

## Potential trainee research projects

*This list contains just a sample of potential short-medium term pediatric research projects. The list is not comprehensive. Visit <https://www.pedsresearch.org/people/faculty/> to learn about more pediatric faculty interests*  
 Trainees may contact faculty directly to inquire about any specific projects on this list.

### Clinical Research Projects

Faculty Researcher Name	Research Discipline	More Information
Laura Blackwell, PhD	Critical Care Neurology including autism Neuropsychology	Our lab focuses primarily on diagnostic biomarker discovery within the spectrum of traumatic brain injury (mild to severe) as well as the role in biomarkers in predicting functional outcomes in children. We have several ongoing research projects that the student could be involved in, including enrollment, data collection, entry, and analysis. We would expect a poster presentation and manuscript at the end of the time period. (With Dr. Andrew Reisner)
Rebecca Burger, MD	Emergency Medicine	Quality improvement project to reduce the number of attempts to complete CT and reduce failed sedation attempts to complete CT in pediatric patients in the emergency department.  Chart review and entering data into RedCAP database. Participate in quality improvement plan-do-study-act (PSDA) cycles.
David Greenky, MD	Emergency Medicine	Implementation of Pediatric Disaster Center of Excellence grant  Assist in developing and implementing HHS ASPR grant (grant application already submitted, there will be wiggle room for actual implementation plan). Focus for our site will be infectious disease pathogens and education.
Nandini Govil MD, MPH	Surgery Palliative Care	A qualitative interview based study examining the role of parental grief after a child is diagnosed with sensorineural hearing loss, as well as ways to mitigate and support parents during this difficult time.  The Discovery student would help identify and enroll eligible subjects, and conduct structured interviews on parental grief. The student would be involved in coding the interviews and be primary author on the eventual manuscript.
Samantha Hill, MD, MPH	Infectious Disease Adolescent Medicine	This project focuses on HIV prevention using biomedical tools like pre-exposure prophylaxis (PrEP) as well as mHealth to adapt an mHealth app that will increase the uptake and successful use of PrEP among Black adolescents and young adults.  Students will learn quantitative, qualitative, mixed methods, and community-engaged methodologies and strategies. Students will be engaged in data analysis. There will also be opportunities for abstract and poster submissions and presentations and authorship on publications.

Benjamin Kopp, MD	Cystic Fibrosis	The Kopp lab has several ongoing basic science, translational, and clinical projects related to host-pathogen-environment interactions that cause chronic lung disease in children with cystic fibrosis, sickle cell, and long-COVID. Trainees can participate in hands-on bench studies with human cellular or airway models, omics-based analyses, or clinical data projects. See our lab site for more details <a href="https://www.pedsresearch.org/research-group/kopp-lab">https://www.pedsresearch.org/research-group/kopp-lab</a> . Trainee projects can be tailored to individual goals. Dr. Kopp routinely interacts with trainees at all levels, from high school to medical fellows.
Tobey MacDonald, MD	Cancer/Blood Disorders	Clinical/translational research of patient outcomes after treatment for childhood brain cancer Perform clinical research in pediatric brain tumor population using questionnaires and/or clinical data to link genetic testing and/or clinical data obtained from medical record to outcomes (e.g. neurocognitive, survival, response to treatment and treatment-related toxicity)
Nathalie Maitre, MD	Neurology Neonatology	Observational and interventional patient-based research related to development of pre-term infants and young children with varying developmental needs and their families.  All students are encouraged to participate in ongoing projects and lab activities, including trainings, scientific posters, presentation, and publications.
Tamara Miller, MD	Cancer/Blood Disorders	Children with cancer undergo intensive therapies that can cause significant treatment-related side effects, or toxicities. The focus of our research group is to better identify and understand toxicities that patients experience. This is accomplished through development of detailed datasets using a combination of chart abstraction and use of automated extraction of electronic medical record data. There are several ongoing studies developing these datasets and using them to answer clinical research questions about toxicities of therapy.  Discovery students will be involved in performing chart abstraction to expand the cohort of leukemia patients that will be used for the analyses and to identify the toxicities. The student will be involved in analyzing the data in the cohort to answer these clinically relevant questions and determining how the results can be used to impact clinical care.
Claudia Morris MD	Emergency Medicine/Infectious Disease	Use of novel virtual reality tool to identify concussion in the emergency department
Sampath Prahalad, MD	Rheumatology	Investigation of joint acoustic emissions as digital biomarkers of juvenile idiopathic arthritis. As part of the discovery project we are looking for students interested in recording joint sounds from children with JIA as well as controls who are healthy children or those with orthopedic conditions. This will involve interactions with children with JIA in our pediatric rheumatology clinics at the Center for Advanced Pediatrics. In addition to getting trained in recording joint sounds, discovery students will have opportunities to observe the informed consenting process, shadow preceptor to understand the phenotypes of the diseases they are studying and attend rheumatology grand rounds, research meetings and journal clubs.

Christina Rostad, MD	Infectious Disease	<p>Clinical predictors and social determinants of health associated with severe pediatric COVID-19 and MIS-C.</p> <p>The Discovery student could perform medical chart abstractions, data entry into a multicenter database of pediatric patients with COVID-19 and MIS-C (PreVAIL consortium), statistical analysis, abstract write-up and presentation, contribute to manuscript. This would be a sub-study of the larger PreVAIL consortium, and the student could contribute to the parent study as well.</p>
Michelle Schoettler, MD	Cancer/Blood Disorders	<p>We are investigating novel diagnostic, predictive and prognostic markers in pediatric transplant- associated thrombotic microangiopathy (TA-TMA). One third of children will develop this complication after bone marrow transplantation and of them, more than half will develop multiorgan failure or die. We have retrospective and prospective studies investigating clinical features, outcomes and biomarkers.</p> <p>Student can select from several ongoing studies. Duties include some chart extraction, analysis (if they have this background, otherwise I will do this), writing an abstract and paper. Deliverables- abstract at Transplant and Cellular Therapy National Meeting (TCT), and pending project, manuscript within 1-1.5 years. Pending interest, we can identify related case reports/series for additional publications.</p>
Andi Shane, MD	Infectious Disease	<p>Retrospective, multi-site medical record review to describe the clinical, laboratory, imaging, and outcomes of infants with parechovirus infections. Potential for a prospective component to the study (under discussion) involving interaction with research participants and collection of residual laboratory specimens.</p> <p>Qualifications: Children's Epic access and familiarity with Epic and Redcap, human subjects research training at Children's and Emory.</p> <p>The Discovery student will gain an understanding of the clinical manifestations of parechovirus infections in infants, will contribute to the retrospective collection of data from medical records, will gain experience in the participation of a multisite study, and potentially may have an opportunity to participate in prospective enrollments.</p>
Elizabeth Stenger, MD	Cancer/Blood Disorders	<p>Hematopoietic cell transplantation for sickle cell disease, with either a focus on late effects post-transplant (registry data) or novel approaches to prevent graft-versus-host disease (clinical trial).</p> <p>Participate in regular study meetings with other investigators and statisticians, assist in data collection and subsequent data cleaning, assist in analyzing data, and assist in presentation of data (abstracts, manuscripts).</p>
Jinbing Bai PhD, RN	Nursing	<p>Trainees can help with patients consents, data collection, and manuscript preparation and other collaborations</p> <p>Dr. Bai's major research interest is cancer treatment toxicities, gut microbiome and the microbiome-gut-brain axis in children. He has several ongoing projects and welcomes trainees to join.</p>

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### Outcomes Research Projects

Faculty Researcher Name	Research Discipline	More Information
Maneesha Agarwal, MD	Emergency Medicine; Injury Prevention	<p>We have a variety of injury prevention projects, and have previously mentored students on outcomes research projects related to helmet use, safe sleep, adverse childhood experiences, and more in the past.</p> <p>Role and opportunities vary. If timing and interest align, could potentially present at a national injury prevention conference in December 2024 in Florida.</p>
Sharon Castellino, MD	Cancer/Blood Disorders	<p>Evaluating acuity of illness and association with race, ethnicity and age in childhood cancer.</p> <p>Role: Abstraction of presentation of disease in pediatric cancer                      Deliverables: poster at a meeting, potential authorship on a paper, commensurate with level of effort on project.</p>
Preeti Jaggi, MD	Infectious Disease Hospital sustainability	<p>Climate change is the biggest global threat to public health. The health sector contributes 8.5% to the total US carbon footprint. Pharmaceutical waste is a problem in pediatric hospitals due to weight based dosing and more use of suspensions. We have identified a running report of antibiotic waste and have previously published on ways to reduce this waste. In this project, we will identify ways to reduce all pharmaceutical waste (not just antibiotics) in a pediatric hospital.</p> <p>Participate in quality improvement/outcomes research methodologies to identify key reasons that pharmaceuticals are wasted, create and disseminate a survey of pharmacists, nurses, and clinicians, and outcome for publication of results.</p>
Claudia Morris MD	Emergency Medicine	<p>Become familiar with Pediatric Health Information Systems (PHIS) database, extrapolate data to answer study questions. Deliverables will be data for abstract and manuscript submission.</p> <p>Gun violence: Aim 1: Determine healthcare utilization after pediatric firearm injury by examining Pediatric Health Information Systems (PHIS) database to ascertain the overall hospital charge, length of stay, fatality rate, events and admission placement during hospitalization (intensive care unit vs inpatient floor vs operating room) in comparison to victims of motor vehicle accidents. Aim 2: Determine if recurrent pediatric healthcare utilization is increased comparatively for patients who are victims of firearm injury compared to victims of motor vehicle injury over a 2-year period from injury.</p>

Matt Oster, MD, MPH	Cardiology	Pediatric cardiologist at Children's Healthcare of Atlanta as well as a medical officer at the CDC's National Center on Birth Defects and Developmental Disabilities. When not seeing patients, I direct outcomes research activities using big data in a variety of domains among individuals with congenital heart disease, including newborn screening using pulse oximetry, neurocognitive outcomes, and long-term outcomes / quality of life across the lifespan. In addition, I have particular interests in the use of predictive analytics, technology, social media, and digital health in medicine, and I have received a "Healthcare Hero" award from the Atlanta Business Chronicle for development of PulseOxTool, a mobile app that helps providers in the screening of critical congenital heart disease.
Chris Rees, MD	Emergency Medicine/Global Health/Health Inequities	Using data collected from 7 countries as part of the Child Health and Mortality Prevention Surveillance (CHAMPS) network, we aim to understand specific gaps in clinical care that lead to mortality among children aged <5 years.  Assist with study design, data extraction, analysis, abstract preparation, and manuscript writing.
Miriam Vos, MD	Gastrointestinal/Hepatology, Nutrition, and Endocrine	This is a clinical research project based on reviewing charts of children who previously participated in research studies of liver disease to see if any have developed type 2 diabetes and to examine their insulin levels.  The student project would be to complete the chart review portion of the study to gather data from medical records, organize the data and present the results in an abstract and poster format.

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### Basic Science/Translational/Informatics Research Projects

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David Archer, PhD	Cancer/Blood Disorders	<p>Research interests are focused on the pathogenesis of sickle cell disease in respect to the generation, prevention and treatment of organ dysfunction. Our studies on the pathogenesis of sickle cell nephropathy are likely to examine the role of endothelial cells in the generation of both the proteinuria and the concentrating defects associated with renal dysfunction. In particular my lab employs hematopoietic stem cell transplantation to correct the hematological defect in murine models of sickle cell disease. We have considerable experience in the maintenance of sickle mouse colonies, transplantation, hematological and functional analysis of the outcomes. In our collaborative projects, these skills will enable us to generate the sickle phenotype in the models of oxidant stress included in this project and therefore allow us to investigate the role of various oxidant response genes in the pathogenesis of sickle vasculopathy.</p>
Swati Bhasin, PhD	Cancer/Blood Disorders	<p>We are studying the alternations in the bone marrow expression landscape in leukemia and are interested in finding markers related to disease treatment resistance/relapse in childhood T-cell acute lymphoblastic leukemia.</p> <p>Students will participate in in-silico analysis of bulk RNA and single cell datasets to investigate markers associated with disease relapse/therapy resistance.</p>
Ann Chahroudi, MD, PhD	Infectious Disease	<p>HIV persistence and cure: available projects include 1) Investigation of HIV persistence and latency reversal in naive and memory CD4+ T cells in tonsils and tonsil organoids; 2) High dimensional flow cytometric analysis of immune responses and SIV-infected cells from infant nonhuman primates (banked samples); 3) transcriptomic analyses of HIV reservoirs and their response to immunologic interventions (for students proficient in R).</p> <p>Role: experimental design, bench research, data acquisition and analysis Deliverables: lead author on conference abstract; lead/co-authorship on a manuscript; opportunity to apply for funding from IDSA and/or PIDS for the project.</p>

Shanmuganathan Chandrakasan, MD	Cancer/Blood Disorders; Rheumatology; Transplant; Immunology and immune dysregulation	<p>We are a translational immunobiology lab. We study the immunobiological basis of several autoimmune and hyperinflammatory disorders involving hematological, rheumatology, and GI system. We develop novel biomarkers, targeted small molecule therapies, and non-genotoxic stem cell transplant approaches for these disorders. We also do several short team clinical/ translational research projects.</p> <p>Discovery students can lead short-term clinical studies in immune disorders. I direct one of the largest immune dysregulation programs in the country with active clinical and translational research. Students can also participate in post-doc-driven translational work on identifying novel biomarkers and immunobiology of immune dysregulation disorders.</p>
Shanmuganathan Chandrakasan, MD	Cancer/Blood Disorders; Rheumatology; Transplant; Immunology and immune dysregulation	<p>Immunobiology of HLH and hyperinflammatory disorder</p> <p>Opportunity to develop novel assay and lead a sub-project evaluating hyperinflammatory disorders utilizing human subject samples</p>
Satheesh Chonat, MD	Cancer/Blood Disorders	<p>Chonat lab has several ongoing basic science, clinical and translational projects related to sickle cell disease, hemolytic anemias, transfusion biology, complement disorders and thrombotic microangiopathies. See the link for additional details. <a href="https://www.pedsresearch.org/research-group/chonat-laboratory">https://www.pedsresearch.org/research-group/chonat-laboratory</a> The student is welcome to discuss their interest and find the most suitable project based on their interests and timelines. Dr. Chonat currently mentors several trainees (medical student, resident, fellow and nurse practitioner) in their basic and clinical projects. These projects have helped mentees present their research in local and national meetings and be a co-author in publications. Current mentees have received Butcher Research Award (Resident research) and American Society of Hematology HONORS (Discovery project) awards for their projects.</p>
Cheryl Day, PhD	Infectious Disease Immunology Global Health	<p>Analysis of cellular immune responses, immune activation, and response to childhood vaccines in longitudinal cohorts of HIV-exposed and unexposed infants and children in Kenya.</p> <p>Discovery students can participate in generation of immunology data by conducting experiments to measure immune activation levels in plasma and peripheral blood mononuclear cell (PBMC) samples from longitudinal mother/child pairs enrolled in Kenya, including mothers with and without HIV. In addition, Discovery students will have the opportunity to analyze large multi-omics and flow cytometry data sets that have been generated from samples within these cohorts and determine the effect of early life maternal HIV exposure and immune activation on the developing immune system, response to childhood vaccines, and other health outcomes in children.</p>
Kiesha Fraser Doh, MD	Emergency Medicine	<p>To determine the association between adverse childhood experience and community gun violence exposure from participants in the Fragile Families Child and Well-Being Study Cohort.</p> <p>The Discovery student will be involved in data extraction, analysis, presentation, and publication.</p>

Tim Gershon, MD, PhD	Neurology including Autism	<p>The project will study how immune cells in the brain react to brain tumors, using mouse models. Our goal is to develop ways to get the immune cells to reduce brain tumor growth.</p> <p>Student will analyze recently generated data on gene expression in different cells within mouse brain tumors, including cancer cells, normal brain cells and immune cells. The work will require sorting through data in spreadsheet form, searching the literature to learn about highlighted genes, and planning follow up experiments.</p>
Joanna Goldberg, PhD	Cystic Fibrosis	<p>The lungs of cystic fibrosis (CF) patients can be co-infected by multiple species of bacterial pathogens; particular species have been associated with worse patient outcomes but the mechanisms responsible for bacterial-bacterial interactions and their impact on the host are poorly understood. This project will examine the competitive interactions that occur between different species of bacteria isolated from CF patients.</p> <p>The medical student will be actively involved in performing co-culture assays between bacterial pathogens, determining antibiotic resistances, extracting genomic DNA, and performing bioinformatic analyses. The student will work as part of a highly motivated team on a project that is expected to be presented at national conferences and be published in a relevant medical journal (such as the Journal of Cystic Fibrosis, Journal of Infectious Diseases, and/or Infection and Immunity).</p>
Grace Gombolay, MD	Neurology	Evaluating inflammation in refractory epilepsy, including efficacy of the ketogenic diet.
Grace Gombolay, MD	Neurology including Autism	The clinical course and risk factors for relapses in pediatric neuroimmunological diseases are often unknown. This project would examine those features in any of the neuroimmunological diseases including multiple sclerosis, optic neuritis, anti-MOG antibody demyelinating diseases and anti-NMDA receptor autoimmune encephalitis.
Grace Gombolay, MD	Neurology including Autism	<p>Autoimmune encephalitis can cause high morbidity and mortality. Biomarkers are needed to predict clinical outcomes to guide treatments.</p> <p>Looking for someone who is interested in working in the lab performing experiments including flow cytometry and cytokine analyses.</p>
Steven Goudy, MD	Surgery	<p>Identifying regenerative approaches to improving oral cavity wound repair in a cleft palate model</p> <p>The discovery student will be able to identify critical regulators of the oral cavity wound healing pathway and test regenerative strategies to repair the oral cavity.</p>
Steven Goudy, MD	Surgery	Identifying the role and requirement of TgfBR3 during osteoblast development and identifying novel ways to deliver TgfBR3 to induce bone formation in vivo.
Steven Goudy, MD	Surgery	<p>Develop immunoregenerative strategy to improve oral cavity wound healing in a cleft palate model.</p> <p>Determine the role and requirement of macrophages, neutrophils and T cells during oral cavity wound healing and helping identify drugable targets.</p>
Steven Goudy, MD	Surgery	<p>Develop bone regenerative strategies to repair bone loss in children.</p> <p>Perform surgical repair of bone loss with delivery of bone inductive agents and identify down stream targets.</p>
Andrew L. Hong, MD	Hematology/Oncology	Research is focused on high risk solid tumors (e.g. kidney cancers, soft tissue sarcomas and brain tumors). These cancers represent the areas of greatest need in Pediatric Oncology. His work uses functional genomic techniques (e.g. RNAi, CRISPR-Cas9) and the latest sequencing technologies (e.g. long range phased sequencing, scRNAseq, ATACseq) to identify new therapeutics and mechanisms in pediatric cancers.



Nadja Kadom, MD	Radiology/Neuroradiology/Pediatric Neuroradiology	Best Practices for Pituitary Imaging in Children Literature search & summary, abstract presentation as 1st author, manuscript writing (author position commensurate with effort)
Benjamin Kopp, MD	Cystic Fibrosis Pulmonary	The Kopp lab utilizes multidisciplinary and innovative approaches to advance our understanding as to how innate immunity contributes to the pathogenesis of chronic lung diseases. Available projects include translational lab research involving biomarkers of disease analysis, drug discovery pathways, or mechanisms of immune aging. Further tailored clinical studies in CF or sickle cell lung disease are available. <a href="https://www.pedsresearch.org/research-group/kopp-lab">https://www.pedsresearch.org/research-group/kopp-lab</a>  Deliverables include data generation for manuscript co-authorship, abstract generation for posters/conferences, training in translational research. Roles would be dependent on project and would include human sample data generation or data analysis of existing datasets.
David Ku, MD, PhD	Cardiac/Cardiology Surgery	Determine the potential for heart attack and stroke by testing patient blood in a microfluidic system. Guides anti-platelet therapy. Plan to start study at Grady in the next few months. Collect patient blood samples. Test blood using microfluidics. Analyze for statistical significance.
Christopher LaRock, PhD	Infectious Disease	The LaRock lab examines immune dysregulation during infectious disease. Our major focus is on group A Streptococcus (>1 billion annual infections in children as impetigo and pharyngitis), group B Streptococcus (neonatal meningitis), and Staphylococcus aureus (MRSA). We hope to better treat infection by restoring host protective and healing functions. Available projects use cell culture, donor tissue, and mouse models to study programmed cell death, barrier tissue invasion, transmission, virulence factors, and antibiotic failure.
Tobey MacDonald, MD	Cancer/Blood Disorders	Preclinical testing of novel anti-cancer drugs against brain cancer and cancer metastasis Perform standard assays of drug testing for efficacy against pediatric brain tumors with goal of development of drug to clinical trial
Tobey MacDonald, MD	Cancer/Blood Disorders	Link genomic/proteomic/metabolomic biomarkers to regulation of metastasis of childhood brain tumors Collaborate with investigators at Emory and/or GA Tech to profile patient-derived tumor specimens from pediatric brain tumors with respect to genomic/proteomic and metabolic markers associated with metastasis
Greg Melikian, PhD	Infectious Disease	Ebola entry inhibitor structure-activity study.
Greg Melikian, PhD	Infectious Disease	Control of antiviral activity of interferon-induced transmembrane proteins Learn cell biology, virology and biochemistry techniques, perform experiments and analyze data.
Greg Melikian, PhD	Infectious Disease	Testing and validation of Ebola virus entry inhibitors using a pseudovirus system Learn relevant techniques, perform experiments and analyze data.

Lefteris Michailidis, PhD	Infectious Disease	Interrogate mechanism of action of interferon-stimulated genes (ISGs) against hepatitis B virus, flaviviruses or coronaviruses.  Perform virology/cell-based experiments, learn and use lentivirus-based gene overexpression tools, CRISPR-based gene activation and knockout strategies in cell lines and primary cells, analyze data using ELISA, Immunofluorescence staining and microscopy, western blotting. Work together with PI and other members of the lab. Co-authorship on a manuscript. Gain experience in presenting data.
Lefteris Michailidis, PhD	Infectious Disease	Discover hepatocyte determinants of fatty liver disease in primary hepatocyte systems.  Learn how to work with primary human hepatocytes and apply cutting edge technologies including CRISPR and single-cell RNA-Seq. Identify cellular factors and pathways for follow up research that will lead to a co-authorship.
Claudia Morris MD	Cancer/Blood Disorders; Emergency Medicine; Infectious Disease	We have a new pilot project that evaluates the impact of IV arginine therapy on biomarkers of mitochondrial function and clinical outcomes.  Working with PI (Morris) and post-doc students consenting/enrolling subjects, entering data into a redcap database, analyzing biomarkers.
Kathryn Oliver, PhD	Cystic Fibrosis; Pulmonary	Study mechanisms by which suppression of ribosomal speed and fidelity influences expression of premature termination codons causally linked to Primary Ciliary Dyskinesia.  Learning opportunities will include cell culture (immortalized and primary human airway epithelia), qRT-PCR (RNA measurement), and western blot (protein analysis). Development of assays to monitor ciliary function may also be pursued.
Kathryn Oliver, PhD	Cystic Fibrosis; Pulmonary	Using clinically approved and investigational small molecules, determine the most effective combinatorial therapies for a specific subset of rare/uncharacterized disease-causing variants in the cystic fibrosis (CF) gene. Particular attention is given to mutations that occur in Black, Indigenous, and People of Color with CF.  Learning opportunities will include molecular techniques such as mammalian cell culture, in vitro drug delivery, membrane protein biochemistry, and quantification of transepithelial ion transport.
Dharmeshkumar Patel, PhD	Infectious Disease	Prediction of antiviral resistance mutations using molecular modeling and computational chemistry techniques in various viruses such as RSV, Influenza, SARS-CoV-2 etc.  Student will explore our well-established computational approach to predict the resistance mutations in RSV/Influenza/SARS-CoV-2/Norovirus for known antiviral molecules and validate with available experimental data. Based on the results student will be able to provide inputs to design molecules which are not impacted by resistant mutations and ultimately it could be a manuscript.

Marie-Claude Perreault, PhD	Neurology/autism	<p>Investigate changes in neuronal circuits that underlie early motor deficits in mouse models of ASD.</p> <p>The student will learn and perform experiments using single-neuron calcium imaging (neonatal CNS). Results may be publishable in the form of abstract (presented at conference) and contribute to a peer-reviewed publication.</p>
CK Qu, PhD	Cancer/Blood Disorders	<p>Anti-tumor immunity in Noonan syndrome. Addressing this knowledge gap will lead to a better understanding of the mechanisms underlying the malignant progression in Noonan syndrome, which may ultimately benefit the rational design of a more effective therapeutic strategy for the malignancies developed in Noonan syndrome.</p> <p>The student will examine developmental and functional changes in the mouse model of Noonan syndrome and potentially patient specimens.</p>
Stefan Sarafianos, PhD	Infectious Disease	<p>Studying drug resistance to Paxlovid, the main anti-SARS-CoV-2 therapeutic. We have predicted and confirmed mutations in the nsp5 protease of SARS-CoV-2 that impart resistance to paxlovid. Additional mutations from the clinic will be examined and characterized by testing susceptibility of paxlovid-resistant SARS-CoV-2 to other antivirals towards the discovery of second-generation anti-SARS-CoV-2 drugs.</p> <p>Clone SARS-CoV-2 replicons and building virus-like particles (VLPs) that carry mutations that may cause paxlovid resistance and testing the efficacy of new reagents to antivirals. S(h)e will work with a team of virologists, computational, and structural biologists to interpret the molecular basis of drug resistance as a prerequisite for the design of improved therapeutics. Of note, the replicons and VLPs are advanced BSL2 reagents built in our lab, which allow detailed interrogation of all steps of SARS-CoV-2 replication without being fully infectious.</p>
Stefan Sarafianos, PhD	Infectious Disease	<p>High throughput screening for the discovery of antivirals that inhibit Monkeypox virus. Initial screen will be conducted using the surrogate closely-related Vaccinia virus (MVA strain), which is a safe alternative (serves as vaccine against Vaccinia virus)</p> <p>Will help screen chemical libraries for identifying antivirals that block orthopox virus replication. S(h)e will conduct virological experiments with "safe" orthopox virus (MVA) and work with others to validate against monkeypox virus.</p>
Vahid Serpooshan, PhD	Cancer/Blood Disorders Cardiac/Cardiology Pulmonary	<p>3D printing and 3D bioprinting of in vitro models of diseases, including congenital and adult heart disease, and cancer.</p> <p>The student will work with medical imaging data to prepare the 3D CAD model of interest, 3D print and 3D bioprinting the created models, and use the in vitro models to study various physiological/pathophysiological processes.</p>
Vivien Sheehan, MD, PhD	Cancer/Blood Disorders	<p>The Sheehan lab works with engineers to develop red cell function assays for use in clinical trials and patient care. Most devices have completed analytic validation; clinical validation is now needed.</p> <p>The discovery student can analyze peripheral blood or red cells from individuals with sickle cell disease or healthy controls, or from control and sickle mouse models, and learn how to determine if values are associated with clinical course.</p>

Vivien Sheehan, MD, PhD	Cancer/Blood Disorders	<p>CRISPR/Cas9 based gene therapy is a promising approach to curing sickle cell disease. However, when we attempt to correct the sickle mutation, we can introduce insertions and deletions that can create abnormal hemoglobins or affect cell viability.</p> <p>The Sheehan lab has engineered cell lines with the most common mutations engineered in. Interested students can expand these cell lines and characterize their viability and the functionality and amount of hemoglobin produced, assessing the safety and efficacy of strategies for SCD gene therapy entering into clinical trials.</p>
Vivien Sheehan, MD, PhD	Cancer/Blood Disorders	<p>Fetal hemoglobin induction is an excellent strategy to ameliorate the symptoms of sickle cell disease. Cell based assays can be used to screen compounds that may induce fetal hemoglobin.</p> <p>The Sheehan lab has identified the FOXO3 pathway as important for HbF induction. Interested students can screen FOXO3 activators for their ability to induce HbF first in a cell line, then in primary erythroid culture.</p>
Eric Sorscher, MD	Cancer/Blood Disorders/Cystic Fibrosis	<p>Identifying genes that mediate escape of malignant tumor cells from chemotherapy. Studies of genes responsible for healthy aging. A review of literature concerning genes that mediate stress response in cancer cells, and experiments to determine significance of these pathways in growing tumors and healthy aging. The project will include opportunities to learn standard molecular techniques (tumor cell culture, evaluation of mRNA levels, Western blot analysis; development of high throughput drug screening is also possible) -- with a goal to better understand tumorigenesis and its relationship to cellular senescence.</p>
Eric Sorscher, MD	Cancer/Blood Disorders/Cystic Fibrosis	<p>Effect of common therapies given to cystic fibrosis patients (e.g., azithromycin) on expression of the gene responsible for the disease. This project will include an opportunity to learn basic molecular techniques such as epithelial cell culture, Western blot analysis, and electrophysiology.</p>
Dan Wechsler, MD, PhD	Cancer/Blood Disorders	<p>Our lab is investigating the role of the CRM1 nuclear export protein in infant and childhood leukemias. We use state-of-the-art cell and molecular biology techniques to study protein-protein interactions and the role of different genes/proteins in leukemogenesis. The student will work on one of the subprojects that identify and characterize candidate proteins that interact with CRM1 and proleukemic HOXA genes, using mouse and human cell lines.</p>
Bill Wuest, PhD	Infectious Disease	<p>We utilize organic chemistry to make new antibiotics with unique modes of action. Student would synthesize compounds and perform antibiotic assays.</p>