# Meet the Faculty of the 2026 Summer Child Health Research Internship

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

Contents

## Celiac Disease Research Team

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**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 team 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).

## Ayelet Talmi, PhD, IMH-E®, Psychiatry-Harris Program and Pediatrics

**Overview**
CLIMB (Consultation Liaison in Mental Health and Behavior) provides integrated behavioral health services to pediatric populations in three primary care clinics at Children's Hospital Colorado: Child Health Clinic, Special Care Clinic, and Young Mothers and Families Clinic. The multidisciplinary team of psychologists, psychiatrists, behavioral health navigators, and behavioral health trainees provides the full continuum of integrated behavioral health services in the context of a pediatric medical home. Our research program uses clinical informatics and a mixed methods approach (quantitative and qualitative) to track, characterize, and evaluate the impact of integrated behavioral health services in pediatric primary care settings. Examples of ongoing projects include evaluating: adolescent depression, anxiety, substance use, sleep, psychosocial risk and adversity on child health outcomes, early childhood interventions, weight management and healthy lifestyle, neurodevelopmental disorders, ADHD, gender affirming care practices, health services and systems utilization based on medical and behavioral health diagnoses, and health disparities on service utilization and health outcomes.

**Research Areas and Current Projects**

1) **Early childhood population**: evaluating the HealthySteps intervention – a birth to three, evidence-based intervention pairing a developmental specialist with a primary care provider to see families at all well child visits in the first three years of life; examining child health and health systems outcomes including breastfeeding duration, parent-child relationship quality, child development, adherence to well child visits, utilization of emergency and urgent care, pregnancy related mood and anxiety disorders, and family psychosocial stressors
2) **Adolescent population**: evaluating adolescent depression and suicidality, gender identity and sexual orientation, substance use, sleep hygiene, and family psychosocial stressors impacting adolescent well-being
3) **Health equity and access**: examining socio-demographic and programmatic factors that impact access to integrated behavioral health services; language equity in ADHD treatment in primary care; language and socio-demographic factors influencing enrollment in integrated behavioral health services

Projects recently presented or accepted for presentation at national conferences:

- *Optimizing intensive health behavior and lifestyle treatment for children with obesity: A hybrid approach*.
- *"S" is for sex: Discussing sexual activity, sexual orientation, and gender identity in primary care.*
- *A step in the right direction: Exploring equity and access to the HealthySteps program.*
- *Pay Attention! Integrated behavioral health supporting ADHD management in pediatric primary care.*
- *If you snooze you lose: Detecting adolescent sleep problems in pediatric primary care.*
- *It's all in your HEADSS: Primary care provider response to adolescent substance use.*
- *Don't worry, be happy: Assessing and addressing pediatric anxiety in primary care*.

*Silent struggles: Examining trauma and adversity in the context of adolescent depression in pediatric primary care.*

**Learning Opportunities**

The research intern will join a research team that includes a data scientist, a biostatistician, a research manager, a research assistant, and principal investigators to develop a project based on interest. The intern will learn about electronic health record data collection, clinical informatics as a driver for clinical decision-making, assessment of health outcomes to determine program impact, and enhancing clinical care through research and quality improvement efforts. In addition to developing an individualized project, the intern will be included in ongoing research projects and have the opportunity to collaborate on publications and presentations to national meetings. The intern will also have opportunities to shadow clinical services (weekly if desired) and participate in weekly lab/team meetings where research, clinical care, and policy and advocacy efforts are discussed.

## 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.

## Caitlin Lewis, PhD Critical Care

**Lab Overview**
The research program led by Dr. Caitlin Lewis, PhD, aims to better understand how blood vessels in the lung change and remodel during pulmonary hypertension (PH) — a serious disease caused by high blood pressure in the lungs that currently has limited treatment options. Our lab focuses on how macrophages, a key type of immune cell involved in vascular disease, contribute to the development of PH, with the goal of identifying new therapeutic and diagnostic strategies.

**Research Areas and Current Projects**
We use a variety of models to study macrophage-driven mechanisms of PH, including the chronic hypoxia mouse model (which simulates high altitude), cell culture systems, and bio-banked human lung tissue. Our work examines how macrophages are reprogrammed in low-oxygen environments to interact with vascular cells and drive disease progression.
Current projects in the lab include:

- Investigating how antioxidant signaling influences platelet–macrophage interactions during PH
- Characterizing macrophage–vascular cell communication in vascular remodeling
- Defining the role of a vessel-associated macrophage subset that recognizes the extracellular matrix component hyaluronan in PH
- Developing primary cell and tissue culture models to study how hyaluronan–macrophage interactions contribute to pulmonary vascular disease

**Learning Opportunities**
Interns will have the opportunity to gain hands-on experience with molecular and cell-based techniques such as flow cytometry, immunohistochemical staining, qPCR and western-blotting, using samples collected from our experimental models of PH and/or human lung tissue. In addition to these technical skills, interns will build a strong foundation in lung and vascular biology, learn about the mechanisms that contribute to pulmonary hypertension, and develop their abilities in experimental design, hypothesis generation, and critical thinking.

## Hui Zhang, MD, PhD, Critical Care Medicine

**Lab Overview**

Dr. Hui Zhang, MD, PhD, a key member of Dr. Stenmark's laboratory within the Section of Pediatric Critical Care and the Cardiovascular and Pulmonary Research Laboratory, was honored as a Senior Expert in Research in 2025 by the Pediatrics Instructor Recognition Committee. The group investigates the cellular and molecular mechanisms that contribute to structural remodeling of the pulmonary vasculature and right heart dysfunction in the context of pulmonary hypertension (PH), a progressive, life-threatening disease affecting both children and adults.

**Research Areas and Current Projects**

The laboratory conducts multiple projects focused on cardiovascular and pulmonary diseases, with a particular emphasis on understanding how pulmonary artery vascular cells become activated and contribute to vascular remodeling. To address these questions, the lab employs diverse models across species, including bovine, rat, and mouse models of PH induced by hypoxia or genetic modification, as well as cell and tissue cultures derived from both animal and human sources. Using cutting-edge spatial approaches that integrate high-resolution imaging with transcriptomic profiling at single cell level, the team investigates how cellular and molecular networks drive immune dysregulation, inflammation, metabolic programming, and structural remodeling within the pulmonary vascular wall.

**Learning Opportunities**

Interns in Dr. Stenmark's laboratory, mentored by Dr. Zhang, have a unique opportunity to actively participate in research that advances the understanding and treatment of PH. They will gain a solid foundation in the structure and function of the pulmonary circulation and learn key organoid, cellular, and molecular techniques using lung, heart, and blood samples from both animal models and human donors. This hands-on experience provides interns with valuable exposure to experimental methods and laboratory procedures in critical care and pulmonary vascular biology, building both practical research skills and a broader understanding of the challenges and opportunities in the field.

## 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.

## Jennifer McKey, PhD Developmental Biology

**Lab Overview**

The McKey laboratory studies the development of the mammalian ovary to identify the developmental origins of female reproductive health. Research in the lab focuses on the perinatal determinants of fertility—specifically how the architecture of the ovary is established around the time of birth, and how variations in this process influence adult reproductive health. To achieve this, the lab uses the mouse ovary as a model system to decode how embryonic patterning dictates adult physiological function. By integrating advanced 3D imaging with single-cell molecular profiling, the lab aims to construct a complete blueprint of ovarian development that links early cellular decisions to long-term female health.

**Research Areas and Current Projects**

Current work in the McKey Lab focuses on three fundamental questions in reproductive biology:

1. **Mechanisms of Ovarian Regionalization:** How does the ovary organize itself into two distinct functional zones: the **cortex** (home to the long-term ovarian reserve) and the **medulla** (site of initial follicle activation)? We investigate how mechanical forces cooperate with molecular signals to guide ovarian cells into these specific regions.
2. **Establishment of the Ovarian Reserve:** How is the finite pool of oocytes is distributed and maintained? Specifically, the lab is exploring why (and how) a subset of follicles in the medulla is programmed to activate immediately after birth and perish by puberty, while cortical follicles remain quiescent to support fertility in adulthood.
3. **Extrinsic Regulation by the Rete Ovarii:** The ovary does not develop in isolation. A major project in the lab is defining the role of the **rete ovarii (RO)**, a historically understudied epithelial structure attached to the ovary. We hypothesize that the RO acts as a communication hub, integrating endocrine signals to regulate ovarian development and homeostasis.

**Learning Opportunities**

Interns in the McKey Lab will gain hands-on experience with cutting-edge biomedical research techniques applied to reproductive and developmental biology. Using the mouse as a model system, interns will learn to image intact organs in 3D, using tissue clearing and 3D fluorescence microscopy to image the ovary in its native conformation. Using

advanced bioimage analysis pipelines, they will learn to measure the ovarian reserve and assess follicle dynamics. Interns will also be given the opportunity to engage with single-cell transcriptomics datasets to understand how gene expression profiles drive cell fate and tissue architecture.
This experience offers students an opportunity to develop practical skills in developmental biology, microscopy, and data analysis, contributing to projects that advance our understanding of female reproductive health.

## 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.

## 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.

## Julia Dunn, PhD, Gastroenterology, Hepatology and Nutrition

**Lab Overview**
The Dunn Lab explores intriguing and unexpected aspects of innate immunity with the goal of revolutionizing treatment of allergic diseases. Dr. Julia Dunn, PhD, is an experienced researcher in the field and the newest faculty hire to the Gastrointestinal Eosinophilic Diseases Program (GEDP).

**Research Areas and Current Projects**
Our cell type of interest is the eosinophil, which is thought to be a pro-inflammatory cell that causes allergic disease when it becomes activated. Recent studies, however, have shown that eosinophils may have important non-inflammatory roles in tissue development and healing. Research in the Dunn Lab explores 1) how eosinophils specialize in different environments, 2) how specialized eosinophils interact with other cells in the environment, and 3) how pro-inflammatory eosinophils may be re-specialized to assist in tissue repair. To address our core questions, we use murine models of allergic disease as well as human organoid tissue cultures to understand how eosinophils respond to environmental signals and how they, in turn, impact their surrounding tissues. We will use microscopy, flow cytometry, and transcriptomic analysis to understand reciprocal changes that occur in eosinophils, epithelial cells, and fibroblasts in the mucosal environment.

**Learning Opportunities**
Dr. Dunn has substantial experience mentoring undergraduate and graduate students in both the technical aspects of laboratory work and the analytical skills that constitute true scientific training. Interns will gain experience reading and analyzing the scientific literature, designing and executing experiments, and assessing the results via statistical analysis and data visualization. Some ongoing projects in the Dunn Lab involve analysis of transcriptomic data, so students may gain experience with statistical analysis in R if they choose. It is expected that the data generated during this internship will be included in subsequent publications, for which the student will be credited as a contributing author.

## 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.

## Jenna Demedis, MD, MS Hematology/Oncology

**Lab Overview**
Jenna Demedis is an Associate Professor of Pediatrics in the Section of Hematology/Oncology and Clinical Director of the HOPE Cancer Survivorship Program. She conducts clinical research with the overarching goal of improving quality of care for patients with and surviving cancer, with most research focusing on adolescent and young adults (AYAs). Within AYA oncology, Dr. Demedis's areas of research include sexual health and transition of care for young adult survivors. Within general cancer survivorship, Dr. Demedis's research includes efforts chemotherapy-induced neuropathy and survivorship needs/clinical care optimization. Dr. Demedis utilizes observational study design, Dissemination and Implementation science methods, and qualitative/mixed methods in her research.

**Research Areas and Current Projects**

- AYA Oncology and Sexual Health: Dr. Demedis's work focuses on development and evaluation of a standardized sexual function screening process for AYA oncology patients. This project employs implementation science methods to design end-user driven interventions, as well as mixed quantitative and qualitative methods. Within this area, the following projects could be considered:
    - Survey or qualitative research project aimed at understanding parent/caregiver perspectives with regard to AYA healthcare within oncology (health independence, privacy, AYA-targeted screenings, etc.).
    - Literature review describing sexual healthcare laws/restrictions for minors across the United States
    - Development of survey understanding external provider perspectives and interest in a sexual health/function screening intervention project and barriers/facilitators to implementation at their site.
    - Survey or literature review of current practices and development of recommendations with regard to post-pelvic radiation supportive care for AYAs.
    - Participation in ongoing study evaluating sexual health educational brochure for patients
- Cancer Survivorship: The Demedis Lab and CCBD have multiple ongoing survivorship-focused research projects, including participation in multicenter interventional studies on physical activity and mental health/resiliency programming. Within this area, the following projects could be considered:
    - Contribution to multicenter trial patient identification, eligibility, screening and enrollment.
    - Development of qualitative/survey based study to evaluate our Multidisciplinary Transition to Adult Care Program.
    - Contribution to study evaluating the utility of motion analysis through the Center for Gait and Movement Analysis for patients impacted by chemotherapy-induced neuropathy.
    - Development/conduct of needs assessment or patient/caregiver satisfaction assessment for the Children's Hospital Colorado HOPE Survivorship Program.

**Learning Opportunities**
Interns in the Demedis clinical research lab will have opportunities to engage with the spectrum of clinical cancer supportive care and survivorship research, tailored to the individual intern's interests and skill. 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 meeting with Dr. Demedis and with other team members as needed, and funding to research assistant and

statistician support. In addition to research, the intern will have the opportunity to shadow in the oncology and cancer survivorship clinics.

Interns can expect to gain both practical skills and a broader understanding of the challenges and opportunities in pediatric clinical research. Depending on the intern's interests and project choice, learning opportunities will gaining exposure to observational and interventional clinical research using quantitative, qualitative, and mixed methods and in the area of implementation science. Specific skills may be related to study design, survey development, interacting with clinical research participants (screening, consent, data collection), and performing a literature review. 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.

## 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.

## 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.

## Eileen I. Chang, PhD, MCR Neonatology

**Lab Overview**

Dr. Eileen Chang is a fetal physiologist specializing in cardiovascular development and striated muscle metabolism. Her lab investigates the physiological and molecular mechanisms underlying the "Developmental Origins of Health and Disease," which links abnormal fetal growth patterns to an increased risk of adult-onset cardiovascular and metabolic diseases. Her research focuses on cardiomyocyte growth, maturation, contractility, and metabolism in both normally developing fetuses and those with placental insufficiency-induced fetal growth restriction (FGR), aiming to develop therapeutic strategies to support heart growth before or after birth.

**Research Areas and Current Projects**

About 10% of pregnancies in the U.S. experience reduced placental transport of nutrients and oxygen to the fetus, which can lead to FGR and low birth weight. Clinical studies in growth-restricted fetuses, children, and adults show impaired heart contractility, structural remodeling, and a higher long-term risk of high blood pressure and heart disease. We found that the hearts of FGR fetal sheep are more immature and exhibit lower expression of genes involved in calcium handling and contractile proteins, indicating compromised heart function compared with normally growing control fetuses. The current projects aim to investigate how FGR affects heart contractility through functional studies using fetal heart cells and muscle fibers. These studies will provide new insights into FGR-related cardiac dysfunction and help identify innovative targeted treatment strategies.

**Learning Opportunities**

Dr. Chang's lab uses integrative approaches to study fetal physiology, from whole-animal studies to tissue, molecular, and cellular experiments. Interns in Dr. Chang's lab will have the opportunity to engage in fundamental cardiovascular research, including RNA and protein analysis of heart tissues, as well as hands-on cell culture training. Working closely with Dr. Chang and her team, interns may contribute to ongoing projects focused on cardiomyocyte growth, maturation, contractility, and metabolism. Any work that results in publication will lead to co-authorship and opportunities to submit abstracts for presentation at scientific meetings.

## Stephanie Skuby Chassen, MD Neonatology

**Lab Overview**

The Chassen lab, led by Dr. Stephanie Skuby Chassen, MD, is a basic/translational research lab in the Section of Neonatology. Our research focus is the metabolism and transport of fatty acids across the placenta during pregnancy, particularly in pregnancies affected by fetal growth restriction (FGR). Fatty acids are crucial for brain development, and by exploring the cellular mechanisms in both the placenta and fetus that affect fatty acid metabolism we hope to better understand its alteration in pathologic pregnancy conditions, as well as the associated long-term outcomes. This information could help tailor perinatal nutritional strategies to improve long-term outcomes (particularly neurodevelopmental) in these infants.

**Research Areas and Current Projects**

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

1. Exploring the effect of oxidative stress on the incorporation of long chain polyunsaturated fatty acids into specific complex lipid molecules in cultured primary human trophoblast cells.
2. Investigation of fatty acid and complex lipid molecule profiles in placenta, cord blood and maternal blood from pregnancies complicated by fetal growth restriction compared to healthy pregnancies with appropriately grown fetuses.

3. Exploring potential correlations between fetal and placental fatty acid concentrations and neurodevelopmental testing scores at 9- and 18-mo of age in infants from pregnancies complicated by fetal growth restriction compared to normally grown infants from healthy pregnancies. (enrollment to start in 2026)
4. Understanding the placenta's ability to synthesize long chain polyunsaturated fatty acids from their essential fatty acid precursors.

**Learning Opportunities**
Students in Dr. Chassen's lab will have the opportunity to participate in basic/translational research related to mechanisms of fatty acid metabolism in human pregnancy, with direct implications for fetal and neonatal health. They will learn to develop hypotheses and obtain hands-on experience with human placental tissue sample processing and fundamental molecular and cellular techniques including protein and/or RNA analysis, histology and immunohistochemistry. Based on the level of interest and ongoing work in the lab at the time, students may have the opportunity to shadow research assistants and/or postdoctoral fellows engaged in more complex bench work, including isolation of primary human trophoblast cells and fatty acid uptake studies. The goal is for each student to complete a project that leads to a lab meeting presentation, as well as an abstract submission to attend a regional or 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, increasing susceptibility to adult metabolic disease, a concept termed developmental programming. Our primary research aims to understand the effects of fetal growth restriction (FGR) 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 focus on understanding how hypoxia and lactate disrupt fetal hepatic metabolism, initiating hepatic insulin resistance and fibrosis. This is important because offspring born with FGR have increased susceptibility to diabetes and metabolic-associated steatotic liver disease (MASLD) across their lifespan. We also have projects investigating the effects of maternal high-fat consumption on offspring liver metabolism.

**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 of 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.

## Jessica Solomon Sanders, MD Neurodevelopmental Disabilities

**Lab Overview**
Dr. Jessica Solomon Sanders is Assistant Professor of Pediatrics, Section of Developmental Pediatrics, and Neurology at the University of Colorado School of Medicine. Her career focuses on enhancing the lives of patients with neurodevelopmental disabilities through the lifespan by utilizing her combined background of special education and medicine to improve access to and quality of age-appropriate, specialized healthcare. She completed the 6-year Neurodevelopmental Disabilities (NDD) residency, which included two years of pediatrics and four years of adult and child neurology and NDD at Boston Children's Hospital. Dr. Sanders founded an adult neurodevelopmental clinic within adult neurology at the University of Colorado, and she oversees the Transition-to-Adulthood Clinic in Developmental Pediatrics at Children's Hospital Colorado.

**Research Areas and Current Projects**
1. Joint Opportunities for Bridging Wellness, Integration of Community Services, and Supported Employment (JOBWISE) – 5-year HRSA-funded grant that is establishing a framework for transition-to-adulthood between medical and community settings that includes employment as a key piece of transition-to-adulthood. Currently in year 2 of 5.
2. Improving Health Care Communication and Engagement for Adults with Down syndrome – 5-year NIH-funded grant utilizing Conversation Analysis, a qualitative technique, to evaluate communication between Adults with Down syndrome and primary care providers. Currently at the start of year 1.

**Learning Opportunities**
1. Qualitative analysis
2. Poster creation and design
3. Administering and scoring surveys

## 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 how complement affects the small blood vessels of the kidney and other organs during health and disease.

Our focus is on the role of complement in mediating vascular injury in the kidney. Complement is a component of the immune system that rapidly responds to internal and external threats in the body, but can cause severe kidney disease when dysregulated or overly active. There has been a recent major increase in interest in understanding complement, with several exciting new drugs targeting the complement pathway approved in the past year alone.

We are particularly focused on specific regulators of the complement pathway, known as Factor H (FH) and Factor H Related (FHR) proteins. Specific mutations of FH and FHRs are known to cause kidney disease in patients, and we are exploring the role of these regulators in microvascular kidney injury. To achieve this, we use multiple approaches including cell culture under flow conditions to examine these effects. This approach allows us to explore mechanisms unique to the microvasculature under flow—providing a unique niche of investigation that traditional culture and animal studies cannot provide.

**Learning Opportunities**
The goal for all lab members is to provide projects that allow for intellectual and technical growth, irrespective of experience level. The lab works with new members to identify projects that best fit their interests and established skills. As a highly collaborative lab, we encourage input from all members in planning and interpretation of studies. There is a wide range of techniques utilized in the lab, including:

- Cell culture
- Immunofluorescence
- Immunohistochemistry
- Flow cytometry
- Immunoblotting
- ELISA
- Recombinant protein production
- Cloning and mutagenesis
- Live microscopy imaging

Trainees receive support in methods, data analysis, and applying results to subsequent experiments. Our philosophy is that trainees have ownership of their projects, from initial planning through data analysis, interpretation, and ultimately presentation. Any work contributing to publication will lead to co-authorship, as well as opportunities for submission to scientific meetings.

## Kristen Boyle, PhD Nutrition

**Lab Overview**
Dr. Kristen Boyle's lab investigates how early-life environments influence lifelong health, with a special focus on nutrition and metabolism. The lab uses cutting-edge techniques to study how conditions during pregnancy, such as maternal obesity, diabetes, and environmental exposures, can shape a child's future risk for metabolic diseases like obesity and type 2 diabetes.

**Research Areas and Current Projects**
The lab's research centers on mesenchymal stem cells (MSCs), which are collected from infant umbilical cord tissue. These cells offer a unique window into how maternal health affects fetal development. By using advanced cell culture and molecular biology tools, including 3-dimensional cell culture and mitochondrial metabolism measures, the team explores how prenatal exposures change stem cell behavior and metabolism.
Current projects include:

1. **Maternal Stress and Infant Metabolism**: Studying how maternal stress biomarkers during pregnancy influence stem cell metabolism and a child's risk for obesity.
2. **Fat Cell Function**: Investigating how the size of fat cells affects their metabolic activity and inflammatory potential.
3. **Multi-Omics Analysis**: Using integrated data approaches to connect maternal health, stem cell characteristics, and long-term metabolic outcomes in children.

**Learning Opportunities**
Interns in Dr. Boyle's lab will be immersed in a collaborative research environment focused on early-life influences on metabolism. They will gain hands-on experience with core lab techniques such as cell culture, mitochondrial respiration assays, and confocal microscopy, while also learning how to analyze and interpret data. Throughout the internship, students will be introduced to the scientific method, including hypothesis development, experimental design, and data-

driven inquiry. Interns will be mentored by lab members and encouraged to engage in scientific discussions, explore areas of personal interest, and present their findings in lab meetings or informal settings. This experience is designed to build foundational skills in biomedical research and foster curiosity about the connections between maternal health and child development.

## Stephanie Gilley, MD, PhD Nutrition

**Lab Overview**
Dr. Gilley is a clinical-scientist focused on multiple areas of pediatric nutrition. The Gilley Lab's primary goal is to improve lifelong health by optimizing nutrition during infancy and early childhood.

**Research Areas and Current Projects**
Our main project centers on how fetal growth restriction changes development of the intestine and establishment of the gut microbiome which then contributes to adverse metabolic outcomes in a mouse model. Other projects look at the role of the gut microbiome in growth outcomes in children in low resource settings; the nutritional gaps of homemade infant formula recipes found across the internet; and the role of iron in infant formulas on development of the microbiome.

**Learning Opportunities**
Students in the Gilley lab can gain hands-on experience with cell culture, DNA/RNA extraction, PCR, and DNA and protein blots. All new members of the lab will learn techniques and data analysis with appropriate supervision and support with increasing independence as mastery is demonstrated. Undergraduate and medical students with a background in epidemiology, statistics, or public health could have an opportunity to analyze existing datasets to ask novel questions. Motivated medical students could also have the opportunity to contribute to a peer-reviewed manuscript such as a case report, short review, or other. Dr. Gilley is also passionate about communication skills and the components of good presentations which will also be taught through practice.

## 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.

## Stephanie Nakano, MD Pediatric Cardiology

**Lab Overview**
The Nakano laboratory focuses on pediatric heart failure and transplantation. Dr. Nakano specializes in the care of children with end-stage heart failure, which can be due to congenital heart disease or cardiomyopathy, many of whom then require heart transplantation.

**Research Areas and Current Projects**
The Nakano lab performs basic and translational research utilizing patient-derived samples. The current projects in the Nakano lab are focused in two main areas:

1. Children with single ventricle congenital heart disease are at lifelong risk of developing heart failure. Nevertheless, traditional heart failure medications are not effective in this population and these children often require heart transplantation. Our goal is to understand factors that may predispose certain patients to early heart failure to identify novel therapeutic medications and approaches. The lab creates cardiac cells from white blood cells from single ventricle patients and matures these cardiac cells in long-term culture. Contractility

measurements, gene expression, and sarcomere morphology are compared between cells from single ventricle patients and normal controls. Additionally, the lab is interested in evaluating immune and inflammatory abnormalities which may contribute to poor outcomes in single ventricle patients.
2. While a heart transplant can be live-saving, there are significant co-morbidities associated with heart transplantation, including acute rejection and cardiac allograft vasculopathy. Our goal is to identify changes in T cell populations to see if they can be used as early biomarkers for rejection or vasculopathy. Using blood samples collected from pediatric heart transplant recipients, we are collaborating with Immunology labs on campus to evaluate T cell populations in depth.

**Learning Opportunities**
Interns will have a unique opportunity to gain expertise in basic and translational cardiology research utilizing human samples from one of the largest pediatric cardiac biobanks in the country. Lab members have exposure to a wide range of wet bench techniques, including peripheral blood mononuclear cell isolation, induced pluripotent stem cell culture, permeabilized single cell contractility measurements, multiplexed immunohistochemistry, single cell RNAseq, and proteomics. Furthermore, we have frequent discussions of scientific results and how they fit into the clinical context. It is our hope that successful interns will have the opportunity to present their work and be co-authors on publications in an environment that will support their future career goals.

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

**Lab Overview**
**I**nnovations 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

## 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.