Summer Research Opportunities by Mentor - 2026

Han Cheng, OD, PhD & Joe Wheat, OD, PhD - Our research interests focus on enhancing the diagnosis and management of ocular and visual conditions. This summer, Dr. Joe Wheat and I will investigate the application of artificial intelligence (AI) tools in primary eye care and optometric education.

Vivien Coulson-Thomas, PhD - The main interest of my lab involves the extracellular matrix (ECM) and how it regulates development, homeostasis, aging and pathological processes of the ocular surface with the goal of developing new therapies. Current projects available include (1) establishing how the limbal stem cell niche maintains viable limbal stem cells, (2) investigating how the ECM regulates corneal regeneration, inflammation and pathological angiogenesis, (3) establishing the etiology of Meibomian gland dysfunction (MGD) and developing prevention strategies, and (4) identifying factors that contribute to lacrimal gland inflammation and dry eye disease. A student working on either of these projects would attain hands-on experience in a vast array of cell biology techniques including primary and established cell line culture, histology, immunofluorescence, protein purification, Western Blotting, molecular biology, imaging, image analysis, and high pressure liquid chromatography. Our lab utilizes various transgenic mouse models and human tissues.

Luca Della Santina, PharmD, PhD - My laboratory focuses in identifying the alterations occurring to retinal function and synaptic connectivity during ocular diseases. Projects include: 1) Imaging and quantification of synaptic rearrangement occurring in the retina following to neuronal loss using confocal microscopy 2) Development of high-performance image analysis algorithm for quantification of large number of synapses 3) Development of deep learning neural networks for automating the detection of external ocular diseases from photographs and video streams.

Arthur Fernandes, MPH, PhD - My work combines clinical, demographic, and biological data to study eye diseases. Current projects include global and community-based studies of visual impairment, pediatric myopia and screening programs, ocular health in underserved and Indigenous populations, translational non-human primate models of ocular aging and glaucoma, and multi-omics biomarker discovery. A summer student in my lab would work on a secondary data analysis project using public health datasets (e.g., Texas Department of State Health Services; Centers for Disease Control and Prevention), gaining hands-on experience with literature review, data extraction and management, basic statistical analysis, and preparation of a research report suitable for presentation or publication. This project is designed to introduce students to clinical and population-based vision research.

Tarsis Gesteira Ferreira, MSc., PhD - Our laboratory specializes in drug development, with a focus on designing proteins and small molecules to aid in wound healing and regeneration, particularly targeting the ocular surface and dry eye disease. We actively manipulate extracellular matrix (ECM) proteins to explore their roles in development, homeostasis, aging, and various pathological conditions affecting the ocular surface. Our current projects include (1) Engineering small leucine-rich proteoglycans to understand their function in organizing the corneal extracellular matrix and enhancing their affinity to key molecules like TGF- b1, VEGFRII, integrins, and TGFBRII; (2) Developing hyperstable mini-protein binders that target multiple factors involved in inflammation and corneal wound healing, and (3) Designing small molecules and peptides aimed at developing effective treatments

for burns, dry eye, and corneal injuries. Students engaged in these projects will gain extensive hands-on experience in a variety of cell biology techniques, including protein design, protein expression and purification, biophysical analysis of proteins, and Western Blotting.

Michael Kalloniatis, MSc, PhD - The primary focus of our lab is to understand how structural changes in the retina and optic nerve relate to visual function in normal and diseased eyes. We combine clinical imaging with visual and functional testing to understand how structural changes relate to vision. Current research interests include retinal and optic nerve diseases such as glaucoma, retinal vascular diseases, diabetic retinopathy, and inherited retinal diseases. We utilize advanced imaging modalities, including optical coherence tomography (OCT), OCT angiography (OCTA), and retinal imaging, alongside psychophysical measures such as visual fields testing in mesopic and photopic conditions, color vision, and other functional assessments. A key goal of the lab is to link local structural damage to specific visual deficits, helping improve diagnosis and patient management.

Anna Matynia, PhD -The main focus of my lab is to define the neural underpinnings of behavior, specifically pain-related behaviors in mouse models of human disease or injury. We will be investigating light aversion as a surrogate for photophobia and facial grimace for ocular pain in animal models with surgical, pharmacological and molecular interventions. Current projects available are 1) identifying peripheral and central nervous system pathways involved in migraine associate light aversion and 2) defining the complexity of corneal innervation. A student working on these projects will gain experience in behavioral, cell and molecular biological, and/or immunohistological approaches as well as scientific design and analysis.

Kimberly Meier, PhD - Our lab studies how the human visual system develops and maintains sensitivity to contrast, motion, and binocular cues. We study both typical and atypical visual development in both kids and adults. Current projects include (1) investigating contrast sensitivity and binocular function using EEG and psychophysical testing, (2) characterizing eye-movement patterns in typically and atypically developing children, and (3) understanding how amblyopia alters visual perception compared to controls. Students working in the lab would gain hands-on experience with experimental design, programming and quantitative data analysis, behavioral vision testing, high-precision eye tracking, and/or EEG acquisition and analysis.

John O'Brien, PhD - A major goal of research in my lab is to understand the molecular mechanisms used by retinal neurons to optimize synaptic strength and retinal circuitry to function under different lighting conditions. We will be investigating signal transduction pathways that control the function of gap junction proteins, which form electrical synapses. These studies may involve cell culture or animal (mouse and zebrafish) model systems, molecular biology techniques, and advanced imaging strategies. A second focus of the lab is to understand mechanisms of regeneration and integration of photoreceptors in a zebrafish model of retinal degeneration. We will be studying the differentiation of progenitor cells into rod photoreceptors and the role of microglia in integration of new photoreceptors into the retina.

Nimesh Patel, OD, PhD - The research interest of my lab include the accurate quantification of optic nerve head morphology in normal and disease eyes. We use optical coherence tomography (OCT) to image the eye, and develop custom algorithms for analysis, which are then histologically validated. Current projects in this area include; 1) accounting for retinal curvature for OCT based optic nerve head and macula quantification, and 2) determining the retinal ganglion cell density and axonal characteristics in the peripapillary tissue of healthy and glaucomatous eyes.

Maureen Plaumann, OD, PhD - My research interests include the visual deficits that develop due to abnormal development of the binocular vision system in humans. Specifically, a current project is analyzing the monocular fixation patterns of individuals with and without binocular vision anomalies on multiple instruments. These measurements will be compared to each other and to other visual functions (ex: visual acuity, stereopsis, contrast acuity). Research for the summer would include testing both control and test subjects through this clinically translational project.

Jason Porter, PhD - The main goals of our laboratory are to learn more about the causes of retinal and optic nerve head diseases and how the retina develops in normal eyes. In conjunction with the use of conventional clinical tests (such as fundus photography and optical coherence tomography [OCT]), we use a technology called adaptive optics to correct the blur imposed by the eye's optics and examine the structure of single cells in healthy and diseased eyes. Current projects in the lab include (1) measuring changes in the lamina cribrosa, optic nerve head, and retinal vasculature over time in eyes with glaucoma, 2) examining changes in the photoreceptor mosaic in patients with retinal degenerations (such as retinitis pigmentosa) to better understand genotype-phenotype and structure-function relationships in these diseases, as well as 3) examining how the cone photoreceptor mosaic, foveal pit and optic nerve head change during normal development and differ between healthy eyes with different refractive errors. Occasionally, the lab also has projects that examine retinal structure and function in patients following a concussion and/or traumatic brain injury.

Rachel Redfern, OD, PhD - My laboratory is investigating ocular surface inflammation and infection. We hypothesize ocular surface damage stimulates the release of alarmins which activate toll-like receptors (TLR) to perpetuate inflammation through the production of cytokines and conversely protect the ocular surface through the production of antimicrobial peptides. These studies have been investigating using a variety of models including cell culture, animal, and human subjects to examine molecular changes that occur with disease (e.g. dry eye). Currently, we are examining novel therapeutic options that may modulate the risk of inflammation and infection.
Given the prevalence of dry eye expected to double over the next few decades and the lack of definitive treatment regimes, there is a critical need to development of therapeutic regimens that reduce inflammation while not increasing the risk for infection.

Christophe P. Ribelayga, PhD – A major research focus in our lab is to understand the retinal mechanisms that contribute to refractive development and the onset of myopia. We use a variety of genetically engineered and experimentally induced mouse models of myopia to dissect how retinal pathways regulate eye growth. In particular, we are interested in how gap junction signaling and circadian (24-hour) clock mechanisms shape retinal processing in ways that influence refractive state. Our goal is to identify the cellular and circuit-level mechanisms by which the retina detects visual experience and drives myopic change. A student joining our lab would gain hands-on experience with quantitative analysis of refractive development of the mouse eye (refractometry, keratometry, OCT/biometry).

Eric Ritchey, OD, PhD - The research interests of the Ritchey Lab are in the areas of contact lenses, myopia, and dry eye disease. In dry eye disease, the lab is investigating how low-level red light therapy affects patients with dry eye, including the effect of this therapy on the ocular surface, meibum quality, and clinical outcomes. In myopia, my research interest is in contact lens control of myopia progression and the visual performance of these contact lenses. I am interested in the optical profiles of contact lenses, the effect on treatment efficacy, and the quality of life with these devices. My contact lens research examines factors related to contact lens comfort and dropout, with a goal of predicting which

contact lens product matches the need of the patient. This includes subjective and objective methods for evaluation of Lid Wiper Epitheliopathy and Meibomian Gland Disease.

Diane Sayah, OD, PhD - Our current research focuses on the biomechanical properties of the sclera in glaucoma and myopia. In other words, we use an imaging technique to measure if a subject's eyeball is rigid (like a soccer ball) or compliant (like a birthday balloon), and evaluate the role of this parameter in the development and progression of eye diseases. Current projects include investigating the role of ocular rigidity in the development and progression of childhood myopia. Students with a keen interest in ocular imaging, image processing, and/or clinical research are encouraged to discuss their specific interests with Dr. Sayah, as other projects may be in the pipeline.

Maria Walker, OD, PhD - My research interests are based around ocular surface research in disease and contact lens wear. I have a translational research lab, which means that I collect clinical data and samples and often use basic science techniques to assess these samples in the lab. I mostly focus on collection of tear samples, evaluating the proteins, cells, and lipids contained to understand inflammation and how it plays a role in disease and lens wear. The primary disease we are focused on is keratoconus, and our research is often in keratoconus and other disease populations that are wearing scleral lenses. My scleral lens research interests range from evaluating the tear fluid for inflammatory cells and analytes, to investigating the impact of scleral lenses on corneal structure and metabolism.

Geunyoung Yoon, PhD - My lab’s research interests cover broad areas in physiological optics, vision science, and biomedical engineering. The overarching goal of my laboratory is to improve our understanding of optics of the eye, its impact on neural processing and spatial vision, and underlying mechanisms of eye problems such as keratoconus, presbyopia, and refractive error development/control. We achieve this goal by conducting human-based translational research that involves advanced optical imaging modalities, vision correction technology (adaptive optics and wavefront-guided contact lenses), and visual psychophysics paradigms.