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.

2024 Medical Student Summer Research Mentors

Mentor	Project Descriptions	Project Type & Location	Contact Information
Pilar de la Puente PhD	Elucidating dynamics of extracellular matrix remodeling in response to chemotherapy in ovarian cancer. The de la Puente lab focuses on the development of novel, human, precision-based models that allow early detection of cancer and empower drug screening by more closely replicating a tissue microenvironment for in vitro assays. We have developed precision-based 3D models of the tumor microenvironment in order to more accurately mimic cell-cell and cell-matrix interactions. Through these culture models, we hope to gain a deeper understanding of the role of the tumor microenvironment and their accessory cells during cancer progression, drug resistance and cancer immunology. Our lab uses tissue-specific physiologically relevant 3D models with an emphasis in tumor-immune interactions, microfluidic	Sanford Research, Sioux Falls. In-person only	pilar.puente@sandfordhealth.org P-605-312-6042

	"tumor-on-a-chip", as well as understanding of mechanisms of chemoresistance. The lab goal is to use these tools to empower biological research, drug discovery and personalized medicine in health and disease. Our ultimate goal is to provide human surrogate models that could support the prediction of drug efficacy, thereby saving the patient from trial-and-error treatments, and ultimately serve as a guide for the selection of patient-targeted drug therapies.		
Kevin Francis PhD	Determine how lipid metabolism regulates stem cell fate and functionality. Studies analyzing cholesterol metabolism demonstrate lipid species expression varies between cell types, resulting in varied responses to changes in cholesterol homeostasis. However, the requirements for lipid homeostasis for stem cell function and differentiation is unclear. We will use stem cell models, gene expression, and super resolution microscopic imaging of differentiating cell types to define how changes in cholesterol homeostasis and other lipid species regulate cell identify and function. We hypothesize lipid metabolism is tightly regulated and tissue-specific with lipid changes being causative or tissue malformation and dysfunction in developmental disorders.	Sanford Research, Sioux Falls. In-person only	Phone: 605-312-6422 E-mail: kevin.francis@sanfordhealth.org

Kevin Francis PhD	Define the impact of lipid metabolism on extracellular vesicle signaling and function. Cholesterol and lipids are critical components of endosomes trafficked intracellularly and vesicles released extracellularly as signaling molecules. However, the specific requirements for lipids within various vesicles and endosomal compartments for vesicle formation, release, cargo maintenance, and transport to target tissues is unclear. Using isolation techniques and analyses of vesicles through biochemical, imaging, and molecular methods, we will test the hypothesis that lipid homeostasis is critical to normal vesicular signaling during mammalian development.	Sanford Research, Sioux Falls. In-person only	Phone: 605-312-6422 E-mail: kevin.francis@sanfordhealth.org
Kevin Francis PhD	Examine how changes in lipid metabolism impact the subcellular localization and function of lipid-binding proteins. Use of precise gene editing techniques, such as CRISPR/Cas9, allows researchers to create physiologically relevant cell models to analyze real-time expression of proteins of interest. Using these models, we are analyzing dynamic changes in protein localization in using human cell lines to detail the effects of metabolic perturbation on developmentally critical signaling pathways and the specific requirements for lipid-protein binding. These projects utilize techniques spanning molecular biology, cell biology, and biochemistry to identify target proteins and analyze the impact of lipid metabolism.	Sanford Research, Sioux Falls. In-person only	Phone: 605-312-6422 E-mail: kevin.francis@sanfordhealth.org

Kevin Francis PhD	Determine the impact of lipid homeostasis on the internalization of cargo and nutrients. Recent work in the lab has determined that endocytosis through various mechanisms is inhibited upon loss of cholesterol homeostasis and environmental stress. Based upon clinical findings in patients and cellular data, we hypothesize deficits in the organization of lipids within membranes are a prime contributor to endocytosis inhibition. Using super resolution microscopy, stem cell culture, and quantitation of endocytic signaling pathways, we will define the mechanisms whereby disease-associated changes in lipid metabolism leads to endocytic dysfunction.	Sanford Research, Sioux Falls. In-person only	Phone: 605-312-6422 E-mail: kevin.francis@sanfordhealth.org
Henry Travers MD, FACP	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 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.	Variable, Sioux Falls In-person Or Remote	Phone: 605-359-2750 E-mail: henry.travers@usd.edu

Henry Travers MD, FACP	Race and The South Dakota Medical Journal. The medical journal, known initially as the Journal Lancet and now as South Dakota Medicine shares with other publications the medical understandings of race in each period of its history. One publication, The New England Journal of Medicine, has conducted a systematic review of racial viewpoints influential for medicine in its pages and analyzed them within the social and scientific context of today. In this research, we review the digitalized issues of the journal going back to the early 20th century to discover to what extent South Dakota physicians' publications have mimicked those found by other publications. This summer's project will extend last year's work from 1930 through 1999.	Variable, Sioux Falls In-person Or Remote	Phone: 605-359-2750 E-mail: henry.travers@usd.edu
Henry Travers MD, FACP	Legitimate Scientists and Illegitimate Science: Hoax and Humbug. Taking as examples Haekel's embryologic studies and Samuel George Morton's racial classification based on skull measurements in the 19th century and the Piltown Man hoax in the 20th, this research explores the consequences for 21st century science and medicine of bias in individual scientists. The research will not cover deliberate scientific misconduct, but rather intrinsic characteristics of scientists framed by their cultures. Using not only the technical writings of scientists, but also their commentary and that of others from the mid-18th through the early 21st	Variable, Sioux Falls In-person Or Remote	Phone: 605-359-2750 E-mail: henry.travers@usd.edu

	centuries, this research will investigate the effects of science framed simply as a source of neutral facts or alternatively framed as a more complex enterprise influenced by the entire society in which it is conducted.		
Henry Travers MD, FACP	History of Bias in South Dakota Medical Journals. The medical journal, known initially as the Journal Lancet and now as South Dakota Medicine shares with other publications the medical understandings of race in each period of its history. One publication, The New England Journal of Medicine, has conducted a systematic review of racial viewpoints influential for medicine in its pages and analyzed them within the social and scientific context of today. In this research, we review the digitalized issues of the journal going back to the early 20th century to discover to what extent South Dakota physicians' publications have mimicked those found by other publications. This summer's project will extend last year's work from 1930 through 1970.	Variable, Sioux Falls In-person Or Remote	Phone: 605-359-2750 E-mail: henry.travers@usd.edu
Henry Travers MD, FACP	The Historical Meaning of Professionalism. Much of what it means to be a doctor has changed over the thousands of years that the healing arts have been recognized as a specialized human calling. But some of it has not, and it is those persistent elements that are the underpinnings of medical professionalism. Changes in how civilizations are organized and how people apprehend those organizations within the contexts of their own understandings of humanity	Variable, Sioux Falls In-person Or Remote	Phone: 605-359-2750 E-mail: henry.travers@usd.edu

	alter ideas of what being practitioners of medicine (the term used here to encompass the healing arts) meant. Thus, understanding what it means to be a doctor today requires that we examine an evolution in science, art, sociology, economics and politics among others. This research explores that evolution.		
Jianning Tao PhD	Cancer research - focusing on the pathogenesis and treatment of osteosarcoma, rhabdomyosarcoma, breast cancer, and leukemia.1. In person project – This is a cell model-based project to examine the in vitro effects of targeting NOTCH1-RBPJ interaction using a small molecule inhibitor of RBPJ (RIN1) against human osteosarcoma cells. The effects of the drugs on cellular functions such as cell proliferation, osteoblast differentiation, and target gene expression will be examined. The project was conducted by a former SPUR summer student using a cell line. Data summary/abstract has been published in Cancer Res, 15 June 2022, Volume 82, Issue 12_Supplement, 6308. Complementary studies using another cell line are required to complete the project.	Sanford Research Center-Sioux Falls SD In-person or remote	Jianning.Tao@Sanfordhealth.org
Jianning Tao PhD	Congenital diseases - focusing on the study of the genetic causes and treatment of congenital kyphosis.2. Remote project – This is a bioinformatics-based project designed to examine a mutation landscape of a human patient-derived xenograft cell line (termed COS-33) that was generated and published in my laboratory. My laboratory performed whole-genome sequencing using genomic DNA from COS-33. The raw data has undergone	Sanford Research Center-Sioux Falls SD In-person or remote	Jianning.Tao@Sanfordhealth.org

	preliminary processing. Completing the project requires completing the remaining genomic analysis of the cell line and comparing the results with currently published data. Applicants need to have the drive and desire to complete this program. This project will be completed together with our current bioinformatics collaborators.		
Lisa MacFadden PhD	Biomechanics Data Analysis Data analysis using already collected data from baseball, golf, ACL, and other research studies to assess biomechanical trends in movement in young athletes and their relationship to injury or sports performance outcomes. We have collected movements from hundreds of athletes through different prospective research protocols. The project may also include prospective data collection during the Summer of 2024 in Sioux Falls or Vermillion.	USD Gear Center, Sioux Falls SD In-person or remote	Phone: 585-315-6917 E-mail: lisa.macfadden@usd.edu
Lisa MacFadden PhD	3D printing for medical education. 3D printing has emerged as a pivotal tool for medical education and communication. This research project will focus on the development and effectiveness of leveraging 3D printing as a tool for medical education. Educational modules or courses will be developed along with 3D models of human anatomy and disease for medical education and provided to medical students. Surveys will be used to assess the effectiveness of 3D printing to augment medical education.	USD Gear Center, Sioux Falls SD In-person or remote	Phone: 585-315-6917 E-mail: lisa.macfadden@usd.edu

Lisa MacFadden PhD	Development of tools for quantifying human movement using artificial intelligence. Students do not need programming experience to work on this project. This project aims to improve biomechanical assessments in clinical settings by addressing limitations of current motion capture technology, such as high costs and space requirements. We are leveraging wide field-of-view cameras and artificial intelligence in computer vision and data science to quantify human movement in close proximity without the subject wearing markers or sensors. The ultimate goal is to create a fully functional treadmill prototype integrated with markerless motion capture technology, facilitating natural subject movements for broader clinical adoption.	USD Gear Center, Sioux Falls SD In-person or remote	Phone: 585-315-6917 E-mail: lisa.macfadden@usd.edu
Casey Williams, PharmD, MBA Benjamin Solomon, MD Chad Spanos, MD David Starks, MD, MPH Tobias Meissner, PhD Rachel Elsey, PharmD	Our research topics available for summer students are compiled from multiple mentors and investigators. Novel therapeutic combinations, access to personalized medicine services and clinical trials, comprehensive molecular profiling and deep clinical annotation of real world data, and the impact of molecular alterations on therapeutic response and/or development of drug resistance are current areas of interest. -Establish baseline metrics for Research to develop FTE: staff ratio benchmarks	Avera Cancer Institute, Sioux Falls In-person or Hybrid	Phone: (605) 322-3588 E-mail: casey.williams@avera.org

Casey Williams, PharmD, MBA Benjamin Solomon, MD Chad Spanos, MD David Starks, MD, MPH Tobias Meissner, PhD Rachel Elsey, PharmD	Our research topics available for summer students are compiled from multiple mentors and investigators. Novel therapeutic combinations, access to personalized medicine services and clinical trials, comprehensive molecular profiling and deep clinical annotation of real world data, and the impact of molecular alterations on therapeutic response and/or development of drug resistance are current areas of interest. -Retrospective analysis of data from the Avera Sequencing 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. 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 Assessment of patients with FGFR alterations that received lenvatinib for treatment o Evaluation of proteomics in SCCHN and/or gynecologic malignancies and	Avera Cancer Institute, Sioux Falls In-person or Hybrid	Phone: (605) 322-3588 E-mail: casey.williams@avera.org

	correlation with DNA/RNA and treatment outcomes o IO response and immune markers/MHC o Taxane resistance / PIK3 o risk assessment of Mosaiq for patient safety- top 3 risk of the EMR o Breast program - compile CESM data		
Casey Williams, PharmD, MBA Benjamin Solomon, MD Chad Spanos, MD David Starks, MD, MPH Tobias Meissner, PhD Rachel Elsey, PharmD	Our research topics available for summer students are compiled from multiple mentors and investigators. Novel therapeutic combinations, access to personalized medicine services and clinical trials, comprehensive molecular profiling and deep clinical annotation of real world data, and the impact of molecular alterations on therapeutic response and/or development of drug resistance are current areas of interest. -Cost effectiveness and quality related to cancer services is the main topic.	Avera Cancer Institute, Sioux Falls In-person or Hybrid	Phone: (605) 322-3588 E-mail: casey.williams@avera.org
Casey Williams, PharmD, MBA Benjamin Solomon, MD Chad Spanos, MD David Starks, MD, MPH Tobias Meissner, PhD Rachel Elsey, PharmD	Our research topics available for summer students are compiled from multiple mentors and investigators. Novel therapeutic combinations, access to personalized medicine services and clinical trials, comprehensive molecular profiling and deep clinical annotation of real world data, and the impact of molecular alterations on therapeutic response and/or development of drug resistance are current areas of interest. -Develop longitudinal research project with a mentor that may extend beyond summer 2025 • Options include developing an investigator-initiated clinical trial, retrospective real world data review, and/or working	Avera Cancer Institute, Sioux Falls In-person or Hybrid	Phone: (605) 322-3588 E-mail: casey.williams@avera.org

	on a current ongoing project o Expectation will be to present and publish on chosen project		
Denise Arrick, Ethan Snow	The research project will involve a cadaveric clinical case analysis of scoliosis and subsequent asymmetrical psoas major/iliacus/iliopsoas anatomical variations due to the pelvic obliquity. The research will require careful examination of the case documentation (e.g., photos, measurements) and a thorough literature review to compose a detailed composition of the condition's gross anatomy, etiology, epidemiology, symptomology, diagnosis, subtype descriptions, treatment, and comparisons to other studies. A biomechanical analysis will be performed on the bilateral psoas major, iliacus, and iliopsoas muscles (and their variant components), which involves examination and measurement of each muscle's postmortem fixed sarcomere lengths, gross parameters of each muscle, and use of mathematical formulas to calculate each muscle's normalized maximal isometric force (Fmax). Comparisons of each muscle's Fmax will form the basis of the case's discussion about structure, function, and relevance to hip mechanics for that individual. The discussion will also focus on the interconnectedness of the non-typical anatomical morphologies and the resulting clinical implications. Mentorship of the medical student will ensure project productivity and success.	Lee Med Building Vermillion, Hybrid-In person and remote	Phone: 605-658-6336 E-mail: denise.arrick@usd.edu

	The selected medical student will be the lead author on the project. The abstract will later be submitted to the American Association for Anatomy's (AAA) annual conference OR the American Association of Clinical Anatomists' (AACA) annual where it will be peer-reviewed and selected for publication. This will lead to a prepared manuscript which will then be submitted to Translational Research in Anatomy for peer review and publication.		
Alexander Kloth PhD	A long-term goal of our laboratory is to determine whether treatments with neurotrophic actions-including environmental enrichment and pharmacological agents-might one day lead to successful therapies for ASD. One possible strategy that has recently attracted our attention involves erythropoietin (EPO) and its derivatives. EPO is an endogenous cytokine that has potent, long-lasting effects on cell survival, neuroplasticity, and neurogenesis, making it a candidate for treating a host of neuropsychiatric disorders, including ASD. However, EPO's potential has been limited by it severe hematological side effects. To overcome this hurdle, researchers have engineered non-hematopoietic derivatives that appear to have similar actions as EPO and appear to ameliorate disease features in model mice. For instance, we have recently shown that carbamoylated EPO (CEPO), which rescues anxiety and depression-related behavior in the BALB/c mouse model, also restores social approach behavior in these mice. However, the degree to which	Augustana University, Sioux Falls. In-person Only	Phone: (605) 274-4720 E-mail: alexander.kloth@augie.edu Lab web page: https://www.sdbrin.org/undergraduate/research-mentors/augustana-university/kloth-alexander

	CEPO rescues social and other ASD-related behaviors, the mechanisms underlying these potential behavioral changes, and the applicability of these findings to other ASD models all remain unclear. The goal of the proposed project is to more broadly assess the effects of CEPO on ASD-related behaviors and examine the underlying neurobiological correlates of these effects.		
Lee Baugh PhD	Neuromodulation to Reduce Chronic Pain- Chronic pain is a condition that affects up to 100 million people in the US and constitutes a major healthcare burden. Current treatments include primarily opioids and NSAIDs as first-line treatments, but long-term use of opioids has major drawbacks and addiction issues. There is a pressing need to develop alternative therapies to address chronic pain. Pain Education is a therapeutic approach that has been shown to reduce a patient's perception of their chronic pain, and this project will combine pain education with neuromodulation to evaluate the combined effects on reducing chronic pain. The neurostimulation will consist of 3mA high-definition transcranial direct current stimulation (HD-tDCS) or sham, for 20 minutes over the insula, centered over T7 based on the international 10/20 EEG system via a 4x1 montage delivered via Ag/AgCl sintered ring electrodes, ensuring maximum stimulation of the left insular cortex. The insula has a role in pain perception and emotional regulation, and this project would directly assess the outcome of activation of the insula	Lee Medical Building, Vermillion In-person	Email: Lee.Baugh@usd.edu

	combined with pain education on patients experiencing chronic pain.		
Lee Baugh PhD	Neuromodulation to Assess Ethical Decision Making- Are you interested in exploring the neural basis of moral decision-making? Join our research study investigating how transcranial magnetic stimulation (TMS) affects moral judgments. This project examines the agent-deed-consequences (ADC) model of moral reasoning by targeting key brain regions—the temporoparietal junction (TPJ) and dorsolateral prefrontal cortex (DLPFC)—to understand their roles in ethical decision-making. Participants will undergo EEG recordings, TMS interventions, and behavioral assessments to determine how neural modulation influences moral evaluations. This is a unique opportunity to gain hands-on experience with cutting-edge neuromodulation techniques, cognitive neuroscience methodologies, and human decision-making research. If you are interested in psychology, neuroscience, or bioethics, we invite you to be part of this exciting study.	Lee Medical Building, Vermillion In-person	Email: Lee.Baugh@usd.edu
Lee Baugh PhD	Neuromodulation to assess motor learning and control- Are you interested in how neuromodulation can enhance motor learning and cognitive function? Our research explores the impact of transcranial magnetic stimulation on tool use motor learning, focusing on the left anterior supramarginal gyrus (aSMG)—a brain region critical for integrating tools	Lee Medical Building, Vermillion In-person	Email: Lee.Baugh@usd.edu

	into the motor system. Using state-of-the-art neurostimulation techniques, we aim to determine whether inhibiting this brain region reduces acquisition and modulates neural activity associated with motor resonance. Participants will undergo behavioral training with chopsticks after receiving targeted neurostimulation, with performance measured through EEG, eye tracking, and eeg-based connectivity analysis. This work has broad applications, from optimizing learning in medical and military contexts to advancing rehabilitation and human-robot interaction. If you are passionate about neuroscience, cognitive enhancement, or translational neuromodulation, we invite you to join us in pioneering the future of brain-based skill acquisition.		