

PI/Lab Name	Rotation Semester(s)	Rotation Project(s)
Alcorn, John	Fall and Spring	<p>Projects are available studying the immunopathogenesis of influenza pneumonia and secondary bacterial super-infection. The laboratory is interested in host pathways that mediate susceptibility to infection and worsened lung injury. In addition, the opportunity exists to test novel therapeutic options in this context. Currently, the role of influenza memory on super-infection and the impact of bacterial virulence factors on MRSA infection are of interest for development towards dissertation projects. A variety of additional pathways remain open for investigation based upon student interest. In addition, the potential exists to work on human influenza and SARS-CoV-2 samples from infected or vaccinated patients.</p>
Ambrose, Zandra	Fall and Spring	<p>1) Understanding HIV and SARS-CoV-2 protein interactions with host cell proteins during replication, using techniques in molecular biology, virology, and microscopy. 2) Understanding HIV pathogenesis and co-infection with other pathogens, such as M. tuberculosis and hepatitis B virus, using animal models. 3) Characterizing new antiretroviral drug delivery methods for HIV treatment and/or prophylaxis. 4) Understanding HIV reservoirs and immune responses during infection with or without co-infection with other pathogens. See www.ambrose-lab.com for more details.</p>
Apetrei, Cristian	Fall and Spring	<p>1. Studies on the role of a Western diet on the SIV reservoir formation, maintenance and reactivation. Rotation projects designed for optimization of assays aimed at measuring the SIV reservoir. 2. Assessment of new strategies to improve gut health during acute and chronic SIV infection. Rotation projects to test biomarkers of gut integrity, chronic inflammation and comorbidity risk. 3. Studies on the role of intrinsic host immunity in controlling the outcome of SIV infection upon crossspecies transmission. Rotation projects to test the expression of host restriction factors.</p>
Atianand, Maninjay	Fall and Spring	<p>Our research is aimed at uncovering novel genetic determinants of immune cell development and function during homeostasis, infection and inflammatory diseases. In particular, we are currently working on discovering the immune functions of long noncoding RNAs, a large family of genes (~16,000 in humans) in the so called “junk” or “dark matter” of the genome. The rotation project(s) would be developed based on student’s research interests and training goals.</p>

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Bakkenist, Chris	Fall and Spring	T cell cycles – A project to study how DNA replication and transcription are coordinated in T cells is available. Since T cells divide extremely rapidly and have a short G1 phase, the majority of transcription has to occur with DNA replication in S phase. A mechanism that ensures DNA and RNA polymerases travel through genes in the same direction is essential to prevent DNA-RNA polymerase collisions. A mechanism that allows the synthesis of a single, long transcript through multiple T cell cycles is also essential as long genes cannot be transcribed within a single T cell cycle.
Bina, Jim	Fall and Spring	The Bina lab studies antibiotic resistance and pathogenesis in the gram negative pathogens <i>Vibrio cholerae</i> and <i>Klebsiella pneumoniae</i> . Current areas of interest include the link between multiple drug efflux systems and environmental adaptation, evolution of resistance in <i>K. pneumoniae</i> , and the molecular mechanisms involved in host interactions and disease development. Trainees in the Bina lab gain expertise in molecular biology, gene regulation, bioinformatics, antimicrobial resistance, bacterial pathogenesis and in vitro model systems.
Binder, Robert	Fall and Spring	Current projects center on the role of heat shock proteins in initiating immune responses to cancer; (1) Examining the role of single nucleotide polymorphisms in the HSP receptor on interactions with ligands (2) examining the prophylactic and therapeutic role of autologous tumor derived HSPs in a mouse model of osteosarcoma (3) Role of HSPs in cancer immunosurveillance. Trainees in the lab will gain significant expertise in mouse models of cancer, human immunology, tissue culture work, molecular biology, biochemical purification techniques etc.
Biswas, Partha	Fall and Spring	Current projects in Biswas lab include: (1) Determine how IL-17 drives irreversible kidney damage, with the ultimate goal of revealing effective therapeutic approaches to block IL-17 signaling in chronic kidney diseases. (2) Delineate the mechanisms of IL-17-mediated renal immunity against disseminated candidiasis and uropathogenic <i>E. coli</i> infection. (3) Define the role of IL-17 signaling in renal fibrosis, the final outcome of acute or chronic kidney diseases leading to kidney dysfunction. (4) Define the mechanisms of increased mortality in patients with kidney disease due to systemic bacterial and fungal infections.

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Bruno, Tullia	Fall and Spring	<p>The Bruno lab is focused on understanding the function of B cells in solid tumors. In particular, we are interested in evaluating their role within tertiary lymphoid structures (TLS) as most B cells gravitate to these structures within patient tumors. Further, both B cells and tertiary lymphoid structures correlate with increased patient survival and immunotherapeutic response. We are utilizing a multi-level approach for a thorough interrogation of B cells within patient tumors. Specifically, we routinely perform single cell RNAseq, high level flow cytometry (18-35 parameters), micro-sized in vitro functional assays, and spatial analyses, including multispectral imaging (Vectra) and spatial transcriptomics (Nanostring DSP and 10x Visium). We are particularly interested in evaluating these structures within head and neck squamous cell carcinoma and lung cancer, but have begun working on ovarian, melanoma and glioma-focused projects as well. While we routinely utilize patient samples to study B cells and their interactions with CD4+ and CD8+ T cells, we have begun to also develop physiologically-relevant mouse models for an enhanced mechanistic understanding of TLS formation within solid tumors. Current projects in the lab are surrounding B cell function with and without TLS formation, the impact of the tumor microenvironment on TLS formation, and the importance of TLS formation in cancer progression.</p>
Byersdorfer, Craig	Fall and Spring	<p>The Byersdorfer Lab studies in vivo T cell metabolism during graft-versus-host disease (GVHD) and in the development of anti-leukemia responses. The lab utilizes mouse models, genetic manipulation, and metabolic analyses to elucidate the role of specific proteins in the metabolic reprogramming of immune cells. Projects for rotating students include using conditional knock-out mice to functionally characterize the role of specific metabolic proteins in the pathogenesis of GVHD, testing in vivo the ability of novel metabolic inhibitors to mitigate GVHD while still preserving anti-leukemia effects, and enhancing immune based cellular therapies by increasing the in vivo persistence of anti-leukemia T cells through metabolic manipulation. The Byersdorfer Lab is a dynamic group and welcomes PSTP, MSTP and graduate students for a rotation and thesis projects as well as medical students to conduct their Longitudinal Research Project or to perform summer research as part of the Dean's Summer Research Program.</p>

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Campfield, Brian	Fall and Spring	<p>The Campfield Lab focuses on the discovery of novel mediators of host defense and innate-to-adaptive immune responses. We have several ongoing collaborative projects ready for MD, PSTP, MSTP, rotation and graduate students: 1) The protective role of follistatin-like 1 (FSTL-1) in bacterial pneumonia. 2) Novel mechanisms of host immunity to lung infection. 3) The role of FSTL-1 in acute lung injury/ARDS. 4) Novel mechanisms regulating hematopoietic stem cell function. Learn more at Website: https://www.pediatrics.pitt.edu/infectious-diseases/research/campfield-lab or @TheCampfieldLab</p>
Chang, Yuan / Moore, Pat	Fall and Spring	<p>The Chang-Moore lab studies two human cancer viruses that it discovered to uncover fundamental processes in cancer cell formation. These projects include 1) KSHV: Biogenesis of virus-encoded circular RNAs, 2) Merkel cell polyomavirus: Regulation of MCV replication by cellular SCF E3 ligases and definition of small DNA virus proteostatic latency and 3) Single molecule MCV replication origin studies using C-trap optical tweezers, AFM and cryoEM. Additional studies are ongoing to understand potential vaccine immune responses to KSHV LANA and SCoV2 RdRp proteins. We have developed the first mAb to SCoV2 RdRp and are using it to investigate SCoV2 replication dynamics.</p>
Cooper, Vaughn	Fall and Spring	<p>1) Evolutionary dynamics, genetics and mechanisms of antimicrobial resistance in <i>Acinetobacter baumannii</i> or <i>Pseudomonas aeruginosa</i>. 2) Population demography and molecular mechanisms of biofilm formation</p>
Culyba, Matt	Fall and Spring	<p>Our lab studies how bacterial stress-responses enable antibiotic evasion. Current projects are focused on MRSA. Projects include monitoring microbial evolution using WGS, biochemistry of purified stress-response enzymes, molecular mechanism, and high-throughput screening.</p>

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Das, Jishnu	Fall and Spring	Current projects in the lab involve the use of computational systems approaches (machine learning and network systems approaches) to analyze high-dimensional immunological datasets (including genomic, transcriptomic, proteomic and metabolic) in the contexts of autoimmunity and alloimmunity. Specifically, we are interested in using these techniques to elucidate molecular mechanisms underlying the pathophysiology of 1) arthritis (rheumatoid arthritis and osteoarthritis) and 2) organ rejection following liver and kidney transplants. The lab's research program is highly interdisciplinary (lab members have backgrounds in immunology and computational systems biology), and the training environment is tailored to individual mentees, based on their interests.
Delgoffe, Greg	Fall and Spring	TBD
DePas, William	Spring	The main focus of our lab is understanding how nontuberculous mycobacteria (NTM) form biofilms in response to the infection environment. We use an in vitro aggregation system to determine what genes are involved in regulating aggregation in response to environmental cues. In parallel, we use a tissue clearing/bacterial labeling technique to quantify bacterial biofilm formation (and other spatial phenotypes) directly in patient samples.
Dermody, Terry	Fall and Spring	The Dermody laboratory has several projects in the general area of reovirus replication and pathogenesis. These include (i) viral attachment and entry into cells, (ii) mechanisms of genome replication and packaging, (iii) patterns of cell signaling and gene expression in response to viral infection, and (iv) links between reovirus and celiac disease. Trainees in the Dermody laboratory gain expertise in genetics, cell biology, biochemistry, and organismal biology.
Dutta, Partha	Fall and Spring	The focus of my lab is to understand the mechanisms of innate inflammation, primarily mediated by monocytes and macrophages, in cardiovascular disease. We use RNA seq, single cell RNA seq, spatial RNA seq, high resolution microscopy, intra-vital microscopy, multi-color flow cytometry in various transgenic mouse models and human samples. Lab website: https://duttalab.pitt.edu

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Falo, Jr., Louis	Fall and Spring	<p>Our research focuses on understanding and utilizing skin immune networks to control systemic immune responses, with the goal of translational development of novel vaccines and immunotherapeutic strategies. To accomplish this, we integrate an evolving mechanistic understanding of skin immune function with novel bioengineering approaches. Current projects include: 1) Development and clinical application of skin targeted COVID-19 vaccines, including the current PittCoVacc and “next generation” vaccine strategies; 2) Development of novel strategies to modify the tumor microenvironment of cutaneous neoplasms, including non-melanoma skin cancers, to utilize the patient’s existing tumor as a patient and tumor specific vaccine; and 3) To engineer the skin microenvironment to induce systemic tolerance to cutaneously delivered antigens including contact sensitizers and food allergens.</p>
Ferris, Robert	Fall and Spring	<p>Dr. Ferris’s research and clinical programs are focused on understanding immunological and molecular mechanisms of resistance to immuno-oncology (IO) therapies, biomarker discovery and identifying novel IO drug candidates with the overall aim of early diagnosis and improved treatment of head and neck squamous cell carcinoma (HNSCC). Recent work has focused on the impact of TIM-3 expression on effector and regulatory T, as well as NK cells and the roles they play in tumor elimination. The premise of current research projects includes preclinical, basic, translational, as well as clinical research using multi-dimensional molecular biological (single-cell RNAseq), cell-based (multicolor flow cytometry and functional assays) and mouse model platforms leading to novel investigator-initiated clinical trials.</p>
Flynn, JoAnne	Fall and Spring	<p>Our lab studies tuberculosis using non-human primate models. We are interested in immunology and pathogenesis of tuberculosis and interventions—including drugs and vaccines. We have numerous funded projects regarding host-pathogen interactions, immunology, pathology, and vaccines. Such projects include the role of CD8 and CD4 T cells in TB, the role of innate cells in TB, the mechanism by which BCG delivered intravenously provides profound protection against TB, the host-pathogen interactions in the granulomas, the ability of primary infection to prevent reinfection, etc. We develop and employ cutting edge technologies, including PET CT imaging, single cell RNAseq, multiparameter flow cytometry, reporter and barcoded strains of Mtb, among others. We are an interactive and inclusive lab and strongly believe in collaboration and teamwork.</p>

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Gaffen, Sarah	Fall and Spring	<p>The Gaffen lab is a highly interactive and collegial group that studies the nexus of immunity to fungal infections and autoimmune disease pathogenesis. Specially, we study the Th17 pathway and its signature cytokine IL-17, using both cell-based and mouse-based approaches. Rotation projects will vary depending on the interest of the rotation student and availability of open projects. Sample projects include analysis of how IL-17 signaling mediates post-transcriptional gene regulation through distinct RNA binding proteins that determine mRNA fate (stability, translation, methylation, etc.), and how these pathways contribute to pathology in mouse models of multiple sclerosis or renal autoimmune disease. Studies of oral mucosal immunity to the commensal fungus <i>Candida albicans</i> may include single cell RNASeq analysis, immunofluorescent or RNAScope tissue imaging, or mouse studies of fungal infection. See web site for more details: www.gaffenlab.pitt.edu</p>
Gao, Shou-Jiang (SJ)	Fall and Spring	<p>The Gao lab primarily studies the mechanism of infection and oncogenesis of cancer viruses. The student will be exposed to molecular virology, cancer biology, cancer metabolism, epigenetics, epitranscriptomics, interactions of cancer cells with tumor microenvironment and immune cells, inflammation, microbiome and cancer therapy. The lab has also recently worked on the new coronavirus that causes COVID-19. Areas of works include cell tropism and viral gene expression program, pseudovirus entry and trafficking, innate immunity and inflammation, and antiviral therapy.</p>
Gong, Yi-Nan	Fall and Spring	<p>1) Modulating lipid mobilization on the plasma membrane to promote anti-cancer immunity. We will work with genetical tools to control a phospholipid and move it to either inner or outer leaflet on plasma membrane. We are also developing therapeutic strategies to neutralize the inhibitory effects of this lipid. 2) We will use genome-wide CRISPR knockout screening to study the programmed cell death in tumor cells and macrophages and explore the consequent inflammatory responses as well as in drug resistance. 3) We study how plasma membrane pore-forming damage can affect the tumor microenvironments via immune or non-immune modulations.</p>

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Gottschalk, Rachel	Fall and Spring	Rotation trainees will gain experience in quantitative analysis of macrophage signaling and inflammatory responses. 1) By quantifying inflammatory responses in mice with conditional deletion of the transcription factor GATA2. This will include using qPCR, flow, and ELISA to assess the magnitude and duration of inflammatory responses in mice with bacterial pneumonia 2) Using phosphoproteomics, motif analysis, and statistical approaches, we have identified candidate STAT-cooperating transcription factors that we believe support cytokine specific gene expression. Help us validate these findings in bone marrow derived macrophages, by quantifying regulation of these transcription factors and the consequence of their knockdown or deficiency.
Guo, Haitao	Fall and Spring	Guo lab is studying the mechanisms of hepatitis B virus (HBV) persistent infection and HBV-induced hepatocellular carcinoma (HCC), as well as developing novel therapeutics for treatment of HBV and HCC.
Hand, Tim	Fall and Spring	The Hand lab studies the interaction of the immune system and the microbiome in the intestine. We have a particular interest in how T and B cells respond to and shape new bacterial colonizations. Current rotation projects are focused on 1) how memory CD4 T cells mediate intestinal protection via long-term interactions with the enteric nervous system and 2) how antibodies in breast milk shape the neonatal microbiome. https://www.chp.edu/research/rkmfi/research-labs/hand-lab
Hartman, Amy	Fall and Spring	Rotation projects are available studying the pathogenesis of Rift valley fever virus (RVFV) and other related bunyaviruses. In vitro and in vivo (rodent) projects include: 1) Elucidating the role of host factors in binding and entry of bunyaviruses into host cells, including study of the newly identified bunyavirus receptor Lrp1. 2) Tropism of RVFV and other bunyaviruses for mammalian placenta. 3) RVFV infection of neurons and amelioration with immunotherapeutic drugs.

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Hawse, Bill	Fall and Spring	<p>The Hawse lab utilizes proteomics, biochemistry, genetics, chemical genetics, high resolution imaging and animal models to study signal transduction in T cells. Current projects focus on 1) elucidating how kinase signaling networks drive T cell fate choices and 2) understanding how signaling lipids function in T cell biology. The overarching hypothesis is that differential phosphorylation of key proteins involved with metabolism, signaling and transcription regulates T cell fate decisions. Our current mass spectrometry analysis of CD4+ T cell differentiation identified 200 phosphoproteins that correlate to specific cell fates. We are performing functional studies to determine how these signaling events shape cellular differentiation programs. There are many possible rotation and thesis projects that can be tailored to the student's interests ranging from basic mechanism to in vivo models of autoimmunity.</p>
Hinterleitner, Reinhard	Fall and Spring	<p>1) Study how gut microbes modulate immune responses to dietary antigens in the context of celiac disease and food allergies. 2) Study the mechanisms of gut epithelial-immune crosstalk in intestinal inflammatory disorders and enteric infections.</p>
Hooven, Tom	Fall and Spring	<p>The Hooven laboratory on the 8th floor of the Rangos Research Building studies bacteria that contribute to maternal, fetal, and neonatal disease. A major focus area is group B Streptococcus (GBS), the dominant cause of neonatal sepsis in the U.S. and worldwide. Projects are available to 1) use a CRISPR/Cas9-based knockdown library of conserved GBS surface proteins to identify novel targets for preventing perinatal infection; 2) study the influence of changing metabolite levels on GBS virulence outside of its commensal niches; 3) define the molecular mechanism of MrvR, a bacterial regulatory protein with virulence-enhancing properties. See www.hoovenlab.com.</p>

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Joglekar, Alok	Fall and Spring	<p>The Joglekar lab focuses understanding the antigenic targets of T cell responses and engineering T cells for immunotherapy. Two main projects are available in the lab: 1) Identify the cognate epitopes of autoimmune T cells using a novel epitope discovery technology called SABRs. We will use systems immunology approaches to combine TCR repertoire, T cell transcriptomics, and TCR specificities to understand the autoimmune T cells in Lupus nephritis: 2) Engineer T cells and other immune cells for immunotherapy. We will use chimeric receptors to engineer T cells, B cells and APCs to augment or suppress immune responses in an antigen-specific manner. We will also use computational methods to aid design of chimeric receptors</p>
Kane, Melissa	Fall and Spring	<p>The Kane Lab studies immunity to retroviral infections at a cellular and organismal level. Ongoing projects include, 1) Mechanism of inhibition of HIV-1 nuclear import by the restriction factor Mx2; 2) Genetic and immunological mechanisms of antiviral resistance in animal models; 3) Regulation of retroviral gene expression; 4) Inhibition of viral replication by interferon stimulated genes. www.kanelab.org</p>
Kaplan, Dan	Fall and Spring	<p>The Kaplan lab explores how innate and adaptive immune cells interact in peripheral tissues, particularly skin. We focus on how epithelial cells control the residence of peripheral memory cells during memory as well as within the tumor microenvironment. We also explore how neurons that innervate the skin control the development, amplification, persistence and resolution of innate and adaptive responses. Individual projects can be crafted to suit the interest of the rotating student.</p>

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Kinchington, Paul R (Kip)	Fall and Spring	<p>The Kinchington lab works with the human Herpesvirus Varicella Zoster Virus (VZV) that causes Chickenpox and the debilitating disease, Zoster (Shingles) when it reactivates from latency. Two projects are open. The first is an investigation of the newly discovered RNAs associated with the neuronal latent state termed VLT, and how they function in lytic epithelial infections, as well as the lytic-latent-reactivation decision process in cultured neuron systems. The second project is to determine the contribution of mutations in the live vaccine strain to the attenuated phenotypes of poor replication in the skin and inefficient reactivation from neurons. Both projects will involve extensive use of complex tissues culture systems, molecular virology and biology, genetic manipulation of the viral genome using recombineering methods and characterization of recombinant herpesviruses.</p>
Klimstra, William	Fall and Spring	<p>The following rotation projects are available: 1) Development of live attenuated vaccine vectors for eastern, Venezuelan and western equine encephalitis viruses (EEEV/VEEV/WEEV) based on identification and inactivation of viral virulence determinants and then testing the recombinant viruses for virulence and immunogenicity in the mouse model. 2) Characterization of the role of syndecan heparan sulfate (HS) proteoglycans in EEEV cell infection and pathogenesis. In this project, CRISPR/Cas9 technology, ectopic over-expression and knockout mice are being used to modify syndecan proteoglycan levels in various cell types and in vivo, and the dependence of EEEV infection on syndecan levels will be assessed. 3) Use of next generation sequencing to track host-adaptive mutations that arise during eastern equine encephalitis virus infection. We are examining the changes that occur in HS binding sites and miR142-3p microRNA restriction sequences that occur during EEEV replication cycles in mice, monkeys, quail and mosquitoes. The goal is to assess the capability of EEEV to acquire replication competence in myeloid cells (normally restricted by miR142-3p binding and HS receptor use) by alteration of the HS/miR142-3p sites and the effect of such mutations upon virus replication and innate immune cytokine induction in myeloid cell cultures and mice.</p>

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Larregina, Adriana	Fall and Spring	The Larregina Laboratory studies the skin immune system and the way that regulatory mechanisms modify local and systemic immune responses. Specifically, we study how proinflammatory neuropeptides modify innate and adaptive immune responses initiated by antigens that permeate the skin. We are also interested in dissecting the mechanisms of cell to cell communication that propagate Ag and generate skin immunostimulatory or suppressive responses.
Lee, Janet	Fall and Spring	The Lee lab studies host-pathogen interactions in the lung and mechanisms of lung injury from severe respiratory infections. We utilize extracellular Gram-negative bacterial pathogens such as <i>Pseudomonas aeruginosa</i> and <i>Klebsiella pneumoniae</i> as main model systems to better understand the host immune response to distinct pathogen virulence factors. Current projects focus on mechanisms of host protection from (1) pathogen proteases that drive proteolytic lung injury and inflammation; (2) pathogen disruption of nutritional immunity within macrophages; (3) pathogen transition from local infection to hematogenous spread.
Lee, Nara	Fall and Spring	The Lee lab studies how noncoding RNAs expressed by the Epstein-Barr virus benefit the viral life cycle. Our methodologies include RNA biochemistry, techniques to study RNA modifications, and a plethora of different next-generation sequencing applications. Candidates will learn how to put a modern twist on 'old-school' techniques by coupling them with cutting-edge technology.
Lee, Robin	Fall and Spring	The REC Lee lab investigates how single cells process information to make cell fate decisions in inflammatory disease and cancer. Projects regularly use wet-lab experiments, such as CRISPR, particle tracking, and live-cell imaging with microfluidic and robotic cell cultures, as well as computational approaches to extract data and develop mechanistic models. Upcoming projects will use cutting edge approaches to decipher roles of cell-cell communication and interacting cell types in establishing healthy and diseased cellular responses.

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Levin, Tera	Fall and Spring	<p>The Levin lab integrates evolution, genetics, and microbiology to learn how new bacterial pathogens emerge from nature. We're particularly interested in how forces in the environment select for virulence genes before bacterial pathogens ever encounter a human host. These forces include inter-bacterial competition and interactions between bacteria and their eukaryotic predators. Our main model organisms are Legionella bacteria and their natural hosts, free-living amoebae. Rotation project areas include: 1) uncovering mechanisms of resistance and susceptibility during inter-bacterial competition in Legionella, 2) determining how rapidly evolution alters the functions of Legionella effectors used to hijack host cells, 3) discovering 'immune' strategies used by amoeba to detect and respond to bacteria, and 4) detecting signatures evolutionary arms races in bacterial and/or amoeba genomes. We welcome rotation students from a variety of backgrounds and are happy to discuss these or additional projects. Feel free to get in touch! https://www.teralevinlab.com/</p>
Little, Steven	Fall and Spring	<p>The Little Lab merges the fields of Bioengineering, Chemical Engineering and Immunology as we seek to develop biomimetic drug delivery strategies which treat inflammation and restore immune homeostasis. We formulate polymeric, controllable release strategies (i.e., microparticles, stimuli-responsive hydrogels, etc.) which release immunological cues (i.e., chemokines, cytokines, etc.) in a local microenvironment for immunomodulation. Current ongoing projects in our lab are focused on therapies for periodontal disease, chronic rhinosinusitis, myocardial infarction and vascularized composite allotransplantation rejection. We are looking for students to join our transplant-focused sub-team, as we move towards large animal models and clinical translation of our immunotherapy platform.</p>

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Liu, Shihui	Fall and Spring	<p>We sincerely welcome PMI graduate students to join our research team for their thesis studies. We are located in the excellent scientific environment of the Aging Institute and the Division of Infectious diseases. Our research is supported by three R01 grants from the National Cancer Institute and the National Institute of Allergy and Infectious Diseases, NIH. We are using various state-of-the-art molecular, genetic, and mouse gene-targeting approaches to understand the molecular mechanisms underlying the pathogenesis of several medically important bacterial toxins, including anthrax toxins and <i>B. cereus</i> hemolysins, which are essential in guiding development of therapeutics for treating the infectious diseases caused by <i>B. anthracis</i> and <i>B. cereus</i>. We study how the key signal transduction pathways, such as the RAS and ERK pathways, are dysregulated by these toxins in both normal cells as well as cancer cells. We use the knowledge learned to develop the biological-based therapies for anthrax disease as well as for tumor targeting. As such, we have recently generated a series of novel reengineered anthrax toxins with potent and high tumor-specificity that directly target a wide range of cancer cells, as well as tumor stromal cells. Using unbiased genome-wide CRISPR knockout screens, we recently identified the cellular receptors for <i>B. cereus</i> hemolysin BL</p>
Mailliard, Robbie	Fall and Spring	<p>Our laboratory focuses on basic immunology related to HIV pathogenesis, and the development of immunotherapy approaches to treat chronic HIV-1 infection. Much of our work focuses on dendritic cells and their crosstalk with T cells and NK cells. One project centers on the use of dendritic cells as a latency reversal agent, to kick latent HIV out of hiding for subsequent elimination by effector cells. In this study, we are interested in characterizing the antigen specificity of the T cell receptor (TCR) on CD4+ T cell harboring latent HIV. Another study focuses on the therapeutic potential of a rare population of 'memory-like' NK cells that are highly expanded in HIV infected individuals, Candidates working on these projects will develop skills in primary tissue culture, flow cytometry/sorting, ELISpot assays, single cell RNA sequencing and general dendritic, T cell and NK cell biology.</p>

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Mathers, Alicia	Fall and Spring	We have several ongoing projects, including both basic science and translational studies examining cutaneous inflammation. Projects include, 1) understanding how ATP signals through the purinergic P2X7R to induce autoinflammatory/autoimmune psoriasis and chronic wounds, 2) studying how Trm cells regulate innate immunity in the skin using pet store mice and inflammatory models, and 3) examining the ability of electrophilic fatty acids to suppress psoriatic inflammation in a translational project using xenotransplants and psoriasis models.
McCarthy, Kevin	Spring	Adaptive immunity is an evolved trait. Individual B cells evolve their B cell receptors to bind antigens more tightly in a process termed affinity maturation. The secreted versions of these receptors, antibodies, mediate humoral immunity. Antibodies can directly interfere with cell-entry and/or mark viruses and cells for destruction by other arms of the immune system. We study how B cells affinity mature, how convergent evolution among B cells produces antibodies that engage common sites and how these processes drive viral evolution. Pathogens currently studied in our laboratory are influenza viruses and SARS-CoV-2.
McElroy, Anita	TBD, email me and we'll talk	The FABLAB (https://fabvirology.com/) studies the hemorrhagic fever virus known as Rift Valley fever virus. Ongoing projects are focused on understanding the role of liver and brain tropism in clinical disease manifestations. Studies utilize in vitro techniques with a focus on primary cells in addition to various mouse models to assess the role of host genetic diversity in disease.
Meisel, Marlies	Fall and Spring	1) Examine how the tumor-microBiome impacts on tumor immunity and cancer immunotherapy at gut-distal sites cancer. 2) Define whether and via which mechanisms physical exercise acts as an adjuvant to boost cancer immunotherapy

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Moore, Pat / Chang, Yuan	Fall and Spring	<p>The Chang-Moore lab studies two human cancer viruses that it discovered to uncover fundamental processes in cancer cell formation. These projects include 1) KSHV: Biogenesis of virus-encoded circular RNAs, 2) Merkel cell polyomavirus: Regulation of MCV replication by cellular SCF E3 ligases and definition of small DNA virus proteostatic latency and 3) Single molecule MCV replication origin studies using C-trap optical tweezers, AFM and cryoEM. Additional studies are ongoing to understand potential vaccine immune responses to KSHV LANA and SCoV2 RdRp proteins. We have developed the first mAb to SCoV2 RdRp and are using it to investigate SCoV2 replication dynamics.</p>
Morelli, Adrian	Fall and Spring	<p>To unveil basic mechanisms of allorecognition and regulation of the host-immune response following transplantation and during fetomaternal tolerance. To study the role of donor- and recipient-derived antigen-presenting cells (i.e. dendritic cells) and extracellular vesicles (i.e. exosomes, microvesicles) during allosensitization, graft rejection, and induction of donor-specific immunosuppression / tolerance following transplantation and during pregnancy The work will be focused on the role of dendritic cells and extracellular vesicles (e.g. exosomes, microvesicles), the later as a mechanism of cell-to-cell communication between the graft donor and the recipient, or the fetus and the mother. Research will be conducted in experimental models of skin and heart transplantation in mice and humanized mouse models, and in mouse pregnancy models. Techniques will include state-of-the-art methods of extracellular vesicle generation, purification and analysis; in vitro in vivo and ex vivo immunological analysis; and biological imaging by intravital multiphoton, confocal, super-resolution and immunoelectron microscopy.</p>

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Poholek, Amanda	Fall and Spring	<p>The Poholek Lab explores the transcriptional and epigenetic pathways regulating immune cell differentiation and function in settings of loss of tolerance or dysfunction such as asthma, cancer or lupus. We use innovative genetic mouse models and NextGen sequencing approaches including RNAseq, CUT&TAG, ATACseq, single cell sequencing and Spatial Transcriptomics to understand immune cell function in the context of the tissue environment. Current projects in the lab focus on the cell type specific function of Blimp-1 to initiate Th2 cells and drive allergic asthma, the intersection of metabolism and epigenetics in lupus T cells, and factors in the tumor microenvironment that promote dysfunctional epigenetic landscapes in exhausted T cells. Please contact for specific rotation projects available. www.poholeklab.com</p>
Ray, Prabir / Ray, Anuradha	Fall and Spring	<p>Research in our laboratory is focused on elucidating host defense mechanisms against bacterial and viral pathogens. This knowledge will help us to develop better tools to treat bacterial pneumonia or viremia. As an example, <i>Klebsiella pneumoniae</i> is an opportunistic bacterial pathogen. During active infection, most virulent strains can be targeted with antibiotics as they are sensitive to antibiotics, and also the host immune system can control this pathogen to prevent bacterial pneumonia. Unfortunately, more and more, recent clinical isolates are showing resistance to antibiotics and are refractory to the host's immune system. One way to address this problem is to improve the host's immune response to infection. Our laboratory uses multiple molecular and immunological approaches to address this. Our current projects are: 1) How hypervirulent <i>K. pneumoniae</i> isolates escape host defense mechanisms by dysregulating antibacterial properties of neutrophils. 2) How host proteases induced during bacterial infection cause lung injury. 3) How inhibitory functions of the anti-inflammatory properties of regulatory myeloid cells gets inhibited during infection leading to persistent inflammation in the lung. We have an outstanding group of lab members who can help new students to learn all relevant techniques.</p>

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Reed, Doug	Fall and Spring	<p>“It’s all about the aerosols.” The Reed lab studies the biology of aerosolized viruses and bacteria that cause severe, acute diseases, the pathogenesis of respiratory infection in animal models, and the host immune response to respiratory infection. This primarily involves tularemia, a severe zoonotic infection caused by <i>Francisella tularensis</i>, a gram-negative bacterium, encephalitic alphaviruses, and avian influenza viruses. Possible projects include 1) infectious disease aerobiology, studying the properties of bacteria & viruses in aerosols and on surfaces, 2) explore respiratory delivery of vaccines and therapeutic mAbs for treating severe, acute infections, 3) study the pathogenesis of tularemia and avian influenza viruses in relevant animal models, and 4) use flow cytometry and transcriptomics to develop novel, translatable correlates of protection in the rabbit model for live, attenuated tularemia vaccines.</p>
Richardson, Anthony	Fall and Spring	<p>The Richardson Lab studies immunometabolism in the context of <i>Staphylococcus aureus</i> infections. We focus on the metabolic adaptations that this pathogen undergoes to cause disease as well as the metabolic changes that immune cells make to mount an effective immune response. Our approach employs cell culture, bacterial genetics, mouse models of infection, molecular biology and comparative evolutionary biology to answer questions surrounding the immunometabolic state of the host and the pathogen during infection.</p>
Rothstein, David	Fall and Spring	<p>The Rothstein lab is focused on immunoregulation mediated by the balance between TIM-1+ regulatory B cells (Bregs) that maintain self-tolerance, and TIM-4+ B cells that promote inflammatory responses. A number of rotation projects are available including: 1) Determining whether TIM-1+ B cells belonging to different B cell subsets regulate distinct aspects of the immune response. 2) Identifying transcriptional regulation and cross-talk between IL-17 and IL-10 expression in B cells. 3) Identifying the role of IL-10 as a B cell autocrine growth factor. 4) Determining how the microbiome regulates Breg expansion. 5) Identifying the transcriptional regulation underlying development of a novel population of TIM-1+ ProB cells that differentiate into exceedingly potent Bregs in mice. 6) Determining whether we can identify similar ProB cells human marrow and establishing their activity in humanized mouse models. These projects are all novel and most have preliminary data sufficient to allow steady progress.</p>

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Sadovsky, Yoel	Fall and Spring	Our lab studies molecular processes underlying placental development and function, and their impact on early human development, with a focus on trophoblast-specific microRNAs (miRNA), which are packaged in extracellular vesicles and communicate genomic material among the fetal, placental, and maternal compartments. We study signals that regulate miRNA expression and trafficking in target cells, and the role of these RNAs in trophoblast immunity.
Sarkar, Saumen	Fall and Spring	Sarkar Lab is interested in the innate immune responses in the context of infectious disease and cancer. Our research uses state-of-the-art molecular biology, immunology, and in vivo studies to dissect the complex dialogue that occurs between virus/bacteria and host during the course of microbial infections, and to identify potential therapeutic targets that might limit pathogenesis of human diseases. Specific Projects include: (1) Defining the novel roles of ISGs in regulating antiviral innate and adaptive immunity; (2) Antibacterial functions of OAS family proteins and (3) Role of IFN-regulatory factors (IRFs) in tumor progression. Students will have the freedom to pursue one of these ongoing projects and/or develop new projects under the broad area of Innate Immunity.
Shair, Kathy	Fall and Spring	Epstein-Barr virus (EBV)-associated cancer mechanisms and molecular pathogenesis. Projects open to rotation students examine how EBV infection, and the expression of EBV genes, contribute to oncogenic mechanisms and molecular pathogenesis in the nasopharynx. There are two projects available. One of these projects is more cancer focused and the other addresses EBV infection in primary 3-D nasal organoid systems.
Shlomchik, Mark	Fall and Spring	The Shlomchik lab works on B cell immune responses and systemic autoimmune disease mechanisms. We have exciting rotation and thesis projects in the area of: 1) germinal center B cell signaling, 2) memory B cell epigenetics, 3) cloning and analyzing T cells that promote autoimmunity, and 4) investigating how TLRs promote autoimmunity using novel genetically modified mice.

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Shlomchik, Warren	Fall and Spring	Warren Shlomchik's lab studies alloimmunity in the context of allogeneic hematopoietic stem cell transplantation and the development of adoptive T cell immunotherapies for use in conjunction with an allogeneic stem cell transplant and in treatment of cancer in general. A second focus is on understand the resistance of acute myelogenous leukemia (AML) to T cell therapies. Available rotation projects include CRISPR/Cas9 editing of mouse AML lines, the use of a rapid T cell receptor (TCR) cloning approach to identify TCRs reactive against targets of allogeneic T cells, and performing adoptive T cell therapy experiments testing the role of TCR affinity in dictating efficacy of therapies.
Shuda, Masahiro	Fall and Spring	Shuda lab is studying the mechanisms of viral oncogenesis induced by two small DNA tumor viruses: Merkel cell polyomavirus (MCV), an etiological agent of Merkel cell carcinoma (MCC), and high-risk human papillomavirus (HPV), which causes head and neck cancer, cervical cancer, and anal cancer. We are also investigating the mechanisms of Merkel cell polyomavirus replication with a focus on the viral small T (sT) antigen protein. Potential rotation projects include: (1) delineating the mechanism of MCV-induced activation of stem cell factor Sox2, (2) analyzing the genes deregulated by HPV E6-E7 oncoproteins in head and neck cancers, and (3) identifying host proteins that interact with sT and promote MCV replication.
Singh, Harinder	Fall	Bone marrow plasma cells (BMPCs) are terminally differentiated B cells that constitutively secrete pathogen or vaccine induced antibodies and protect the host during primary and secondary infections. We are elucidating the nature of BMPC precursors that emanate from the spleen during an immune response and migrate through the circulation to the bone marrow, where they undergo terminal differentiation into long-lived plasma cells. We have established a new experimental model to identify and analyze the genomic states of BMPC precursors using scRNA-Seq and CITE-Seq. The extensive datasets are revealing new genes and molecular pathways that appear to control the generation of long-lived plasma cells.

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Smithgall, Tom	Fall and Spring	<p>Research in the Smithgall laboratory applies a chemical biology approach to a variety of questions related to HIV/AIDS and myeloid leukemias. Our work involves high-throughput chemical library screening, medicinal chemistry and drug development, structural biology of drug-target protein complexes and in vivo pharmacology using animal models. Rotation projects related to HIV involve evolution of drug resistance to novel antiretroviral drug candidates, mechanisms by which viral proteins hijack host cell signal transduction pathways to benefit the virus, and use of chemical biology tools to better understand viral persistence and latency.</p>
Snyder, Mark	Fall and Spring	<p>The primary focus of our research is studying how maladaptive adaptive immune responses contribute to chronic lung injury. We do this using translational models of investigation. Projects include: 1. Studying the impact of inhaled and systemic glucocorticoids on the function of human lung tissue resident memory T cells using ex-vivo lung perfusion. 2. Studying the impact of the DUSP4/MAPK pathway in the promotion of pulmonary fibrosis in both idiopathic pulmonary fibrosis (IPF) and chronic lung allograft dysfunction (CLAD).</p>
St. Leger, Anthony	Fall and Spring	<p>The St. Leger Lab currently has several projects that are developed and ready for a motivated graduate student. First, we are interested in the host's generation of immunity response against the ocular microbiome. Projects along these lines focus on 1) understanding the microbial genes that regulate ocular colonization and immunity (microbiology and immunology) or 2) identifying how human cells respond to components of the ocular microbiome (immunology). For these studies, we have an array of transposon mutants of a single ocular bacterium, <i>Corynebacterium mastitidis</i>. We also have a library of <i>Corynebacteria</i> that were isolated from the eyes of humans. The other arm of the lab focuses on herpes simplex virus type 1 infection of the cornea. Projects along these lines focus on 1) understanding pathological processes that result in corneal pathology and blindness (neuroimmunology and virology); 2) understanding how HSV-1 can disrupt the corneal nerve architecture to cause disease (neuroimmunology); 3) how HSV-1 can cause dysbiosis in the ocular microbiome (immunology); 4) how HSV-1 can modulate cell metabolism at the ocular surface (cell metabolism and immunology). For these studies, we have several strains of HSV-1 that result in varying degrees of pathology, which would allow for comparisons of mechanisms governing pathology.</p>

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Storkus, Walter	Fall and Spring	<p>Projects are available to investigate therapeutic interventions promoting vascular and immune cell normalization within the tumor microenvironment (TME) that lead to diversification in the anti-tumor T cell repertoire, tertiary lymphoid structure neogenesis and enhanced treatment benefit against disseminated disease. Models include exploratory analysis in ongoing clinical trials for patients with advanced-stage melanoma or renal cell carcinoma, as well as murine models of these 2 forms of cancer. Based on compensatory regulatory changes occurring in the TME, combination treatment regimens will be designed and tested for improved bioefficacy in translational models.</p>
Turnquist, Heth	Fall and Spring	<p>The Turnquist lab has opportunities for trainees to complete graduate projects as part of NIH-, DoD-, and Industry-funded studies 1) Elucidating immune-mediated mechanism of tissue repair after transplant and trauma, 2) Developing novel biologics and cell therapies for tissue repair and tolerance in transplant, 3) Identifying how alarmins/damage-associated molecular patterns shape outcomes after the transplantation of organs and cells. These projects will provide training in successful completion of discovery science using rodent models and clinical samples harnessing cutting edge technologies.</p>
Van Tyne, Daria	Fall and Spring	<p>Project 1: VRE adaptation to cause extra-intestinal infection. We want to understand how enterococci adapt to cause infection in the bloodstream, rather than their native gastrointestinal tract environment. We are analyzing the genomes of VRE strains from bacteremia and GI colonization to generate hypotheses about genes/pathways that are important for bloodstream infection. Project 2: Bacteriophages to treat drug-resistant infections. We are isolating bacteriophages from a variety of environmental sources that can kill multidrug-resistant bacteria. We build panels of phages that can infect particular bacterial species, and which can ultimately be combined and used as phage therapy.</p>

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Vignali, Dario	Fall and Spring	The Vignali Lab primarily studies inhibitory mechanisms in cancer using mouse models and patient samples, with a focus on inhibitory receptors and regulatory T cells (Tregs). We also study immune regulatory insufficiency that underlies autoimmunity, and structure-function analysis of TCR and LAG3 signaling, and emerging projects on neuroimmunology. We make heavy use of sophisticated mutant mouse models, transcriptomic analysis (scRNAseq), super-res microscopy and multispectral imaging, and samples from patients treated with immunotherapies.
Vlad, Anda	Fall and Spring	We focus on identifying immune biomarker or response in ovarian cancer patients treated in Phase I/II clinical trials with combination chemo-immunotherapies. We also aim to develop new immune modulators using aldehyde dehydrogenase inhibitors (ALDHi). Our work combines translational studies using clinical trial specimens with in vivo studies in transgenic mice.
Wang, Jing Hong	Fall and Spring	The goals of my research program include: (1) define the cellular and molecular mechanisms of immune evasion during cancer development; (2) develop more effective cancer immunotherapy, with a focus on head and neck squamous cell carcinomas (HNSCCs) and B cell lymphomas; (3) elucidate the basic mechanisms of antibody gene diversification and B cell lymphomagenesis.
Wright, Erik	Fall and Spring	We are seeking a graduate student to lead a project about deciphering the language of the microbiome using mass spectrometry. What molecules govern inter-species interactions? How many different “languages” does each species “speak”? Can we decode these languages? Can we talk back?