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 13, 2017

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 clinical and health-related research career. Optometry students who participate will receive a Predoctoral Research Fellowship in the amount of $5844 for the summer (May 10 to Aug. 8, 2017). At least 11 trainee fellowship slots are open, primarily to 1st year students, 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 are also 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 3, 2017**. Acceptance announcements will be made by Monday, March 20th. 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
Vivien Coulson-Thomas	Glycosaminoglycans and proteoglycans in cornea, cancer, wound healing, stem cells, inflammation, development, spinal cord injury and nerve regeneration.
Laura Frishman, PhD	Retinal physiology, non-invasive evaluation of visual function in lab and clinical studies
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	Structural and functional ocular changes in myopia, susceptibility for other ocular disorders such as glaucoma, in myopic eyes.
Nimesh Patel, OD, PhD	Structure-function relations in an animal model of glaucoma, and in glaucoma patients
Jason Porter, PhD	Imaging the eye with an adaptive optics scanning laser ophthalmoscope
Daniel Powell, OD, PhD	Environmental influences on the tear film; tear film imaging; contact lens discomfort
Vijaykrishna Raghunathan	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.
Scott Stevenson, PhD	Eye movements and binocular coordination, visual processing of motion and depth, motion tracking

Summer Research Opportunities - 2017

Heather Anderson OD, PhD – One aim of my research lab is to investigate the measurement of accommodation in both children and young adults using objective techniques with efforts to better quantify the overall accommodative amplitude of clinical patients and identify age-related changes. A second aim is to investigate the optical limits of visual acuity in patients with Down syndrome and determine whether spectacle prescriptions derived objectively to minimize the negative impact of optical aberrations on retinal image quality will improve visual performance beyond that obtained with standard clinical techniques.

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 – Texas Eye Research and Technology Center offers a number of interesting opportunities. We will be conducting clinical studies involving new contact lens designs and materials and new contact lens care products. We are also studying the tear film in 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. We have an ongoing research program in the area of ultraviolet radiation (UVR), where we are developing new ways to measure transmittance through contact lenses and intraocular implants (IOLs) and the in vitro cornea. Finally, 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.

Vivien Coulson-Thomas- The overarching goal of my lab is to elucidate the precise mechanism by which stem cell-specific matrices modulate the immune system. We have previously shown that mesenchymal stem cells are not rejected when transplanted into the stroma of immunocompetent mice. Therefore, these human stem cells attain the ability to suppress the mouse immune system thereby avoiding rejection. We are currently investigating the mechanism by which the stem cells suppress the host immune response. We have recently isolated a glycosaminoglycan present in the glycocalyx of the stem cells, which is responsible for them suppressing the inflammatory response. Therefore, the aims of the project are to characterize the glycocalyx secreted by stem cells and elucidate the mechanism by which these cells evade host rejection. A student working on this project would choose between elucidating the mechanism by which stem cells suppress the immune system, obtaining hands-on experience in a vast array of cell biology techniques including primary and established cell line culture, various co-culture techniques, isolation and maintenance of stem cells, immunofluorescence, or characterizing the glycocalyx, gaining training in structural biology techniques such as protein purification, western blotting and immunofluorescence.

Laura Frishman, PhD – The electroretinogram (ERG) is a retinal response to a flash of light or to modulation of the contrast of a patterned stimulus that can be recorded noninvasively from the surface of the cornea. The overall objectives of the work in this laboratory are to analyze the retinal origins (i.e. to identify the specific retinal cell types) that contribute to the flash and multifocal ERG so that we can improve the utility of this noninvasive measure in assessing retinal function in the lab and in the clinic. To this end, we are comparing ERGs recorded from normal humans, monkeys and mice, with ERGs of humans with diseased retinas, and animal models.

Ruth E 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 – One of the goals in my lab is to understand environmental influences, such as light exposure, on eye growth and circadian rhythms. Light exposure has a close link with numerous aspects of human physiology and has been implicated in several different pathological processes including circadian rhythm disturbances, mood disorders, cancer, and metabolic disorders. The intrinsically photosensitive retinal ganglion cells (ipRGCs) are an inner retinal cell type that respond directly to short wavelength blue light, and are responsible for non-image forming functions including circadian rhythm entrainment and pupil size. Current projects in the lab include 1) measuring and correlating ipRGC function with light exposure, circadian rhythm patterns, melatonin levels and refractive error, 2) determining the effects of short and long wavelength blocking glasses and/or contact lenses on ipRGC function and choroidal thickness, and 3) determining the effects of blue light emitting devices (iPads, iPhones) on ipRGC function and the choroid.

Nimesh Patel, OD, PhD – Glaucoma is a group of optic neuropathies that can result in irreversible blindness, especially if not treated. Although there is no cure, early detection and treatment can slow the progression of vision loss. Non-invasive OCT imaging is often used to assess early structural changes within the retina and optic nerve. Current projects in the lab include investigating; 1) methodologies for structural analysis that account for non-neuronal tissue and ocular magnification, 2) structural risk factors for glaucoma progression, and 3) the relationship between ganglion cell layer/inner plexiform layer thickness and 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.

Daniel Powell, OD, PhD – Dry eye is a commonly encountered condition in the clinical setting and can be associated with a decrease in quality of life if left untreated or undermanaged. A myriad of risk factors have been associated with dry eye ranging from contact lens wear to the external environment. Potential studies include investigating the effects of tobacco smoke and contact lens wear on dry eye status as well as repeatability and validation studies of diagnostic dry eye tests.

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 ***(i)*** characterizing the mechanical properties of ECM with perturbed Wnt signaling, and ***(ii)*** 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.

Scott B 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.