UNIVERSITY of HOUSTON | OPTOMETRY

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TO:	First year optometry students
FROM:	Laura Frishman, Associate Dean
SUBJECT:	NEI Summer Research Fellowship for Professional Students
	http://www.opt.uh.edu/research/summer-research-program
DATE:	January 18, 2018

The University of Houston, College of Optometry (UHCO) has a summer research program supported by the National Eye Institute (NEI). The purpose of the program is to introduce students in health professional schools to opportunities for a research career. The program is designed to help avoid a future shortage of clinician investigators by attracting professional students into a career that includes clinical and health-related research. Optometry students who participate will receive a Predoctoral Research Fellowship in the amount of $5961 for the summer (May 14 to Aug. 12, 2018). At least 11 trainee fellowship slots are open, primarily to 1st year students who are not enrolled in Optometry coursework during summer. **U.S. citizenship or permanent residence is required**. Special consideration will be given to students from underrepresented minorities.

More detailed descriptions of research projects are on subsequent pages, and will also be included on the webpage http://www.opt.uh.edu/research/summer-research-program. If you have a special research interest and/or wish to work with a particular faculty member, please include this information on the application form which is attached in a separate file. It is **strongly** recommended that you contact faculty members whose research interests you. Email addresses are on the UHCO website- http://www.opt.uh.edu/research/research-faculty.

If you are interested in doing vision research this summer, please use the application form attached to this notice, or posted on the UHCO website. Additional information and forms can be obtained by contacting Renee Armacost, the program manager, (rrattelade@uh.edu). Applications are due Friday, **March 2, 2018**. Acceptance announcements will be made by Monday, March 19th. If you have any questions, please email Dr. Frishman, Renee Armacost or the faculty mentors:

MENTORS	CURRENT RESEARCH INTERESTS
Heather Anderson, OD, PhD	Objective measurements of accommodation in children and factors limiting visual quality in individuals with Down syndrome
Ray Applegate, OD, PhD	Optical characteristics and correction of normal and clinical eyes, e.g., cataracts, refractive surgery, keratoconus; correction of the highly aberrated eye
Jan P.G. Bergmanson, OD, PhD	Corneal anatomy and pathology, contact lenses and tears
David Berntsen, OD, PhD	Development and progression of myopia in children, contact lenses, eye aberrations
Alan Burns, PhD	Leukocyte behavior within the injured cornea
Han Cheng, OD, PhD	Noninvasive evaluation of visual pathways
Dan Coates, PhD	Normal and impaired visual perception
Vivien Coulson-Thomas, PhD	Glycosaminoglycans and proteoglycans in cornea, cancer, wound healing, stem cells, inflammation, development, spinal cord injury and nerve regeneration.
Wendy Harrison, OD, PhD	Structure and function relationships in diabetic eye disease
Ruth Manny, OD, PhD	Vision development, refractive error and anomalies of binocular vision
Jason Marsack, PhD	Quantification of optical performance in highly aberrated eyes and development of correction strategies
Lisa Ostrin, OD, PhD	Behavioral and environmental influences on refractive error development and circadian rhythm; choroidal and optic nerve head changes in myopia.
Nimesh Patel, OD, PhD	Optical coherence tomography imaging of the optic nerve head and surrounding tissues
Jason Porter, PhD	Imaging the eye with an adaptive optics scanning laser ophthalmoscope
Vijaykrishna Raghunathan, PhD	Role of extracellular matrix in ocular disease, biomechanics and surface phenomena at the ocular surface interface, materials based strategies for development and delivery of therapeutics.
Rachel Redfern, OD, PhD	Toll-like receptors (TLRs) involvement in dry eye inflammation and the risk for ocular surface infection.

Rose Reins, PhD	Effects of vitamin D treatment on dry eye-induced inflammation and characterization of vitamin D metabolites at the ocular surface
Kathryn Richdale, OD, PhD	Anterior segment changes associated with contact lens wear and complications and obesity and diabetes
Eric Ritchey, OD, PhD	Contact lenses, lid wiper epitheliopathy, refractive error development, ophthalmic optics
Scott Stevenson, PhD	Eye movements and binocular coordination, visual processing of motion and depth, motion tracking

Summer Research Opportunities by Mentor - 2018

Heather Anderson OD, PhD – This summer the student working in my lab would be conducting a study to evaluate the use of a newly developed contrast sensitivity test, CamBlobs, in children. The study design may include comparing the test to other pediatric contrast tests, as well as determining the repeatability of the test administered twice in the same subject. In addition to conducting this study, the student may also observe and assist with study visits for an on-going spectacle lens trial for adult subjects with Down syndrome.

Raymond Applegate, OD, PhD – My research centers on understanding the visual impact of the optical aberrations of the normal and clinical eye and optimizing the visual outcomes of therapy designed to optically improve the visual performance of the normal and clinical eye.

Jan P G Bergmanson, OD, PhD, D.Sc. – Texas Eye Research and Technology Center offers a number of interesting opportunities. We are often conducting clinical studies involving new contact lens designs and materials and new contact lens care products. We are studying the tear film in scleral gas permeable contact lens wearers, post-refractive surgery patients and patients with anterior segment pathologies. In addition, we also routinely receive corneal buttons from keratoplasty transplant surgery to be evaluated histopathologically. These specimens will allow the study of diseases like keratoconus and macular-, granular-, lattice- and Fuchs endothelial dystrophies, some of which are rare anomalies. Keratoconus is a disease that distorts the cornea of the young person with a profound effect on vision and quality of life. TERTC is conducting clinical and basic research to uncover its etiology, histopathology and to improve our clinical management of this disorder. You could be part of this team effort.

David Berntsen, OD, PhD – My research interests include both the development and progression of myopia in children, contact lenses, and aberrations of the eye. My research involves using biometric data (measurements of the ocular components) and measures of optical quality to better understand the mechanism responsible for the progression of myopia in children. My research also involves determining the effect of refractive correction (spectacles and contact lenses) on the central and peripheral optics of the eye, retinal image quality, and on choroidal thickness.

Alan Burns, PhD – The location of the cornea makes it vulnerable to traumatic injury, either accidental or as a result of surgery. Healing of corneal wounds is of vital importance, not only to ensure the integrity of the eye but also to maintain the best possible visual acuity. The mechanisms regulating healing after corneal injury are not fully understood. Migration of inflammatory cells to the site of corneal injury appears to be necessary and beneficial for wound healing. However, dysregulated inflammation delays wound healing and increases the risk of infection. Our experiments are designed to understand mechanisms regulating inflammatory cell migration within injured corneas. In studies of injured cornea, we examine the healing process and inflammatory cell migration in mice that are deficient in certain adhesion molecules or specific cell types. Techniques employed include high resolution immunofluorescence light microscopic imaging (deconvolution), electron microscopy and computerized 3D image reconstruction, morphometric computer-assisted analysis, cell culture and live cell imaging. Information gained from our studies will help to identify molecular and cellular mechanisms responsible for inflammatory cell recruitment into the injured cornea and this may define new therapeutic targets for regulating inflammation while still preserving the benefits it brings to wound healing.

Han Cheng, OD, PhD – My general research interest is to improve diagnosis and management of optic nerve diseases. Summer research this year will be focused on measuring contrast sensitivity (CS) using a newly designed inexpensive CS test in patients with optic nerve diseases.

Daniel Coates, PhD – My research laboratory has two broad foci: visual perception, including peripheral vision, reading, and color vision in normal subjects and in the presence of disease; and the use of computational and statistical techniques for modeling, diagnosis, and prediction. Example summer projects include psychophysical experiments involving low vision, or machine learning-based analysis of clinical data.

Vivien Coulson-Thomas, PhD – The research interests of my lab involve primarily the study of glycosaminoglycans and proteoglycans in the fields of cornea, wound healing, stem cells, inflammation, development, brain injury and nerve regeneration. One of our ongoing projects is to unveil the role of hyaluronan in ocular surface development and pathology using knockout approaches. Another ongoing project in my lab is to investigate the anti-inflammatory role of the hyaluronan matrix in the glial scar and the therapeutic potential of targeting this matrix after brain, retina and optic nerve injury. 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 and high pressure liquid chromatography.

Wendy Harrison, OD, PhD – The goal of our research lab is to better understand what happens in the eye in patients with diabetes. Diabetes is the leading cause of preventable vision loss in working aged Americans. It affects both blood vessels and nerves in the retina as well as the front of the eye. We evaluate retinal nerve function with a multifocal electroretinogram and nerve and vascular structural changes with an OCT and retinal photographs. We hope to understand the timeline of changes to structure and function as the disease progresses. We also hope to learn how gender, diet, and health differences play into vision loss in these patients.

Ruth Manny, OD, PhD – My research interests encompass several broad areas that include vision development, refractive error and anomalies of binocular vision. My focus this summer will be on studies to support the development of a screening procedure for preschool children.

Jason Marsack, PhD – The research interests of our laboratory center on the development of new optical correction strategies (glasses, contact lenses) for individuals with ocular diseases that cause distorted corneal optics and poor retinal image formation (e.g.: keratoconus). We are interested in three aspects of this problem. 1) Design, manufacture and evaluation of custom contact lenses that contain patient-specific optical corrections: We are currently building and evaluating these 'wavefront-guided' lenses in-house. 2) Evaluation of pseudo-custom corrections: This study is evaluating whether the types of refractive error present in keratoconus have enough commonality across patients to develop corrections that are applicable to not just one keratoconus patient, but to groups of patients, making delivery of these corrections cheaper for the patient, and easier for the clinician. 3) Simulation of the impact of refractive error on visual performance: These experiments focus on developing computer models that simulate real-world optical conditions and neural constraints. These three areas have as a common goal increasing clinical access to care and improving quality of life for individuals that suffer from abnormally high levels of corneal distortion.

Lisa Ostrin, OD, PhD – My research interests include environmental and behavioral influences on circadian rhythm, myopia, and the choroid. Light exposure has a close link with numerous aspects of human physiology and has been implicated in several different pathological processes including myopia development, circadian rhythm disturbances, mood disorders, cancer, and metabolic disorders. The intrinsically photosensitive retinal ganglion cells (ipRGCs) are an inner retinal photoreceptor type that respond directly to short wavelength blue light, and are responsible for non-image forming functions including circadian rhythm entrainment and pupil size. Ongoing projects in the lab include 1) measuring and correlating light exposure with ipRGC activity, circadian rhythm patterns, melatonin levels and refractive error, 2) determining the influence of retinal blur on the choroid, and 3) developing devices to continuously and objectively measure behaviors related to eye growth.

Nimesh Patel, OD, PhD – Optic neuropathies can result in irreversible blindness, especially if not treated. Hence, early detection and determination of progression are essential. Clinically, non-invasive optical coherence tomography imaging is often used to assess structural changes within the retina and optic nerve, and standard automated perimetry is used to assess visual function. Our lab is interested in factors that influence retinal and optic nerve head measures, and how clinically assessed structural measures relate to visual function.

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 normal 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 normal eyes with different refractive errors.

Vijay Krishna Raghunathan, PhD – Primary open angle glaucoma (POAG) is a retinal disease that is manifested by ocular hypertension due to increased resistance to aqueous humor outflow. Most of the resistance to the outflow is thought to be through the extracellular matrix (ECM) of the trabecular meshwork (TM). My lab is interested in investigating the bidirectional relationship between TM cells and the ECM that they deposit in order to better understand the molecular principles underlying TM dysfunction. Current projects include (1) characterizing the mechanical properties of ECM with perturbed Wnt signaling, and (2) determining the effects of pathologic ECM on normal cell gene/protein expression, and phenotype (adhesion, cell-cell communication).

Rachel Redfern, OD, PhD – My laboratory is investigating toll-like receptors (TLRs) involvement in dry eye inflammation and the risk for ocular surface infection. We hypothesize that endogenous TLR ligands are increased on the ocular surface in dry eye and can activate TLRs to inflammation, while also reducing the risk for infection through the production of antimicrobial peptides. Currently, we are determining 1) the involvement of TLR endogenous ligands in dry eye and dry eye-associated conditions, 2) the impact of TLRs on the secretion of proinflammatory cytokines and proteases in mice

with experimental dry eye and in human ocular surface cells, and 3) the involvement of TLRs in modulating the risk for microbial infection in mice with dry eye. With the prevalence of dry eye expected to double over the next few decades and lack of definitive treatment regimes, there is a critical need to better understand the pathophysiology of dry eye to aid in the development of therapeutic regimes that reduce inflammation while not increasing the risk for infection.

Rose Reins, PhD – Vitamin D is a natural, multifunctional hormone that is known to play a significant role in immune system regulation, protecting against chronic inflammation. Increasing evidence shows that vitamin D plays a protective role in maintaining eye health. However, its function, bioavailability, and immunomodulatory capacity at the ocular surface need to be investigated. The goal of my research is to determine the efficacy of vitamin D as an anti-inflammatory agent for the treatment of inflammatory eye conditions, such as dry eye disease, and to characterize vitamin D's bioavailability and function at the ocular surface and in the tear film. Projects for the summer include 1) evaluation of vitamin D in dry eye subjects; and 2) examination of vitamin D treatment in a mouse model of experimental dry eye.

Katherine Richdale, OD, PhD – My research interests are primarily in cornea/anterior segment and contact lenses. Some of my current research proposals include understanding contact lens complications in children and young adults, developing better ways of treating and managing patients with multifocal and orthokeratology contact lenses, and exploring changes in the anterior segment of the eye with obesity and metabolic disease.

Eric Ritchey, OD, PhD – My research interests are in the area of 1) contact lenses and 2) refractive error development. While contact lenses are the preferred method of vision correction for many patients, we know that dropout from contact lens wear remains a significant issue in clinical practice. My 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. I also have an interest in myopia development, with my interest in contact lens control of myopia progression and contact lens performance.

Scott Stevenson, PhD – Eye movements are controlled through a combination of voluntary and reflexive responses to visual input. Research in my laboratory examines the visual processes that support each of these aspects, and the way in which they are combined in the final motor response. For comparison to eye movement responses, we also study visual processing of motion and depth information with psychophysical methods, and we study visual tracking behavior using hand and head movements instead of eye movements.