview
Dr. Christine Vohwinkel, MD, PhD, leads the lab within the Division of Critical Care, focusing on research in the field of acute lung injury. The primary clinical manifestation of interest is the acute respiratory distress syndrome (ARDS), a severe and highly morbid critical illness characterized by acute onset hypoxemia, pulmonary edema, and bilateral chest X-ray opacities.

Research Areas and Current Projects
The central focus of Dr. Vohwinkel's lab is the investigation of how metabolism regulates inflammation, a key element in the pathogenesis of acute lung injury and ARDS. The lab is particularly interested in understanding the mechanisms by which the lung epithelium communicates with macrophages. To explore these research questions, the lab employs various models, including mouse models of acute lung injury induced by ventilation, acid aspiration, and pneumonia, as well as cell cultures involving both mouse cells and cells donated by human patients. The lab utilizes an array of techniques such as PCR, Western Blotting, ELISA, enzyme activity assays, and histology to delve deeper into these research areas.

Learning Opportunities
Interns in Dr. Vohwinkel's lab will have the unique opportunity to actively engage in research focusing on critical aspects of acute lung injury and ARDS. They will be exposed to various research models, including mouse models and cell cultures, and learn to apply techniques such as PCR, Western Blotting, ELISA, enzyme activity assays, and histology. This hands-on experience provides valuable insights into experimental methodologies and laboratory procedures relevant to critical care and pulmonary research. Students will work closely with Dr. Vohwinkel and her team, contributing to ongoing projects aimed at understanding the molecular and cellular mechanisms underlying acute lung injury. This experience offers the opportunity to develop practical research skills and gain a deeper understanding of the complexities of critical care research.

Eva Nozik, MD Critical Care/Developmental Lung Biology

Lab Overview
The Nozik laboratory, led by Dr. Eva Nozik, MD, is a basic science and translational research group in the Section of Pediatric Critical Care. The lab's overarching mission is to gain a deep understanding of the mechanisms responsible for life-threatening diseases of the lung including pneumonia, pediatric acute respiratory distress syndrome, chronic lung disease of prematurity and pulmonary hypertension.

Research Areas and Current Projects

Our laboratory has several ongoing projects related to lung and pulmonary vascular diseases. We use a range of genetically engineered mouse strains that have different expression levels of an important antioxidant enzyme that is abundant in the lung and blood vessels to understand how reactions controlled by antioxidant systems influence disease progression. One set of projects investigates bacterial pneumonia and seeks to identify new pathways responsible for inflammation and lung injury. Another set of projects uses models of pulmonary hypertension (elevated blood pressure within the blood vessels of the lung) including exposure to hypoxia in chambers that simulate high altitude. In the hypoxia model, we study the role of macrophages and platelets in the development of pulmonary hypertension.

Learning Opportunities

Interns in the Nozik lab will have a unique opportunity to engage in research that directly impacts the understanding and treatment of pediatric lung and vascular diseases. They will gain a strong understanding of the structure and function of the lung and vascular system and conduct important biochemical and molecular techniques using lungs or blood from injured mice or cultured cells. This hands-on experience provides interns with valuable insights into experimental techniques and laboratory procedures relevant to critical care and lung biology. Interns can expect to gain both practical skills and a broader understanding of the challenges and opportunities in pediatric critical care research and also have the opportunity to submit an abstract to a national meeting and be a co-author on a manuscript based on data generated during the summer.

Bruce Appel, PhD Developmental Biology

Lab Overview

The Appel laboratory, led by Dr. Bruce Appel, PhD, focuses on understanding the formation of the nervous system during embryonic development. The ultimate goal is to provide insights that can aid in the repair of nervous systems that have been damaged due to disease or injury. To achieve this, the lab employs zebrafish embryos as a model system, given their unique characteristics such as transparency and development outside the mother's body. This enables the use of time-lapse microscopy to observe the dynamic processes of neural cell migration and differentiation into neurons and glia.

Research Areas and Current Projects

The lab is engaged in several areas of research, including:

1. Investigation of neural development in zebrafish and the effects of mutations that disrupt this process, which can offer insights into the genetic basis of neurological disorders in humans.
2. Study of zebrafish as a model system to understand how to promote the regeneration of neural cells that are lost as a result of birth defects or other conditions.

Learning Opportunities

Interns in Dr. Appel's lab will actively participate in research focused on the development of the nervous system and its potential for repair and regeneration. They will work with a unique model system, zebrafish, and leverage time-lapse microscopy to observe and understand the intricate processes of neural cell migration and differentiation. Students will delve into the effects of mutations on neural development, with direct implications for genetic diseases that lead to neurological disorders in humans. This experience offers students an opportunity to develop practical research skills and contribute to projects with the potential to advance our understanding of nervous system development and repair.

Emily Bates, PhD Developmental Biology

Lab Overview

Dr. Emily Bates is a prominent researcher in the field of Developmental Biology. The Bates lab specializes in the study of molecular mechanisms underlying abnormal fetal development. Dr. Bates is particularly interested in how ion channels contribute to embryonic and fetal development.

Research Areas and Current Projects

Dr. Bates' research focuses on how ion channels contribute to embryonic and fetal development. Ion channels are the targets of medications and recreational substances that can cause differences in development- like cleft palate, or abnormal brain development. For example, recent projects have defined how nicotine vaping during pregnancy disrupts craniofacial and skeletal development through inhibition of a potassium channel. Other studies have focused on how fetal cannabidiol (CBD) exposure disrupts brain and pancreas development in offspring.

Learning Opportunities
Interns in Dr. Bates' lab will have the opportunity to engage in research that explores the fundamental molecular basis of human genetic disorders. They will be actively involved in the process of identifying and characterizing mutations, both in humans and in model organisms. This hands-on experience will provide interns with a unique perspective on how genetic research can translate from the clinical to the laboratory setting. Additionally, involvement in research related to structural birth defects, brain defects, and neurodegeneration offers an opportunity to understand the challenges and potential breakthroughs in addressing these complex issues. Working closely with Dr. Bates and team, students will contribute to ongoing projects that could have implications for the clinical practice. Some interns have had the opportunity to contribute to published papers as authors and to present their work at national and international meetings.

Kristen Nadeau, MD, MS Endocrinology and Diabetes

Lab Overview
Dr. Kristen Nadeau, MD, MS, is a distinguished Pediatric Endocrinologist and serves as the Vice Chair for Clinical and Translation Science Research for the Department of Pediatrics. Her research focus lies in clinical-translational studies aimed at mitigating the long-term complications of pediatric obesity, type 1 diabetes, type 2 diabetes, and prediabetes. Dr. Nadeau's lab is dedicated to gaining a better understanding of the early contributors to cardiovascular disease (CVD), including mechanisms related to insulin resistance, cardiovascular dysfunction, and muscle dysfunction.

Research Areas and Current Projects
The Nadeau lab is actively engaged in a variety of research areas and projects, which encompass:

1. Clinical studies involving assessments of insulin sensitivity and pancreatic function using advanced techniques such as IV hyperinsulinemic clamps with isotopes, hyperglycemic clamps, mixed meal tolerance tests, and oral glucose tolerance tests.
2. Evaluation of fat deposition in the liver, visceral, and muscle tissues via advanced imaging techniques like MRI/MRS.
3. Investigation of heart function through resting and exercise-stress echocardiography and cardiac MRI.
4. Measurement of endothelial function, arterial stiffness, blood flow, and arteriosclerosis using MRI and other vascular methodologies.
5. Assessment of exercise function, physical activity monitoring, and sleep patterns, including circadian rhythm monitoring.
6. Study of carbohydrate oxidation with metabolic cart assessments
7. Assessment of the effects of bariatric surgery on youth-onset T2D
8. Assessment of the effects of medications to improve insulin sensitivity on diabetes complications in type 1 diabetes

Dr. Nadeau's prior research portfolio also includes several large NIDDK longitudinal studies, such as the "Treatment Options for type 2 Diabetes in Adolescents and Youth (TODAY)" study, focusing on youth and young adults with type 2 diabetes. Additionally, there's a trial aimed at improving pancreatic function in individuals with prediabetes and early type 2 diabetes called "Restoring Insulin Secretion (RISE).", and currently the DISCOVERY study looking at precursors of type 2 diabetes in youth with obesity. The lab is also involved in medication trials with the goal of reducing cardiovascular disease risk and enhancing insulin sensitivity in youth and young adults with type 1 diabetes.

Learning Opportunities
Interns working in Dr. Nadeau's lab will have the opportunity to participate in clinical-translational research related to youth with obesity and diabetes. They will gain experience in various research methodologies, including advanced clinical assessments, imaging techniques, and longitudinal studies. This immersive research environment provides

students with a rich exposure to clinical and translational research in the context of pediatric obesity and diabetes, contributing to a better understanding of the early contributors to cardiovascular disease and potential interventions.

Stephen W. Santoro, PhD Developmental Biology

Lab Overview

The Santoro Lab uses the mouse as a model to study the mammalian olfactory system, which mediates the sense of smell and responses to pheromones. We are interested in how the system develops, how it changes as a result of experience, and how it regenerates after injury. A major focus of current research in the lab is to elucidate how the birth of new olfactory sensory neurons is regulated, with the long-term objective that neuron birth may be manipulated to enhance human health.

Research Areas and Current Projects

The Santoro lab is currently pursuing several areas of research, including:

- Does persistent olfactory sensory neurogenesis in mammals perform an adaptive function, in addition to a reparative one?
  - Our lab has found that, surprisingly, exposure of mice to specific odors selectively accelerates the birthrates of olfactory sensory neurons that express odorant receptors that detect these odors. These findings challenge current assumptions that olfactory neurogenesis is stochastic with respect to odorant receptor (i.e., neuron subtype) and that this process performs a strictly reparative role. We are currently investigating the mechanic and functional implications of this phenomenon.
- What mechanisms govern recovery of the olfactory sensory neuron population following injury?
  - Previous studies have found evidence that the regeneration of olfactory sensory neurons following injury to the olfactory epithelium may not be stochastic with respect to neuron subtype, but rather may depend on the extent to which neurons of the same subtype have been lost. Other studies have found that recovery from injury may depend on exposure to odors. We are currently developing approaches to test these hypotheses in mice.
- How does olfactory experience affect the lifespans of olfactory sensory neurons of distinct subtypes?
  - Previous studies from our lab and others have found that the relative abundance of olfactory neurons of specific subtypes can be selectively altered by olfactory experience-dependent changes in neuron lifespan. To investigate the scope of these changes, we are developing approaches to profile olfactory neuron lifespan in a subtype-specific manner.
- Mechanisms that govern the connectivity of olfactory sensory neurons.
  - In mammals, odorant receptors play key roles in establishing the map of connections between olfactory sensory neurons and second-order neurons in the olfactory bulb. Projects in lab our aim to investigate potential roles for local axonal translation and activity-dependent transcriptional changes in regulating olfactory sensory neuron connectivity and survival.

Learning Opportunities

Interns in the Santoro lab will actively participate in research related to how the mammalian olfactory system develops, how it changes as a result of olfactory experience, how it can become dysfunctional due to age, injury, and disease, and how it regenerates following damage. Experimental approaches that may be learned include mouse genotyping, bulk and single-cell RNA sequencing, spatial transcript profiling, lineage tracing, RNA fluorescent in situ hybridization, immunohistochemistry, quantitative PCR, and quantitative microscopy. Concepts to be learned will include hypothesis development, experimental design, and experimental data analysis.

eXtraOrdinarY Kids Program (Interdisciplinary)

Nicole Tartaglia, MD, MS

Shanlee Davis, MD, PhD

Lab Overview

The eXtraOrdinarY Kids Program is dedicated to further understanding of the diverse phenotype of individuals with sex chromosome aneuploidies, including Klinefelter syndrome (47,XXY), Turner syndrome (45,X and variants), Trisomy X

(47,XXX), 47,XYY, 48,XXYY, and more. Individually, these conditions are rare and underdiagnosed, however when taken together these conditions affect 1 in 400 individuals. Our translational research program seeks to improve the lives of individuals with sex chromosome aneuploidies throughout the lifespan by interdisciplinary collaboration, incorporation of diverse research methods, and development of robust and sustainable resources to support ongoing discovery.

Research Areas and Current Projects

The program's clinical-translational research focuses on various methodologies, including intervention trials, retrospective and prospective observational studies, translational science, secondary data analyses, patient reported outcomes (PROs), community-based participatory research, and more. These approaches are employed to address important clinical questions with the goal of improving patient outcomes in individuals with sex chromosome aneuploidies, with a specific emphasis on neurodevelopmental, endocrine, and health outcomes. The interdisciplinary team involved in this research program comprises experts in Developmental Pediatrics (Dr. Tartaglia), Pediatric Endocrinology (Dr. Davis), neuropsychology, psychology, genetic counseling, speech and occupational therapy, and clinical research professionals. Students are integral members of this team and are assigned projects tailored to their experience and career aspirations. In addition to identifying and completing research projects, students will also assist with visits for ongoing clinical research studies.

Learning Opportunities

Interns in the eXtraOrdinarY Kids Program will actively participate in research dedicated to improving the lives of youth with sex chromosome aneuploidies. They will gain hands-on experience and education in clinical-translational research. Students will contribute to projects that aim to address critical clinical questions in the field, particularly in the areas of neurodevelopment, endocrine health, and overall well-being of affected individuals. Working within an interdisciplinary team, interns will have the chance to collaborate with experts in various fields, enhancing their understanding of the comprehensive approach to patient care. Additionally, students will have the unique opportunity to engage directly with participants in ongoing studies, actively contributing to research that has the potential to significantly impact the lives of youth with sex chromosome aneuploidies. All interns present their work at the annual eXtraOrdinarY Kids Research eXpo. Abstract submission for presentation at other local or national meetings is encouraged if the student is interested.

Tamim H. Shaikh, PhD, Genetics and Genomics

Lab Overview

The Shaikh lab studies the genetic underpinnings of rare, pediatric diseases. Our patient population includes children with intellectual disabilities and developmental delays, who may also have additional abnormalities like seizures, brain malformations, metabolic imbalances, heart defects, dysmorphic features, autism spectrum disorders or other behavioral issues. We use state-of-the art genomic technologies to detect genetic variants in the patients' DNA and apply computational analysis pipelines to analyze and annotate them to identify potentially pathogenic variants that may play a role in the patient's disease. We then use experimental approaches and functional analysis to correlate the candidate pathogenic variants to the observed phenotypes. Our long-term goal is to improve the yield of genetic diagnoses and elucidation of disease mechanisms for potential therapeutic interventions and treatment of rare diseases.

Research Areas and Current Projects

Current projects in the Shaikh lab include:

1. The application of long read sequencing (Oxford Nanopore) and optical genome mapping (Bionano Genomics) to the analysis of genomic DNA from patients. These new techniques allow for a comprehensive analysis of the genome to detect all forms of genetic variation, including cryptic structural variations, many of which are missed by techniques currently used in clinical diagnostic laboratories. We expect that this approach will help us solve rare diseases which remain undiagnosed.
2. Functional analysis and characterization of potentially pathogenic variants detected in patients with rare diseases. We use a combination of experimental approaches which include generation of induced pluripotent stem cells (iPSCs) derived from the patient's own cells, which can then be differentiated into cell types that are relevant to the patient's phenotype, followed by cellular and molecular analysis which include transcriptomics (to detect changes in RNA expression), 3D genomics (to detect changes in DNA folding and its effect on gene

regulation). We expect that this approach will help us better understand how the genetic variants lead to the phenotypes we observe in the patients.

Learning Opportunities
Interns in the laboratory will have the opportunity to participate in the ongoing projects in our laboratory. Individual projects will depend on the intern's interest and the needs of the project and may include computational analysis of long read sequencing data for variant detection and annotation and/or wet bench experiments, including iPSC-based experiments, DNA and RNA extractions for RNAseq, Hi-C and other applications for the functional analysis of the genetic variants. Overall, our interns will learn the various aspects of genetic diagnosis in rare pediatric diseases.

Nathan Dahl, MD Hematology/Oncology

Lab Overview
Dr. Nathan Dahl is a Pediatric Neuro-Oncologist with a basic science lab that focuses on the study of epigenetics in childhood brain tumors.

Research Areas and Current Projects
The primary focus of the Dahl lab is the study of chromatin biology and how it is altered in cancer states. How DNA is packaged and modified determines how genes are activated, repressed, or modulated across normal development. These regulatory mechanisms are often hijacked in cancer, co-opting normal developmental programs. This creates the opportunity to study both fundamental mechanisms of cancer biology but also how specific proteins driving these epigenetic alterations can be targeted for new cancer treatments.

Learning Opportunities
Interns in the Dahl lab will have opportunities to engage with the spectrum of preclinical cancer research, tailored to the individual intern's interests and skill. A typical internship would include hands-on training with human tissue culture, direct measurements of RNA and protein, and preclinical pharmaceutical testing. Exposure to more advanced techniques in chromatin biology such as ChIP-seq, CUT&RUN, or RNA-seq will be integrated with an individual intern's project. We will also discuss fundamentals of scientific presentation and scientific careers according to the intern's own goals. Successful interns will be credited for their work in national and international presentations and may receive co-authorship on resultant publications, allowing for meaningful scientific contribution and advancement towards their own career goals.

Nick Foreman, MD Hematology/Oncology

Lab Overview
The Foreman laboratory, led by Dr. Nick Foreman, MD, specializes in pediatric Oncology. Dr. Foreman is an experienced researcher in the field with a focus on the biology and immunobiology pediatric brain tumors especially ependymoma. Recently this lab has also done published work on tumor associated with neurofibromatosis.

Research Areas and Current Projects
The lab's primary goal is to enhance our understanding of the biology and immunobiology of pediatric ependymoma. Specifically, they seek to identify biological characteristics with clinical relevance, such as drug sensitivity, diagnosis, and prognosis. To achieve this, the lab employs cutting edge molecular tools including single cell RNA sequencing, spatial transcriptomics and CITE-seq. The lab also does translational research involving testing of new agents in vitro and then in mouse models of ependymoma. These technologies allow not only for detailed exploration of the biology of single tumor cells and tumor associated immune cells but also cross talk between cell types. The lab is regarded as the leading ependymoma lab in North America and has collaborators in several countries.

Learning Opportunities
Interns in the Foreman lab will have the opportunity to engage in various aspects of cutting-edge research. By working with the advances molecular tools used by this lab, interns will gain valuable experience in the utility of these approaches and the associated data analyses needed to integrate findings from these complimentary approaches. Hands on experience in specimen handling and interpretation of data will be provided by the very experienced technical staff in the Foreman lab. Additionally, students will delve into the results of microarray analyses through protein

expression studies. Such hands-on involvement in the lab's research processes provides an opportunity for skill development, fostering a deeper understanding of laboratory techniques and analytical tools. Students will be involved in discussion and planning of translational studies but can only be hands on involved in the in vitro experiments and not in the mouse modeling. Promising research projects within the Foreman lab typically offer opportunities for presentations at national meeting, co-authorship on publications, allowing interns to make a tangible contribution to the scientific community.

Siddhartha Mitra, PhD Hematology/Oncology and Todd Hankinson MD, MBA Pediatric Neurosurgery

Lab Overview

Dr. Siddhartha Mitra, PhD, leads the Mitra lab, which is an integral part of the Morgan Adams Pediatric Brain Tumor Research Program within the Department of Pediatrics Hematology/Oncology/Bone Marrow Transplantation section at the University of Colorado School of Medicine. Dr. Mitra's research combines expertise in three distinct fields: Immuno-Oncology, neurodevelopment, and brain tumor oncology. The lab's primary focus centers on understanding the mechanisms of immune surveillance in brain tumors, particularly involving cells of the innate immune system.

Dr. Todd Hankinson, MD, is the head of pediatric neurosurgery at Children's Hospital Colorado and leads the Hankinson lab, which is also part of the Morgan Adams Pediatric Brain Tumor Research Program. His research focuses on the brain tumor, Adamantinomatous Craniopharyngioma (ACP. His lab uses a combination of laboratory and computational tools to translate biological discovery into clinical application. The have developed and work with patient derived cell culture models, machine learning models, and work closely with Dr. Mitra in the study of the immunobiology of ACP.

Research Areas and Current Projects

The Mitra/Hankinson labs are engaged in multiple areas of research, including:

1. Investigating the immune-surveillance mechanisms in brain tumors, particularly involving the innate immune system components such as macrophages and brain resident microglia. These immune cells play a vital role in the brain tumor microenvironment.
2. Exploring the inhibition of the myeloid checkpoint pathway, specifically the CD47-SIRPα signaling axis, to suppress the "don't eat me" signal and enhance the phagocytosis of various types of brain tumors. This research is significant in the context of immune-based approaches to combat brain tumors.
3. Focusing on translational Immuno-Oncology to better understand and harness mechanisms like efferocytosis and immunogenic cell death for the development of improved immune-modulating drugs targeting both adult and pediatric brain tumors.
4. Developing machine learning tools for the analysis and translation of large volume laboratory data

The Mitra/Hankinson labs collaborate with a broader brain tumor research program that encompasses seven labs, each specializing in various aspects, including single-cell RNA sequencing, autophagy, and oncogenic signaling pathways. This multidisciplinary approach enhances the collective expertise in the field.

Learning Opportunities

Interns joining the Mitra/Hankinson lab will be part of a brain tumor research program, offering a unique environment to gain experience and insights into Immuno-Oncology, neurodevelopment, and brain tumor oncology. Interns will have the opportunity to work on cutting-edge projects related to immune surveillance and immunotherapeutic approaches for brain tumors.

Jean Mulcahy Levy, MD Hematology/Oncology

Lab Overview

Dr. Jean Mulcahy Levy, MD, has a background in oncology research, with specific training and expertise in pediatric brain tumors. Dr. Mulcahy Levy's research primarily focuses on the development of new therapies for brain tumors, with a particular interest in understanding and addressing therapy resistance mechanisms.

Research Areas and Current Projects
Dr. Mulcahy Levy's lab concentrates on harnessing autophagy, a cellular recycling program, to enhance therapy for patients with central nervous system (CNS) tumors. The lab's research aims to unravel the mechanisms by which autophagy can be utilized to improve treatment outcomes, especially in cases of therapy-resistant brain tumors. Dr. Levy's lab has made significant contributions to this area, including identifying the connection between BRAF pathway alterations and autophagy addiction in brain tumors. Their work has demonstrated the effectiveness of autophagy inhibition when tumors become resistant to BRAF/MEK inhibitors. This research has led to the initiation of a first-in-pediatrics multi-institutional trial of autophagy inhibition in collaboration with the Pediatric Brain Tumor Consortium and Novartis. Additionally, the lab has conducted extensive investigations into resistance mechanisms to BRAF/MEK inhibitors, with the publication of the largest series of paired pediatric CNS tumor samples. The lab is committed to the development of novel and rapidly translatable treatments for pediatric CNS tumors. Their research has also identified biologically driven therapies for AT/RT and other tumors through genome and pharmacologic screening. A key finding is the identification of CDK7 as a critical vulnerability in AT/RT, which forms the basis for further exploration into the mechanistic relationship between CDK7 and the SWI/SNF complex in AT/RT, and the potential for inhibiting CDK7 alone or in combination with existing AT/RT chemotherapies.

Learning Opportunities
Interns in Dr. Mulcahy Levy's lab will have the opportunity to actively engage in groundbreaking research with significant implications for pediatric oncology. They will play a pivotal role in ongoing projects related to autophagy and resistance mechanisms in CNS tumors, gaining hands-on experience in experimental techniques, data analysis, and translational research. This involvement provides a valuable opportunity for students to develop practical research skills and contribute to the development of novel therapies. Additionally, students may collaborate with a multi-institutional trial, offering a unique perspective on the clinical translation of research findings. Working closely with the experienced research team, interns can expect to contribute to research that has the potential to improve treatment outcomes for pediatric CNS tumors.

Sujatha Venkataraman, PhD Hematology/Oncology and Bone Marrow Transplantation

Lab Overview
Dr. Venkataraman is a faculty member in the Morgan Adams Foundation (MAF) Pediatric Research Program in the Department of Pediatrics. Her lab specializes in pediatric brain tumor research, with a specific interest in developing a novel therapy for DIPG, a fatal brain tumor type in children.

Research Areas and Current Projects
Dr. Venkataraman's lab studies the biology of brain tumors, with particular interest in diffuse intrinsic pontine glioma (DIPG) and developing biology-based therapies to treat patients with DIPG. In line with that, her lab is interested in developing novel immunotherapy strategies to target DIPG. Her lab has developed novel CAR-T (chimeric antigen receptors-T) cells and is studying their efficacy and safety against DIPG. Her laboratory is interested in identifying significant obstacles that will inhibit or minimize CAR-T cells' function in killing tumor cells. Subsequently, her lab members are developing new armed CAR-T cells to overcome those obstacles, thus increasing the tumor-killing effect of their developed CAR-T cells.

Secondly, her lab is also interested in repurposing FDA-approved drugs for DIPG. This is because developing small-molecule drugs is a lengthy and costly endeavor. Yet most drugs fail in development, typically due to their toxic effects on humans. In line with that, no new drugs have ever been approved for DIPG to date. In such a scenario, instead of developing new drugs, an emerging alternative would be repositioning FDA-approved drugs for new purposes. Her lab is now testing these drugs' efficacy in killing DIPG tumors to find a treatment faster.

Learning Opportunities
Interns in the Venkataraman lab will gain hands-on experience in culturing and maintaining normal and brain tumor cells. They will learn the diverse mutational profiles of these brain tumors in children and explore their roles in tumorigenesis. For those who are interested in immunotherapy projects, her lab provides training in designing and developing different CAR-T cells. They will learn advanced techniques to enhance CAR-T cell functionality against tumor cells. Interns focusing on drug repurposing will conduct studies to test the growth-inhibitor effects of FDA-

approved drugs on tumor cells. Using mouse models, they will work on identifying lead compounds with therapeutic potential against DIPG. This summer internship program offers a robust platform for learning cutting-edge techniques and contributing to impactful research in neuro-oncology.

Suchitra Rao, MBBS, MSCS Infectious Diseases, Epidemiology and Hospital Medicine

Lab Overview

Suchitra Rao is Associate Professor of Pediatrics in the Sections of Infectious Diseases and Hospital Medicine at the University of Colorado School of Medicine. She conducts clinical research studying respiratory viruses (with a special focus on influenza and COVID), including the epidemiology of these viruses in children, vaccine effectiveness, vaccine delivery in different healthcare settings and the host response to vaccines and natural infection.

Research Areas and Current Projects

- Development of an influenza vaccination program to improve vaccine uptake in various healthcare settings
- Work with CDC and Health Department on Influenza Studies in Children
- Using EHR data to study long COVID in children through the RECOVER initiative

Learning Opportunities

- Vaccine program development and rollout
- Designing and conducting clinical research studies
- Opportunity to be co-author on manuscript and conference abstracts

Laura Brown, MD Neonatology

Lab Overview

Dr. Laura Brown, MD, leads a research lab in the field of Neonatology, specializing in the study of intrauterine growth restriction (IUGR). IUGR affects approximately 8% of pregnancies and results from placental insufficiency, leading to limited nutrient and oxygen delivery to the fetus and slower fetal growth. Dr. Brown's overall research goal is to understand the basic biology of fetal muscle development and protein metabolism to optimize body composition and metabolic health in infants born with IUGR.

Research Areas and Current Projects

The Brown laboratory investigates how fetal nutrient availability influences skeletal muscle development and its long-term consequences, including conditions like sarcopenia, insulin resistance, and diabetes. The lab conducts in vivo physiological studies using large animal (sheep) models of pregnancy and complements them with in vitro experiments using muscle tissue and primary fetal myocytes to understand the cellular adaptations to nutrient restriction. Additionally, they use stable isotopic tracer and metabolomic techniques to study how nutrient supply and growth factors affect skeletal muscle-specific metabolism.

Learning Opportunities

Interns working in Dr. Brown's lab will have the opportunity to actively engage in research with direct implications for fetal and neonatal health. They will learn to conduct physiological studies, develop hypotheses, and participate in experiments that measure nutrient uptake and metabolic processes in skeletal muscle. Student projects are designed to given interns experience in performing fundamental molecular and cellular techniques including protein/RNA analysis and histology. This hands-on experience provides valuable insights into research methodologies and laboratory procedures relevant to neonatology and maternal-fetal medicine. Working closely with Dr. Brown and her team, students may contribute to ongoing projects aimed at optimizing body composition and growth in the IUGR fetus and neonate, ultimately preempting complications related to low muscle mass. This research experience offers students the chance to develop practical skills and contribute to improving the long-term health of affected individuals. The goal is to have each student complete a project that leads to an abstract submission to attend a national meeting.

Stephanie Wesolowski, PhD Neonatology

Lab Overview
Our lab studies how altered nutrient supply programs fetal metabolism and how these changes may persist after birth and increase susceptibility to adult metabolic disease. Our primary research is aimed at understanding the effects of intrauterine growth restriction (IUGR) on liver metabolism and function using integrative approaches in physiology and metabolism combined with novel molecular techniques in cell biology, epigenetics, and metabolomics.

Research Areas and Current Projects
Current studies in our research program are focused on understanding the mechanisms for the early activation of fetal hepatic glucose production and development of hepatic insulin resistance, specifically the role of reduced glucose versus oxygen supply to the fetus, both key features of placental insufficiency and resulting IUGR. This is important in understanding why IUGR offspring have increased susceptibility to diabetes across their lifespan. We also have projects investigating the effects of maternal high fat diet and obesity on offspring metabolism, specifically the early development of non-alcoholic fatty liver disease (NAFLD) and immune cell reprogramming.

Learning Opportunities
Interns will gain hands-on experience with biochemical, molecular, and cellular techniques in the lab. They will be mentored by the PI and members on the lab. While guidance will be provided, the intern will be expected to take ownership of the project. Opportunities for abstract presentations at national meetings and co-authorship on publications are considered for interns who are interested and make appropriate contributions to the project.

Clyde Wright, MD Neonatology

Lab Overview
Dr. Clyde Wright, MD, leads a research lab in the field of Neonatology, with a primary focus on understanding how inflammatory insults encountered during the perinatal period contribute to the various morbidities observed in prematurely born infants. Dr. Wright's lab aims to investigate cell-specific innate immune pathways to identify potential therapeutic targets for improving the outcomes of these vulnerable patients.

Research Areas and Current Projects
The central research area in Dr. Wright's lab revolves around the study of innate immune responses and their role in neonatal health. The lab employs in vitro and in vivo approaches to evaluate the impact of manipulating innate immune signaling in the presence of clinically relevant stressors, such as infection and oxidative stress. This research aims to reduce inflammatory injury and enhance neonatal health outcomes.

Learning Opportunities
Interns in Dr. Wright's lab will have the opportunity to actively participate in research that directly addresses critical aspects of neonatal health. They will learn to apply the scientific method, including the development and testing of hypotheses. Interns will be mentored throughout the research process, including data analysis and presentation. This experience offers a valuable opportunity for students to develop practical research skills, conduct experiments, and gain insights into the complexities of neonatology research. Promising research projects within the Wright lab typically offer opportunities for presentations at national meeting, co-authorship on publications, allowing interns to make a tangible contribution to the scientific community.

Russell Whelan MD, PhD Nephrology

Lab Overview
The Whelan lab, within the Division of Pediatric Nephrology, is focused on the roles of vascular dysfunction in a wide range of kidney diseases. Utilizing multiple molecular biology, cellular biology and bioengineering techniques, we aim to better understand the roles of inflammation and cell death in mediating kidney injury, with the ultimate goal of finding and evaluating novel therapeutics for kidney disease in children and adults.

Research Areas and Current Projects
The lab's primary goal is to better understand endothelial dysfunction in static and flow conditions, with several foci of investigation.
Currently our principal focus in on the role of complement in mediating vascular injury in the kidney. Complement is a component of the innate immune system that rapidly responds to internal and external threats in the body, but can cause severe kidney disease when dysregulated or overly active. We are particularly focusing on specific regulators of the complement pathway, known as Complement Factor H (CFH) and Complement Factor H Related (CFHR) proteins. Specific mutations of CFH and CFHRs are known to cause kidney disease in patients, and we are exploring the role of these regulators in kidney injury. To achieve this, we use cell culture and engineered microvessel studies to look at these effects, allowing us to explore mechanisms unique to the microvasculature under flow, providing a unique niche of investigation that culture and animal studies cannot provide.
We also study the effects of Shiga toxin on kidney endothelium, as Shiga-toxin mediated injury to the kidney causes significant morbidity and mortality without any effective treatment. We are focusing on a medication that specifically inhibits Shiga-toxin mediated endothelial injury. We have demonstrated near-complete protection in cell-culture and engineered microvessels under flow, and now are looking to better understand the specific mechanisms that provide this protection.
Additional studies focus on the roles of novel mechanisms of cell death and inflammation in the kidney microvasculature.

Learning Opportunities
Dr Whelan's goal for all members of the lab is to have projects that allow for intellectual and technical growth in their skills and interests, irrespective of experience level. Dr. Whelan works with new members of the lab to identify projects that best fit their interests and established skills, and as a highly collaborative lab, the goal is for input from all members in planning and interpretation. There is a wide range of techniques utilized in lab, including cell culture, immunofluorescence, immunohistochemistry, immunoblotting, recombinant protein production, cloning and mutagenesis, microvessel fabrication. All new members will learn techniques under supervision and support until mastery is shown, and then will have the opportunity for independence in planning and executing experiments. Trainees will receive support in methods, data analysis and how to apply results to subsequent experiments. Ultimately the goal at the end of the project is to provide trainee ownership in a project, from initial planning, through data analysis and interpretation, and ultimately with presentation and sharing with others. Any work that contributes to publication will lead to co-authorship, as well as opportunities for submission to scientific meetings for presentation.

Kristen Boyle, PhD Nutrition

Lab Overview
Dr. Kristen Boyle's lab is at the forefront of Nutrition and Metabolism research, with a focus on understanding how early-life factors shape long-term health outcomes.

Research Areas and Current Projects
The Dr. Boyle's lab studies mesenchymal stem cells (MSCs) from infant umbilical cord tissue to understand how maternal factors like obesity, diabetes, and environmental exposures during pregnancy impact children's long-term health. Using advanced cell culture and molecular techniques—such as PCR, RNA sequencing, and metabolic analysis—the lab explores how these prenatal exposures alter stem cell function and metabolism. Current projects in the lab focus on:

1. Investigating how maternal stressors affect infant stem cell metabolism and child predisposition to obesity.
2. Understanding how fat cell size impacts metabolism and inflammatory properties.
3. Using multi-omics approaches to characterize the relationships between maternal health, MSC phenotypes, and offspring metabolic outcomes.

Learning Opportunities
Interns in Dr. Boyle's lab will gain hands-on experience with a variety of cell culture and metabolic techniques, including mitochondrial respiration, substrate metabolism, and qPCR. Students may tailor their research towards specific areas

of interest—whether that's metabolism, molecular biology, or working with data to spot trends, building both lab and analytical skills.

Shelley Miyamoto, MD Pediatric Cardiology

Pediatric Cardiovascular Research Laboratory (PCRL)

Shelley Miyamoto, MD Kika Sucharov, PhD

Brian Stauffer, MD Katie Chatfield, MD, PhD

Lab Overview

Dr. Shelley Miyamoto, MD, leads a multidisciplinary research group with a mission to conduct translational and molecular research focused on children with heart disease. The laboratory brings together expertise spanning the cardiovascular field, encompassing pediatric and adult disease, basic molecular biology, cardiovascular physiology, and clinical translation. The research conducted in the Miyamoto lab leverages a repository of pediatric and adult heart tissues, as well as animal and primary cell culture models.

Research Areas and Current Projects

The lab's current projects encompass a broad range of areas:

1. Investigation of mitochondrial function in the failing hearts of children with cardiomyopathy and single ventricle heart disease.
2. Exploration of the regulation of phosphodiesterase expression and activity in pediatric heart failure.
3. Profiling of tissue and circulating microRNAs for insights into heart disease.
4. Study of myocyte mechanics in the context of the failing heart.

The research undertaken in the Miyamoto lab is pivotal in understanding and addressing pediatric heart failure, a condition for which current treatment strategies are often extrapolated from trials conducted in adult heart failure patients. Dr. Miyamoto's findings reveal that children with heart failure exhibit unique molecular adaptive responses, indicating the need for specific, targeted therapeutic approaches.

Learning Opportunities

Interns working in the Miyamoto lab will have the opportunity to engage in research aimed at unraveling the molecular and translational aspects of heart disease in children. They will work with a diverse set of research tools and techniques, including RT-PCR, Western blotting, various activity assays, and basic biostatistics. This experience offers students the chance to develop practical laboratory skills and contribute to projects with direct implications for the understanding and treatment of pediatric heart failure. Interns will collaborate in a multidisciplinary environment, gaining insights into the translation of research findings into clinical practice.

Anastacia Garcia, PhD Pediatric Cardiology

Lab Overview

The overall focus of my current research program is to better understand the unique adaptations governing pathological cardiac remodeling and the progression to heart failure in pediatric patients with complex congenital heart disease (CHD), including hypoplastic left heart syndrome (HLHS) and other single ventricle defects. The ultimate goal of my research is to develop the critical knowledgebase and infrastructure necessary to identify efficacious therapies for improving outcomes in this vulnerable group.

Research Areas and Current Projects

By using human cardiac tissue and blood samples in combination with cell and animal models, we evaluate both the basic biology of complex congenital heart disease and interventions that have the potential to address the decline in myocardial function. Currently, a major focus of the lab is to elucidate the molecular mechanisms involved in the modulation of cardiac energy metabolism and altered immune cell signaling in single ventricle heart disease. This work will be important for the identification and development of drug therapies that improve cardiac function and enhance transplant-free survival in this population. We are actively investigating the role of specific glycolipids in modulating both

cardiometabolic function and inflammation. We are also actively developing a high-throughput drug screening approach to identify novel therapeutic targets.

Learning Opportunities
Researchers in the Garcia lab will have the opportunity to engage in a spectrum of pre-clinical cardiovascular research utilizing in vitro cell culture-based models as well as in vivo murine based models. We utilize a variety of molecular biology techniques (DNA, RNA, protein) as well as high resolution respirometry functional analysis. A typical internship would include hands-on training with cell culture, direct measurements of RNA and protein, and preclinical pharmaceutical testing. We will also discuss fundamentals of scientific presentation and scientific careers according to the intern's own goals. Promising research projects within the lab typically offer opportunities for presentations at national meeting and co-authorship on publications, allowing interns to make a tangible contribution to the scientific community and will advance their own career goals.

Chaitanya Puranik Ph.D, MDS, MS, BDS Pediatric Dentistry

Lab Overview
Innovations in **D**entistry, **E**ducation, and **A**I **S**olutions Lab

Research Areas and Current Projects
Integration of AI in dental education, healthcare, and innovation

Learning Opportunities
- Investigate and learn application of various AI tools and platforms.
- Study the comparative efficacy of AI platform for application in dental education.
- Apply principles for AI for integration in dentistry

Maya Haasz, MD FAAP Pediatric Emergency Medicine

Lab Overview
The Dr. Haasz is the Director of the PROTECT (**P**revention, **R**esearch, and **O**utreach for **T**raining **E**ducators, **C**aregivers, and **T**eens) Lab focused at the University of Colorado. Her research is focused on identifying and implementing firearm injury prevention for children and adolescents.

Research Areas and Current Projects
The lab focuses on multiple aspects of firearm injury prevention. Dr. Haasz is interested identifying the optimal means by which to identify the clinical visit (ED or primary care) to improve safe firearm storage. Currently, she is developing a tool to encourage safe storage or temporary transfer of firearms for youth at elevated risk for suicide, with a focus on engaging youth in both research and counseling stages. Complementary studies examine youth access to firearms, and the intersection between firearm access and mental health.

Learning Opportunities
Interns in the lab will have the opportunity to learn about research methods in youth firearm injury prevention. Interns will have the opportunity to participate in ongoing research, and gain experience in various research methods including qualitative research and database research. They will also be invited to participate in works-in-progress meetings where they will have the opportunity to hear about research being conducted by other firearm injury prevention or pediatric emergency medicine researchers.

Stacey L. Simon, PhD, DBSM Pulmonary and Sleep Medicine

Lab Overview
Dr. Stacey L. Simon, PhD, is a pediatric behavioral sleep medicine provider with a research focus on mechanisms underlying the negative physical and mental health consequences of insufficient sleep and circadian misalignment

(mismatch between the biological and social clocks) in adolescents. Adolescents are at high risk for insufficient and mistimed sleep due to biological, psychosocial, and environmental factors such as a physiological delay in circadian rhythms, high academic and social demands, and typically early high school start times. Dr. Simon's work has demonstrated associations between short sleep duration, late bedtimes, and circadian misalignment with insulin resistance, vascular impairments, and poor mood and behavior in adolescents including otherwise healthy youth and those with obesity, PCOS, and type 1 diabetes. The overall goal of the lab is to identify countermeasures to poor sleep and circadian health as a means of improving physical and mental health outcomes in adolescents.

Research Areas and Current Projects
Current ongoing studies include:
SUNRISE: a randomized clinical trial assessing the impact of increasing sleep duration on insulin resistance in adolescents with habitually short sleep.
SUNDIAL: a cross-sectional study examining sleep and circadian health in adolescents with type 1 diabetes.
Quantitative and qualitative data from these and other studies are available for analysis. Specific research questions interns could explore include:
- qualitative analysis of facilitators and barriers to healthy sleep in adolescents with obesity
- "morning larks" vs "night owls": differences in adolescents objective and subjective sleep health by chronotype
- anxiety and depression symptoms following a sleep extension manipulation in habitually short-sleeping adolescents

Learning Opportunities
Interns in Dr. Simon's lab will have opportunities to engage in multidisciplinary, collaborative research across the fields of sleep medicine, pediatric psychology, endocrinology, cardiology, genetics, and pulmonology. Clinical shadowing in these areas is also possible. Opportunities for direct interaction with study participants as well as analysis of previously collected data are available. Interns will participate in weekly lab meetings with journal club and career development discussions. This research experience offers a valuable opportunity for students to develop practical research skills and contribute to a deeper understanding of the relationship between sleep and cardiometabolic health. Successful interns will have opportunities to submit an abstract for presentation at a national scientific conference and may receive co-authorship on manuscripts.

Livia Veress, MD Pulmonary and Sleep Medicine

Lab Overview
The Center for Advanced Drug Development translational research laboratory, led by Dr. Livia A Veress as its Director, specializes in pediatric, pulmonary, critical care medicine, and disaster response medical research, with its mission to help invent, test, develop, and FDA approve new therapeutics for patients via in vitro and animal modeling research. Dr. Veress is an experienced researcher in the field with a focus on plastic bronchitis, lung fibrosis, airway fibrotic diseases (such as bronchiolitis obliterans), inhalation injury, acute respiratory distress syndrome (ARDS) and sepsis, utilizing rodent and pig models for research, as well as in vitro and ex vivo models.

Research Areas and Current Projects
The lab's primary goal is to enhance our understanding of the pathogenesis and treatment of various serious pulmonary and critical care diseases. As a translational research laboratory, we seek to uncover the underlying processes of serious diseases that have minimal to no treatments at the present, and then use this knowledge to target those specific pathways with novel therapeutics, such as repurposed or new drugs and devices. We model diseases in relevant animal models, and use these to perform cutting edge translational techniques to understand the disease continuum at physiologic, biochemical, tissue, cellular and molecular levels. Primary endpoints of efficacy of therapeutics are chosen with clinical relevance in mind (echocardiography, pulmonary function, EEG, etc.), for ease of translatability to humans, for follow-on clinical trials and FDA approval. Precision cut lung slice ex-vivo techniques, PCR, Western blots, cytokine ELISAs, tissue histopathologic assessment under microscopy, proteomics, microbiome assessments, BALF analysis, RNAseq and cell culture primary cell isolation studies complement all in vivo animal studies. The lab is regarded as the leading animal modeling lab internationally for pulmonary fibrosis, bronchiolitis obliterans, pulmonary coagulation dysfunction, ARDS (large animal ICU), inhalation injury and acute airway injury internationally, with several drug candidate identification and advancement.

Learning Opportunities
Interns in the Veress lab will have opportunities to engage with the spectrum of preclinical pulmonary and critical care research, tailored to the individual intern's interests and skill. A typical internship would include hands-on training with human tissue culture, direct measurements of RNA and protein, PCR, and preclinical pharmaceutical testing to include animal handling, dosing, and data acquisition with assessment. Exposure to more advanced techniques in cardiac/pulmonary physiology, biomarker assays (CBC, cytokines, organ function biomarkers), RNA-seq, precision cut lung slices (PCLS), and others will be integrated with an individual intern's project. We will also discuss fundamentals of scientific presentation and scientific careers according to the intern's own goals. Successful interns will be credited for their work in national and international presentations and may receive co-authorship on resultant publications, allowing for meaningful scientific contribution and advancement towards their own career goals.

Masanori Hayashi, MD Solid Tumor Program

Lab Overview
The Hayashi lab is dedicated to investigating the biology of pediatric sarcoma metastasis. The primary research objectives are to develop targeted anti-metastasis therapies and identify biomarkers that can predict treatment failures and relapses with metastasis. The lab conducts a comprehensive program focused on liquid biopsies, including the detection of circulating tumor cells and circulating tumor DNA in pediatric sarcoma patients. Dr. Hayashi and team actively engage in preclinical investigations, concentrating on specific targets to disrupt the metastatic process in high-grade sarcomas.

Research Areas and Current Projects
The Hayashi lab is involved in the investigation of the biology of pediatric sarcoma metastasis, with the aim of developing precise anti-metastasis therapies. Specifically, there are multiple projects aimed at testing novel therapeutic targets in pediatric sarcomas using cell culture models and mouse models of sarcomas. We use a variety of molecular biology tools, such as RNA-seq, whole genome sequencing, single cell RNA sequencing, CUT&RUN, among many standard experimental techniques. The second goal of the lab is to develop novel biomarkers to identify patients at risk of conventional therapy failure and relapse with metastasis. The lab is the correlative biology sample center for multiple national trials, testing this rich library of samples with who genome sequencing, single cell RNA sequencing, and ddPCR. There are multiple stages of investigations ongoing for biomarker testing, ranging from early-stage discovery studies to late (closer to clinical implementation) validation studies.

Learning Opportunities
Interns in the Hayashi lab will be assigned specific individual projects, where the intern is expected to have full ownership of their specific project. Projects are determined prior to the start of the internship through multiple meetings, to meet the experience level and career interests of the student. Under guidance of the lab members, interns are expected to study the background prior to starting the internship, learning specific experimental techniques pertinent to their projects through repetition, and to be able to present a completed result at the end of the internship. The main focus will be on having a complete experience that can contribute to the career development of the intern. The experience is designed to offer students opportunities to develop practical laboratory skills, gain confidence to work semi-independently in the lab, and to learn the fundamentals of scientific presentations. Previous successful interns have been credited for their work in national and international presentations and have received co-authorship on resultant publications.