Medical students who have been newly accepted and have committed to our medical school have the opportunity to spend their summers as part of research projects. A group of faculty research mentors provides a range of research in which students can participate through the Medical Student Summer Research Program. The available research projects for the summer program are listed below. Summer projects are not limited to those below. If you have worked with research previously and have a project that can be completed in the allotted timeframe, those will also be considered.

Student Requirements

1. You must have been accepted by the Sanford School of Medicine and committed to attending to be considered for the program.
1. You will need to contact a mentor prior to applying to discuss the project.
2. You must be in contact with the mentor stating that you have committed to the project prior to submitting the application.

2023 Medical Student Summer Research Mentors

Mentor	Project Descriptions	Project Type & Location	Contact Information
Dr. Victor Huber	1. **Vaccines**-The goal of this vaccine effort would be to limit the interspecies transmission events that are often associated with influenza pandemics.	Lee Med, Vermillion-in person or remote	victor.huber@usd.edu P-605-658-6390
Dr. Victor Huber	2. **Super-infections**-The Huber lab has recently identified influenza virus proteins that have the potential to modulate the severity of a bacterial superinfection. One project would be toward defining the impact of these viral proteins on host immune responses within our super-infection model.	Lee Med, Vermillion-in person or remote	victor.huber@usd.edu P-605-658-6391
Dr. Victor Huber	3. **SARS-CoV-2**-This project will evaluate the burden of SARS-CoV-2 infection in a susceptible host after natural infection, with emphasis on patients with cancer. Specifically, we will characterize the quality of the immune response in this compromised host population and the effect of COVID-19 on	Lee Med, Vermillion-in person or remote	victor.huber@usd.edu P-605-658-6392

	cancer biomarkers that can be detected in serum.		
Dr. Pilar de la Puente	1. **Role of Extracellular Matrix remodeling in immune evasion.** High-grade serous carcinoma (HGSC) is the most common type of "ovarian" cancer and one of the deadliest forms of cancer in women. We hypothesize ECM remodeling is a key contributor to immune evasion in HGSC. We will use our previously reported 3D model able to recapitulate key ECM remodeling contributions such as stifness and ECM deposition in order to study the influence of ECM remodeling on immune infiltration and further identify if targeting ECM remodeling (pharmacollogically) can overcame immune evasion and enhance immunotherapy efficacy.	Sanford Research, Sioux Falls. In person only	pilar.puente@sandfordhealth.org P-605-312-6042
Dr. Pilar de la Puente	2. **Effects of aging in cancer immune remodeling**. Age is one of the main risk factors of cancer; and a reduced deposition of specific ECM components and an altered inflammatory response is linked with the aging process. In particular, the impact of age on systemic immunity and the tumor immune infiltrate should be considered, given the expanding role of immunotherapy in cancer treatment. We hypothesize that immune subsets from older patients lead to reduced ECM remodeling and altered	Sanford Research, Sioux Falls. In person only	pilar.puente@sandfordhealth.org P-605-312-6043

	cytokine/chemokine response in HGSC patients. We will investigate ECM deposition and inflammatory response associated to immune aging in HGSC. Characterization of the pro-inflammatory mediators, as well as immune functionality in the context of age is critical for improving the outcomes of HGSC patients.		
Dr. Russ Wilke, MD, PhD	1. Retrospective studies using data from electronic medical records in large observational cohorts e.g., identifying genetic predictors of drug-induced liver injury (DILI) in the All of Us biobank at NIH	Sanford Medical Center, Sioux Falls. In person or remotely from Vermillion	russell.wilke@usd.edu P.605-799-7793
Dr. Russ Wilke, MD, PhD	2. Prospective studies using Randomized Clinical Trials to compare gene-based dosing to usual care e.g., pre-emptive CYP2D6 genotyping to guide opioid selection in patients about to have surgery	Sanford Medical Center, Sioux Falls. In person or remotely from Vermillion	russell.wilke@usd.edu P.605-799-7794
Dr. Henry Travers, MD, FACP	1. **Historical Aspects of Disease**. Drawing on internment records of the Mt. Pleasant Cemetery, this project uncovers the causes of death for over 4,000 citizens of Sioux Falls between 1880 and 1940. Unusual disease prevalence (e.g. myocarditis), common disease incidence (e.g. cancer), and unusual disease occurrence (e.g. summer complaint, Bright's disease, neurasthenia) are examined for their incidence, prevalence and effects on medical practice and	Sioux Falls. In person or remote	henry.travers@usd.edu P-605-359-2750

	community health. The research also encompasses historical disease management in comparison to modern times and the prior gaps in medical knowledge that supported contemporary management.		
Dr. Henry Travers, MD, FACP	2. **Eclectic Medicine**. The eclectic movement operated from 1825 through 1939 and was based on the study of botanicals, mostly North American plants. Botanical knowledge derived largely from Native American sources and that knowledge was applied by distinct groups of practitioners (e.g. Shakers, Thomasonians, Homeopaths, Eclectics) which arose from public dissatisfaction with allopathic medicine. Eclectic pratitioners were licensed in South Dakota. It it is the aim of this research to trace the Eclectic movement and its practitioners based upon the records of the South Dakota Board of Medical Examiners.	Sioux Falls. In person or remote	henry.travers@usd.edu P-605-359-2751
Dr. Henry Travers, MD, FACP	3. **Hospital Quality**. Beginning with the landmark work of Avedis Donabedian, this research briefly explores the development of hospital quality measures generally with a particular focus on South Dakota. We then examine the medical staff quality improvement data from a single rural hospital in South Dakota to determine (1) the general categories of quality	Sioux Falls. In person or remote	henry.travers@usd.edu P-605-359-2752

	issues and (2) did the quality improvement program actually improve quality of care.		
Dr. Henry Travers, MD, FACP	4. **Piltown Man**. The hoax, begun in 1912, involved not only the "discoverer" of the fossil skull that was its basis (Charles Dawson), but the anatomist Sir Arthur Keith, theologian Pierre Teilhard de Chardin, and even Sir Arthur Conan Doyle. Keith, who, with Martin Flack, discovered the sinoatrial node of the cardiac conduction system, may have been fooled by his presumption of large-brained human ancestors. The suggestion, by Stephen Jay Gould, of Chardin's culpability, has provoked considerable controversy. In this research, we examine the hoax to reassess in the involvement of Keith and Chardin.	Sioux Falls. In person or remote	henry.travers@usd.edu P-605-359-2753
Dr. Arun Singh,	**Parkinson's Disease**. There are many effective therapies for upper-extremity motor symptoms of PD but there are fewer therapies for lower-extremity symptoms such as gait and balance dysfunctions. Here, we will test the hypothesis that frontal attenuated theta-band activity and amplified beta-band activity as well as mid-cerebellar decreased theta activity are associated with gait abnormalities in PD patients with FOG compared to PD	Lee Med, Vermillion. In person only	arun.singh@usd.edu P-605-658-6320

	patients without FOG or healthy subjects.		
Dr. Jose Pietri, PhD	**Microbiology, infectious diseases**. Projects focus on understanding the dynamics and mechanisms of bacterial pathogen transmission by insect vectors, primarily lice and cockroaches.	Lee Med, Vermillion. In person only	jose.pietri@usd.edu P-605-658-6391
Dr. Brian Burell, PhD	**Neuroscience.** Current experiments for the summer would include operant conditioning experiments to access the effects of prior injury to learning about nociceptive stimuli or to see the role of endocannabinoid signaling in this process. Students with prior experience in cell biology or biochemistry techniques may be able to work on similar projects related to kinase signaling or endocannabinoid sysnthesis and metabolism.	Lee Med, Vermillion. In person only	brian.burell@usd.edu P-605-658-6352
Dr. Francisco Bustos	Understanding the molecular basis of the intellectual disability MRX105. The student will be involved in a project related to: -Study of the regulation of by USP27X phosphorylation - Validation of novel USP27X protein interaction partners and their cellular function - Study of the role of USP27X in pluripotent or neural cells identity - Identification of	Sanford Research Sioux Falls, in person only	francisco.bustos@sanfordhealth.org P-605-312-6240

	developmental USP27X substrates - Generation of novel cellular stem cell models to study USP27X		
Dr. Adam Stys, MD	Data mining for our databases. Literature reviews/primary drafts for case reports/reviews. Topics of research are: Cardiogenetics, Calcium score database, Cath lab database	Sanford Cardiovascular Insitute, Sioux Falls. In person only	adam.stys@sanfordhealth.org P-605-312-2200
Dr. Michelle Baack	We use rat and cell models to understand DOHD. TProjects include working with the team to analyze ovary, sperm embryo, placental trophoblast and cardiomyocyte imaging and genomic data to understand how diet and diabetes during pregnancy can transmit transgenerational changes.	Sanford Research, 2301 E 60th St. North, Sioux Falls, SD In-person only	michelle.baack@sanfordhealth.org P-605-357-1508
Dr. Sujit Vijay Sakpal	Retrospective clinical analysis of potential and actual kidney donors over a 10-year period (2012-2022) will reveal trends and assist in highlighting donor-factors influencing donation or withdrawal from donation and the most common causes for it. This will help to identify opportunities for effective promotion of live-donation and further access to live-donor KT.	Avera Transplant Institute-Sioux Falls, In-person only	sujit.sakpal@usd.edu p-917-232-6626
Dr. Luye Qin	Autism spectrum disorder (ASD) is a group of neurodevelopmental disorders with significant genetic heterogeneity and strong comorbidities, such as epilepsy. We are interested in discovering the molecular, synaptic mechanisms of ASD and ASD-	Lee Med, Vermillion. In-person only	luye.qin@usd.edu p-605-658-6328

	related epilepsy by using transgenic mouse models, and performing retrospective chart reviews of ASD patients with epilepsy.		
Dr. Grant Campbell	Elucidate a role for caspase-5 processing in the virus-triggered TLR8-mediated macrophage pro-inflammatory cytokine response. Macrophages promote an early host response to infection by releasing pro-inflammatory cytokines such as IL-1β, TNF, and IL-6. Cells can sense pathogenic microorganisms through Toll-like receptors (TLR). Caspase-5 was previously thought only to be activated by bacterial infection. We have data that shows that viral RNA from HIV and SARS-CoV-2 can activate TLR8 in macrophages to elicit the expression of IL-1β via a non-canonical NLRP3 inflammasome pathway involving caspase-5. This project will elucidate a role for caspase-5 processing in the response to virus internalisation.	Lee Med, Vermillion. In-person only	grant.r.campbell@usd.edu. 605-658-6381
Dr. Grant Campbell	Assess the effect of smoking/vaping on the macrophage immune response to virus exposure. The impact of cigarette and vape smoke on NLRP3-dependent responses in human macrophages is largely unknown. We will investigate the effects of cigarette smoke extract (CSE) on the NLRP3 inflammasome pathway and basal glycolysis in human macrophages stimulated with HIV and SARS-CoV-2 antigens and compare the effects with e-cig smoke and nicotine-containing e-cig smoke extract as well as non-smoking controls.	Lee Med, Vermillion. In-person only	grant.r.campbell@usd.edu. 605-658-6381

Dr. Grant Campbell	Evaluate the effect of smoking/vaping on xenophagy. Our objective is to establish whether macrophages from exposed to cigarette/vape smoke have defective autophagy in response to HIV compared to controls. We will challenge macrophages exposed to cigarette or vape smoke with HIV or HIV antigens and assess autophagic flux using fluorescent microscopy, western blotting and flow cytometry.	Lee Med, Vermillion. In-person only	grant.r.campbell@usd.edu. 605-658-6381
Dr. Grant Campbell	Delineate the role of TLR8 signalling in HIV and SARS-CoV-2-mediated atherosclerotic cardiovascular disease. Expression of HIV can drive atherosclerosis in people living with HIV. Increased expression of fractalkine on vascular endothelial cells is associated with artherosclerosis. In this project we will investigate the mechanism, effect, and ability of viral RNA to induce the secretion of fractalkine from human coronary artery endothelial cells and assess the resulting endothelial damage.	Lee Med, Vermillion. In-person only	grant.r.campbell@usd.edu. 605-658-6381
Dr. Grant Campbell	Evaluate the impact of vitamin D on HIV antiretroviral therapy (ART) induced myopathy. Skeletal muscle myopathy is associated with emtricitabine/rilpivirine/tenofovir fixed-dose combination therapy for HIV-infection. In this study we will assess the impact of vitamin D supplementation on ART-induced myopathy resulting from the ART-induced depletion of mitochondria in skeletal muscle. The most sensitive marker for monitoring mitochondria toxicity is through the measurement of mitochondria DNA levels. This study will thus investigate the effects of vitamin D and ART, used alone or in combination, on mitochondria	Lee Med, Vermillion. In-person only	grant.r.campbell@usd.edu. 605-658-6381

	DNA levels in human skeletal muscle myoblasts and myotubes.		
Dr. Grant Campbell	Identification of pharmacologic agents that when used singly or in combination induce death of HIV-infected microglia cells while sparing uninfected cells. Although ART has led to significant HIV suppression and improvement in immune function, persistent viral reservoirs remain in microglia that are refractory to ART and are also resistant to the cytopathic effects of HIV and support persistent HIV replication. Therefore, we need an effective approach that will eliminate HIV from all viral reservoirs. In this project we will identify pharmacologic agents that when used alone or in combination induce death of HIV-infected microglia while sparing uninfected cells.	Lee Med, Vermillion. In-person only	grant.r.campbell@usd.edu. 605-658-6381
• Benjamin Solomon, MD • Chad Spanos, MD • John Lee, MD • David Starks, MD, MPH • Yuliang Sun, MD, PhD • Bing Xu, PhD • Tobias Meissner, PhD • Rachel Elsey, PharmD • Casey Williams,	Retrospective analysis of data from Avera/Sema4 Oncology and Analytics (ASAP) Protocol. The ASAP study, which started with a soft launch in November 2021, will enroll up to 3,000 patients a year, including those with cancer and those at risk for developing cancer. Study participants will receive genomic sequencing of their tumor and hereditary cancer and pharmacogenomics testing to identify targeted, personalized treatment options. Sema4 and Avera will then utilize this clinical and genomic data to improve the understanding of the molecular characteristics in all stages of cancer patients to advance precision oncology treatment. Opportunities to present and publish the work based upon effort and time invovlved. • Examples of projects included: o Outcomes for patients with TP53	Avera Cancer Institute, Sioux Falls. In-person or hybrid	Casey.williams@avera.org 605-322-3588

PharmD, MBA	alterations that have received therapy with a VEGF inhibitor o Outcomes for patients > 75 that received a checkpoint inhibitor for lung cancer, SCCHN, endometrial tumors, or other malignancies o Evaluation and write up of outcomes for patients with mucosal melanoma o Evaluation of patients with HER2 low in diseases other than breast cancer using proteomics and NGS o Using ChatGPT to evaluate symptoms, treatment ranking, and outcomes o Evaluation of molecular signatures in patients that received dual checkpoint inhibitors and assessing differences between responders and non-responders o Assessment of patients with FGFR alterations that received lenvatinib for treatment o Evaluation of proteomics in SCCHN and/or gynecologic malignancies and correlation with DNA/RNA and treatment outcomes		
• Benjamin Solomon, MD • Chad Spanos, MD • John Lee, MD • David Starks, MD, MPH • Yuliang Sun, MD, PhD • Bing Xu, PhD • Tobias Meissner, PhD • Rachel Elsey,	Cost effectiveness and quality related to cancer services	Avera Cancer Institute, Sioux Falls. In-person or hybrid	Casey.williams@avera.org 605-322-3588

PharmD • Casey Williams, PharmD, MBA			
• Benjamin Solomon, MD • Chad Spanos, MD • John Lee, MD • David Starks, MD, MPH • Yuliang Sun, MD, PhD • Bing Xu, PhD • Tobias Meissner, PhD • Rachel Elsey, PharmD • Casey Williams, PharmD, MBA	Develop longitudinal research project with a mentor that may extend beyond summer 2023. •Options include developing an investigator-initiated clinical trial, retrospective real world data review, and/or working on a current ongoing project. o Expectation will be to present and publish on chosen project	Avera Cancer Institute, Sioux Falls. In-person or hybrid	Casey.williams@avera.org 605-322-3588
Dr. Lisa MacFadden	Prospective study exploring the application of markerless motion capture technology using smart phone for biomechanics testing for orthopedics and sports medicine conditions and athletic movements. We will use software on iPads and iPhones called OpenCap to collect data and assess movements and explore utility for clinical assessments.	USD Gear Center, Sioux Falls. In-person only	lisa.macfadden@usd.edu 585-315-6917
Dr. Lisa MacFadden	Data analysis using already collected data from baseball, golf, ACL, and other research studies to assess biomechanical trends in movement in young athletes and relationship to injury or sports performance outcomes. We have	USD Gear Center, Sioux Falls. In-person or remote	lisa.macfadden@usd.edu 585-315-6917

	collected movements from about hundreds of athletes through different prospective research protocols. Project may also include prospective data collection during Summer of 2023 in Sioux Falls or Vermillion.		