Oxyopia, the Greek word meaning "acute vision," is the title of the weekly vision science seminars presented at the Indiana University School of Optometry during the fall and spring semesters. The seminars serve a twofold purpose in that they:

- stimulate intellectual activity among the faculty, and
- provide a learning environment for graduate students.

Oxyopia presenters are IU School of Optometry faculty members and graduate students as well as visiting lecturers from other departments, universities, research facilities, private practices, industry, etc.

Oxyopia Fall 2012 Schedule

All seminars are held on Friday from 12:00 to 1:00 p.m. in Rm. 105 of the Optometry Building on the IU Bloomington campus unless otherwise stated. Seminar coordinator is Dr. Stephen A. Burns.

Fri, Aug 24 12:00-1:00 PM OPT Rm 105	**No Presentation** Meeting with students.
Fri, Aug 31 12:00-1:00 PM OPT Rm 105	**When The Ground Shifts…Adapting to Changes in Science** William Swanson, PhD Indiana University School of Optometry Indiana University A key aspect of success in a scientific career is the ability to adapt to change. Sometimes the ground one has been standing on becomes transformed, the theoretical framework one has been using is no longer valid, and one must adapt. If one only adapts to changes in the external scientific environment, without an overarching goal, it can become difficult to maintain a sustained research program. If one only focuses on the overarching goal, it can become difficult to attract sustained interest by the wider scientific community and funding by external agencies. This talk will discuss a range of changes that have occurred at different stages during my three decades as a vision scientist, and how I have adapted. There have been changes in: the theoretical framework shared by researchers, the emphases of funding agencies, and support from departmental interests. Visual science topics will include psychophysical surround suppression at cortical and retinal levels, psychophysical window artifacts in use of sinusoidal gratings, and psychophysical evaluation of the doctrine of functional reserve as applied to perimetry in patients suspected for

	glaucoma.
Fri, Sep 7 12:00-1:00 PM OPT Rm 105	**Contemporary Issues in the Evaluation of Astigmatism** Mark Bullimore, MCOptom, PhD, FAAO Adjunct Professor University of Houston College of Optometry TBA
Fri, Sep 14 12:00-1:00 PM OPT Rm 105	**Photoscreening of diabetic patients: systems to increase eye examinations and problems in getting patients the help they need** Ann Elsner, PhD Indiana University School of Optometry Indiana University Photoscreening of diabetic patients provides a method of identifying individuals who require eyecare. Digital cameras allow ease of data transfer, but retinal images are negatively impacted by anterior segment optics and small pupils. We are performing a study to increase access to patient examinations, with testing of underserved patients based at 4 Alameda County Medical Center (ACMC) clinics that provide photoscreening via the EyePACS network. Most patients are from minority groups with high incidences and prevalence of diabetic retinopathy. A second study to increase portability for screening, which will facilitate screening and diagnostic image outside of centers, is also underway. To decrease cost and discomfort, but improve usability and image contrast in the presence of media degradation or small pupils, we have developed non-mydriatic, confocal retinal imagers. A Phase I study collected retinal images in patients recruited specifically because of known or suspected diabetic retinopathy, using the Laser Scanning Digital Camera (LSDC), a near infrared scanning imager, and a commercially available, non-mydriatic color camera (Canon CR6-45NM, Canon Inc, Tokyo, Japan). Dilated fundus examinations provide the gold standard for detection of diabetic retinopathy and macular edema. A Phase II study is collecting retinal images in diabetic patients who are being screened, many without specific ocular histories. In addition to the two cameras in the Phase I, Spectral Domain Optical Coherence Tomography (SDOCT) was added (iVue, Optovue). This has provided over 1000 data sets from underserved diabetic patients, the majority of whom are African American, Hispanic, or Asian. A key emphasis in both phases has been the detection of hard exudates as a marker for macular edema. To increase portability, a retinal imager (DLP-cam) is under development that uses digital light projection to replace the illumination and scanning elements. The resulting confocal, digital imager provides a more familiar color image, or a monochromatic image, and has the potential for enhanced contrast due to the simulation of scanning with the projected light. Color retinal images of 8 undilated control subjects demonstrated good vessel contrast. Color balance and uniformity across an image are being investigated by the manipulation of aperture width, and also post-processing of images.
Fri, Sep 21 12:00-1:00 PM OPT Rm 105	**Imaging of Retinal Microvasculature with Different degrees of Confocality using Adaptive Optics Scanning Laser Ophthalmoscope (AOSLO)** Yuen Ping Toco Chui, PhD Indiana University School of Optometry Indiana University

	Adaptive Optics Imaging provides a direct and noninvasive approach to image microvasculature in the living human retina. We investigated the possibility of further improving vascular imaging by combining adaptive optics scanning with multiply scattered light imaging. By using different confocal aperture sizes, varying the degree of confocality and degree of alignment of the confocal apertures of an AOSLO, we can increase the detectability of erythrocytes and the microvasculature, including the fine structure of arteriole wall. Retinal microvasculature and scattering behavior of the blood content were clearly visualized at the foveal, perifoveal, papillary, and peripapillary regions in all subjects.
Fri, Sep 28 12:00-1:00 PM OPT Rm 105	**Street-Crossing Decision-Making: A Comparison between Patients with Age-Related Macular Degeneration and Normal Vision** Shirin Hassan, PhD Indiana University School of Optometry Indiana University **Purpose**: When crossing an unsignalized street, pedestrians must judge gaps in vehicular traffic to allow enough time for them to reach the other side of the street before an approaching vehicle reaches them. Little is known however at how accurate and reliable pedestrians with impaired vision from Age-related Macular Degeneration (AMD) are in making safe street-crossing decisions. The aim of this study was to determine whether the street-crossing decisions of subjects with AMD are as accurate and reliable as those made by young and older subjects with normal vision. **Methods**: Street-crossing decisions in 13 AMD subjects, 20 young and 20 older control subjects with normal vision were measured along an unsignalized street for nine different gap times. After calculating the discriminability (d') of the street-crossing decision variable for all gap pairs and entering these d' values into a one-dimensional scaling model, the means of each distribution of the decision variable relative to a "center of gravity" were estimated and plotted against gap time. The resultant plot was a non-linear function. Street-crossing decision-making accuracy was computed for each subject as the difference between the x-intercept of the non-linear function (tCOG) and subject's measured street-crossing time. Street-crossing decision-making reliability was computed as the value of the slope of the non-linear function at tCOG. **Results**: We found that all subjects were reliable in their street-crossing decisions ($p=0.55$). Significant differences in street-crossing accuracy were found as a function of age ($p=0.003$). Compared to either the older normally-sighted ($p=0.018$) or AMD subjects ($p=0.019$), the young normally-sighted subjects made the least accurate street-crossing decisions. No significant difference in accuracy was found between the AMD and age-matched normally-sighted subjects ($p=0.90$). **Conclusions**: Our data suggests that age and central vision loss did not significantly affect a subject's reliability in their street-crossing decisions. Age, but not central vision loss, significantly affected a subject's accuracy in their street-crossing decisions.
Fri, Oct 5 12:00-1:00 PM OPT Rm 105	**Comparison of the multifocal electroretinogram a-wave and cone density** Michael Klein, BS Graduate Student Indiana University Multifocal electroretinography (mfERG) is a viable clinical tool to analyze localized retinal function. The a-wave of the mfERG is related to cone photoreceptor activity and is used to assess outer retinal dysfunction. However, there is evidence from animal

	studies that post-receptoral neurons may contribute to the mfERG a-wave. There is also considerable inter-individual variability in the a-wave amplitude across normal subjects, further complicating the interpretation of mfERG results. Recently, it has become possible to image cones with high resolution and obtain in vivo cone counts at different retinal eccentricities using an Adaptive Optics Confocal Scanning Laser Ophthalmoscope (AOSLO). In this study, we explored the relationship between cone density and mfERG responses at the same retinal locations. This presentation will review the methods, present preliminary results and discuss implications of the findings.
Fri, Oct 12 12:00-1:00 PM OPT Rm 105	**No Presentation** FALL BREAK
Fri, Oct 19 12:00-1:00 PM OPT Rm 105	**Math Models for Tear Film Dynamics: What do they have to say?** Richard Braun, PhD University of Delaware Though the tear film is part of a very complex system, it is amenable to some kinds of mathematical modeling. Because the tear film is very thin compared to its extent, the complicated equations of fluid mechanics can be simplified to a relatively few equations that are (fairly) readily solved. Those thin film equations can yield the aqueous and lipid layer thicknesses, the osmolarity and fluorescein concentration inside the aqueous layer, the distribution of polar lipids, and other variables of interest. This talk will emphasize results from these mathematical models and comparison with experiment, but not the derivation or mathematical details of the models. Results from blinking, breakup (including comparison with IU experiments), eye-shaped domains, and the tear film's effect on epithelial cells will be presented. This NSF- and NIH-supported work was in collaboration with a number of colleagues, including JL Bruhns (U of Delaware), PE King-Smith (Ohio State) and CG Begley's group at IU.
Fri, Oct 26 12:00-1:00 PM OPT Rm 105	**No Presentation** AAO ANNUAL MEETING
Tue, Oct 30 5:30 - 6:30 PM PM OPT Rm 105	**Smoke gets in your eyes: cannabinoid signaling in the mammalian eye** Alex Straiker, PhD Indiana University Cannabinoid receptors are the endogenous target of the psychoactive ingredients of marijuana and hashish but they are also part of an endogenous cannabinoid signaling system. This system includes the machinery to produce and break down endogenous cannabinoids as well as to modulate the receptors themselves - an alphabet soup of hydrolases and lipases. It is established that CB1 cannabinoid receptors are present and functional in vertebrate

	retina and anterior eye, but almost nothing is known about the expression or function of the remaining proteins in the eye, especially the anterior eye. We have recently completed a study of the expression of these proteins in the murine retina and have now turned our effort to a systematic examination of their expression patterns in the murine anterior eye. Our goal is to understand the architecture of cannabinoid signaling: by identifying the circuitry of cannabinoid receptors, determining where (and which) cannabinoids are produced, where they are broken down, and how the receptors are modulated, we expect to pave the way for functional inquiries and to identify specific targets for therapeutic intervention. This talk will present a survey of the work we have been doing over the last several years, with special attention to recent work involving the enzyme ABHD12. Faulty ABHD12 function has been linked to retinitis pigmentosa and cataracts in humans.
Fri, Nov 2 12:00-1:00 PM OPT Rm 105	**Understanding ocular motor adaptation in myopic children** Priya Sreenivasan, PhD Indiana University School of Optometry Indiana University Accommodation and vergence are two interacting ocular motor systems that function to maintain clear and single vision across a wide range of distances. Sustained fixation results in adaptation of these motor systems, which has been widely investigated in adults but not in children. This talk looks at studies that measured ocular motor adaptation in emmetropic and myopic school aged children (7-15 years) with normal binocular vision but varying degrees of near phoria. Adaptation was studied by conflicting the demands for accommodation and vergence using ±2D adds (over corrective lenses) and monitoring the changes to motor systems at frequent intervals during sustained near fixation. The plus add paradigm will discuss the impact of bifocals/progressive addition lenses (one of many treatment options for reducing myopia progression) on the motor responses of myopic children during periods of prolonged near fixation.
Tue, Nov 6 5:30-6:30 PM OPT Rm 105	**Macular Degeneration and Glaucoma: A Tale of Two Bestrophins** Alan Marmorstein, PhD. University of Arizona The bestrophins are a highly conserved family of anion channels found in organisms ranging from fungi to man. Mutations in bestrophin 1 cause a class of eye diseases termed "bestrophinopathies" which includes Best vitelliform macular dystrophy. Bestrophin 2, a close homologue of Bestrophin 1, plays an important role in regulating aqueous flow and so is implicated in ocular hypertension and glaucoma. In this seminar the roles of Bestrophin 1 and 2 in the eye will be discussed in relation to potentially new therapeutic options for the treatment of macular degeneration and glaucoma.
Fri, Nov 9 12:00-1:00 PM OPT Rm 105	**Elucidating mechanisms of retinal development and disease with human pluripotent stem cells** Jason Meyer, PhD Indiana University Purdue University Indianapolis The retina has long served as an important model of neural development, due in part to its relatively simple, organized structure and ease of access. As such, a wealth of knowledge exists regarding the development of the retina and its cellular subtypes. Like the rest of the nervous system, the retina is afflicted by a number of inherited and acquired neurodegenerative diseases, such as retinitis pigmentosa and age-related

	macular degeneration. Therefore, we sought to develop a simple method of isolating a highly enriched population of optic vesicle (OV) stage, multipotent retinal progenitor cells from human ES and iPS cells. Human pluripotent stem cells (hPSCs) were differentiated toward a retinal lineage and highly enriched populations of OV stage retinal progenitors were manually separated from forebrain progenitor populations and allowed to differentiate for up to 120 days. Differences in gene expression between retinal and forebrain progenitor populations were determined via PCR and microarray analyses. In vitro maturation of OV populations produced all major classes of retinal cell types in a manner reminiscent of normal development. Next, we sought to demonstrate that iPS cells could be used to establish retinal disease models. We generated and characterized an iPS cell line derived from a patient with gyrate atrophy, an RPE-based inherited retinal degenerative disease. RPE from all sources were highly similar based on functional assays, as well as gene and protein expression of characteristic markers. However, unlike iPS cell-derived RPE from normal controls, gyrate atrophy patient-derive iPS cell RPE lacked activity of the ornithine aminotransferase enzyme, characteristic of the disease process. Results from this study demonstrate that highly enriched populations of OV stage, multipotent retinal progenitors can be isolated from hPSCs. Furthermore, patient-specific hiPSCs can be used to produce specific retinal cell types that express disease-causing gene mutations. As such, hiPSCs should prove useful for studying the pathophysiology of some human retinal diseases, as well as for screening small molecules for therapeutic effects. These results will facilitate future studies of mechanisms of human retinogenesis and disease as well as efforts to develop hPSC-based therapies.
Tue, Nov 13 5:30-6:30 PM OPT Rm 105	**Macrophage and Light: Two ways to regulate ocular vascularity** Sujata Rao, PhD. Cincinnati Children's Hospital Medical Center Vascular patterning is critical for organ function. Early eye development is supported by the fetal vasculatures which includes the hyaloid vessels, an arterial network in the vitreous. In all animals with image forming vision, the fetal vasculature undergoes regression to allow for a clear optical axis. The fetal vasculature is replaced by the retinal vasculature which supports the high metabolic demands of the mature eye. In humans these events occur during the first trimester while in mouse it occurs postnatally. Using mouse as a model system we have identified two novel signaling pathways that are responsible for regression, formation of the ocular vasculature and thus the development of a functional eye. In one case, a Wnt ligand that is secreted by the resident ocular macrophages results in a cell cycle dependent apoptosis and thus regression of the hyaloid vessels. Surprisingly, both regression as well as the formation of the retinal vasculature can also be regulated by a fetal light-response pathway. This light response pathway normally suppresses retinal neuron number, limits hypoxia and as a consequence, holds the local expression of vascular endothelial growth factor (Vegfa) in check. It also provides a possible explanation that low light exposure in the first trimester in humans is an independent risk factor for progression of the vascular disease retinopathy of prematurity.
Fri, Nov 16 12:00-1:00 PM OPT Rm 105	**The Dorsomedial/Perifornical Hypothalamus: A Putative Center for Controlling Circadian Fluctuation in IOP and the Translaminar Pressure Gradient** Brian Samuels, MD, PhD Department of Ophthalmology Indiana University School of Medicine Indian University - Purdue University, Indianapolis, IN

	Purpose: Intraocular pressure (IOP) fluctuation has recently been identified as a risk factor for glaucoma progression. Further, decreases in intracranial pressure (ICP), with postulated increases in the translaminar pressure gradient across the lamina cribrosa, has been reported in glaucoma patients. We hypothesized that circadian fluctuations in IOP and the translaminar pressure gradient are influenced, at least in part, by neurons within the dorsomedial and perifornical hypothalamus (DMH/PeF). This study examined whether site-directed chemical stimulation of DMH/PeF neurons with bicuculline methoidide evoked changes in IOP, ICP, and the translaminar pressure gradient. Methods: The changes in heart rate (HR), mean arterial pressure (MAP), IOP, and ICP were recorded and alterations in the translaminar pressure gradient calculated after chemical stimulation of the DMH/PeF region in isoflurane-anesthetized Sprague-Dawley rats. Results: Significant increases in HR, MAP, IOP, and ICP were seen compared to baseline values; however, the peak IOP increase was significantly delayed compared to ICP (28 vs. 4 min post-injection), resulting in a dramatic translaminar pressure gradient fluctuation. Conclusions: Chemical stimulation of DMH/PeF neurons evokes substantial increases in IOP, ICP, and the translaminar pressure gradient. Further defining this pathway has made it possible to identify a potentially novel glaucoma therapy aimed at reducing IOP fluctuations.
Fri, Nov 23 12:00-1:00 PM OPT Rm 105	**No Presentation** THANKSGIVING BREAK
Tue, Nov 27 5:30-6:30 PM Vistakon Conference Room, Clinic building	**Role of aquaporins in lens and corneal transparency** Kulandaiappan Varadaraj, PhD. Department of Physiology & Biophysics Health Sciences Center State University of New York Stony Brook, New York The mammalian lens and cornea are transparent tissues that lack blood vasculature. Several aquaporin (AQP) water channels are expressed in these tissues. The AQP transmembrane channels allow the passive movement of water across the plasma membranes and facilitate nourishing of these avascular tissues to maintain transparency and homeostasis. Two AQPs, AQP1 and AQP0, are predominantly expressed in the lens epithelial and fiber cells, respectively. AQP1 knockout or mutation does not cause cataract whereas loss or mutation of AQP0 leads to autosomal dominant lens cataract. A part of the seminar will focus on the experimental evidences to show the possible reason behind the development of dominant lens cataract in human and mouse, due to AQP0 mutations. Further, our results, in testing the hypothesis that AQP0 may have additional function/s in the fiber cells besides being a water channel, will be presented to show the unique function, using transgenic and knockout mouse models and a novel technique devised in our laboratory. We have recently shown the expression of AQP5 also in the lens. The latter part of the seminar will focus on the role of AQP5 in corneal wound healing. The results indicate that this function can be regulated favorably using a PKA-specific-antagonist. Potential new therapeutic strategies for age-related lens cataract treatment and corneal wound healing will be discussed.
Fri, Nov 30 12:00-1:00 PM OPT Rm 105	**Oxyopia seminar canceled**

Fri, Dec 7 12:00-1:00 PM OPT Rm 105	**A newly observed retinal lesion: Observations on incidence, etiology, and retinal location by AOSLO and SDOCT** Tom Gast, MD, PhD Indiana University School of Optometry Indiana University This presentation will discuss data extracted from our SDOCT files on approximately 850 subjects that were used to characterize a new retinal lesion.
Tue, Dec 11 5:30-6:30 PM Vistakon Conf Room, Optometry Clinic Bldg	**Lipoxygenase Pathway and Diabetic Retinopathy** Mohamed Al-Shabrawey MD, Ph.D Georgia Health Sciences University Features of diabetic retinopathy (DR) include leukocyte/endothelial interaction (leukostasis), breakdown of blood retinal barrier (BRB) and retinal neovascularization (RNV). VEGF plays crucial role in the development of hyperpermeability and RNV via activation of VEGF-R2 which subjected to negative control by oxidation of protein tyrosine phosphatases (PTPs). Despite the clinical evidence which shows that dyslipidemia may contribute to DR, its role has not been studied in detail. Diabetic dyslipidemia is characterized by an increase in arachidonic acid (AA) which is further metabolized by 12/15-lipoxygenase and other enzymatic pathways into proinflammatory lipid metabolites. Recently we demonstrated that upregulation of 12/15 lipoxygenase (12/15-LOX) and its lipid metabolites, 12-HETEs in DR contributes to retinal neovascularization via disrupting glial cells VEGF/PEDF balance. NADPH oxidase and endoplasmic reticulum (ER) are potential targets to the increased lipid metabolites of 12/15-LOX. Furthermore, VEGF-R2 activity is also enhanced by VEGF produced by Müller cells which are activated by the excess lipid metabolites of 12/15-LOX in diabetic retina. The major goal of our study is to investigate the hypothesis that activation of 12/15-LOX contributes to retinal inflammation during DR via NADPH oxidase-dependent mechanism which involves ER stress response, oxidation of PTPs and subsequent enhanced VEGF-R2 activity. Our hypothesis was investigated via 3 specific aims 1) To determine whether 12/15LOX pathway contributes to diabetes–induced retinal inflammation. 2) To determine whether NADPH oxidase-mediated ER stress contributes to retinal inflammation induced by lipid metabolites of 12/15-LOX. 3) To test the hypothesis that enhanced VEGF-R2 signaling pathway plays a role in 12/15-LOX-mediated retinal inflammation. Our study should establish 12/15-LOX inflammatory pathway as a potential novel therapeutic target to prevent the early inflammatory response during DR and in turn halts the progress of the disease to the late stage of retinal neovascularization and vision loss.

Oxyopia Spring 2013 Schedule

Fri, Jan 11 12:00-1:00 PM OPT Rm 105	**New treatment paradigms and advances in imaging for diabetic retinopathy** Jennifer Sun MD Joslin Diabetes Center Harvard University Boston, MA The growing epidemic of diabetes worldwide suggests that by the year 2030, over 552 million individuals worldwide will be at risk for diabetic eye complications, which

	remain the leading cause of vision loss for working age individuals in the U.S. and other developed countries. This talk will briefly review the epidemiology of and classification system for diabetic eye disease. Therapy for diabetic eye complications, including diabetic retinopathy and macular edema has been revolutionized over the last 5 years by the introduction of intravitreally-delivered anti-vascular endothelial growth factor agents. Clinical trial based evidence for recently developed treatment algorithms of diabetic retinopathy and diabetic macular edema will be discussed. Advances in ocular imaging for anatomic and functional outcomes in diabetic eye disease will also be highlighted, including potential applications of adaptive optics scanning laser ophthalmoscopy and spectral domain optical coherence tomography for research in retinal anatomic and functional outcomes in diabetes.
Fri, Jan 18 12:00-1:00 PM OPT Rm 105	**No Presentation**
Fri, Jan 25 12:00-1:00 PM OPT Rm 105	**Impact of primary SA, SCE, and SFs on refractive error** Renfeng Xu Dr. Bradley's Lab Indiana University Bloomington, IN Because the human eye has significant levels of positive spherical aberration, the refraction that focuses paraxial rays will be more hyperopic than that required to focus marginal rays. Which refractions should we use? Interestingly, at photopic light levels, Rx does not vary with pupil size. However, with larger pupils it becomes more myopic at scotopic light levels. One hypothesis for these results argues that due to Stiles-Crawford Effect (SCE) focus of paraxial rays is most important, but at low light levels, there's no SCE and thus the marginal optics may dominate Rx. An alternative hypothesis is that any optical system with spherical aberration will be relatively more myopic for low SFs and more hyperopic for high SFs. Therefore, as light levels drop, and vision becomes limited to low SFs, we might expect a more myopic refraction. I will test and compare these two hypotheses using both computational and experimental methods.
Fri, Feb 1 12:00-1:00 PM OPT Rm 105	**Peripheral Wavefront Aberration of Accommodating Human Eye** Tao Liu Graduate Student Indiana University Bloomington, IN During the last decades the prevalence of myopia globally has skyrocketed to the point that we consider there now to be a global epidemic of myopia (e.g. prevalence can be very high >75%, and magnitude is also very high). Classically, long periods of steady near-work was considered to cause myopia development. During near work many eyes exhibit inadequate accommodation (accommodation lag) resulting in defocus and less than optimal retinal image quality [1, 2], and it was assumed that the resulting blur at the fovea contributed to the excessive eye growth associated with myopia. However, some recent research has implied that poor quality peripheral vision might be key to myopia development [3, 4]. In addition to changing blur associated with accommodation (due to accommodative lag), the sign of the eye's spherical aberration also changes, potentially generating complex differences between unaccommodated and

	accommodate image quality. However, little is known about the impact of accommodation on peripheral image quality. We aimed to measure wavefront aberration in the central and peripheral visual field as a function of accommodative demand. A scanning Shack-Hartmann wavefront aberrometer [5] was employed to measure ocular aberrations along 37 different lines-of-sight over the central 26 degree visual field in 30 seconds. Accommodation was stimulated over the range 0-6D by an acuity target in a Badal configuration. Primary spherical aberration varied significantly in sign and magnitude over the full visual field but always changed in the negative direction during accommodation. For 6D of accommodation, changes in C40 ranged from 0.1 to 0.4 microns RMS, with larger values occurring for larger eccentricities. Unlike C40, secondary spherical aberration C60 was typically positive and did not vary significantly with accommodation. Because the sign of SA can have a profound effect on image quality when coupled with defocus, peripheral changes in SA during accommodation may provide a possible clue for understanding anomalous eye growth.
Fri, Feb 8 12:00-1:00 PM OPT Rm 105	**The effect of increasing ocular surface stimulation on blinking** Zeiwei Wu Graduate Student Indiana University Bloomington, IN Dry eye is a common condition, affecting millions in the U.S. and elsewhere. Although, the etiology of dry eye is still debated, low blink rate has been identified as a risk factor largely because the blink acts to renew the tear film and rewet the ocular surface. However, despite the importance of blinking for maintenance of ocular surface health, the nature of its stimulation remains controversial. Previous studies have shown that blink rate can be modulated by both cognitive state and ocular surface stimulation, but the effect of each factor remains unclear. For example, a number of clinical studies have shown that blink rate decreased with reading or playing computer game (cognitive input) and increased with contact lens wearing or dry eye (ocular surface input), but quantification of the effect of an increasing ocular surface stimulus has not been studied. For that reason, this study was designed to place controls over cognitive input while using a continuous air stimulus of varying intensities to measure the effect of ocular surface stimulation on blink rate. We hypothesize that increasing levels of ocular surface stimulation will lead to a higher blink rate when cognitive state is controlled.
Fri, Feb 15 12:00-1:00 PM OPT Rm 105	**The Accommodative Performance of Children with Unilateral Amblyopia** Vivian M.W. Wong O.D., F.A.A.O. Indiana University Bloomington, IN Amblyopia is a common childhood visual disorder that has been estimated to affect 1.3 to 2.0% of the pediatric population in the United States. It can occur unilaterally or bilaterally depending on the amblyogenic risk factor present during visual development. Conventional treatment strategies for unilateral amblyopia involve penalization of the non-amblyopic eye to bias cortical neural activity to the amblyopic eye. This treatment has been shown to improve visual acuity in the amblyopic eye in the majority of young patients, but many do not achieve full recovery of vision. Several explanations have been proposed for the residual amblyopia, but few have attempted to understand whether the visual experience during patching therapy is sufficient to promote visual improvement. Monocular accommodative amplitude, slope of the accommodative stimulus/response function, and steady-state error have all been shown to be adversely affected in adults with unilateral amblyopia. During childhood, when amblyopia is most

	often diagnosed and treated, subnormal accommodative ability may degrade retinal image quality in the amblyopic eye during patching therapy and limit treatment success. Therefore, the goal of our research is to establish whether monocular accommodative deficits also exist in the amblyopic eye of young children, to assess the role of accommodation in residual amblyopia. The results of our study will be presented in the context of current treatment approaches for amblyopia. Future follow-up investigations will also be discussed.
Fri, Feb 22 12:00-1:00 PM OPT Rm 105	**Do the Roles of Vision and Hearing Impact Time-to-Arrival Judgments Differently For Each Gender?** Julie-Ann Roper Indiana University Bloomington, IN While making appropriate decisions of when it is safe to cross the street, pedestrians must use complex sensory information to identify crossable gaps of sufficient duration to allow them to securely reach the other side of the street. To determine if auditory sensory information augments visual sensory information in street crossing for visually impaired pedestrians, an understanding of street crossing behaviors in normally sighted subjects must first be established. Previous studies have found that observers predicting the time-to-arrival (TTA) of an approaching target rely primarily on visual cues to make these decisions. However these studies used short TTA values, had low subject numbers with wide age ranges, or have been lab based using either videos or a virtual environment. We aimed to determine how accurately young, normally-sighted male and female pedestrians were at making TTA judgments of approaching vehicles along an actual unsignalized street when using just their hearing or both their hearing and vision to make decisions. Our data suggests that males and females use visual and auditory information differently when making TTA judgments. For females, the sensory condition did not affect their ability to make accurate TTA judgments. Males initially tended to be more accurate when using only their hearing after which performance was not affected by the sensory condition.
Fri, Mar 1 12:00-1:00 PM OPT Rm 105	**An Experimental Dry Eye Model: from Tear Film Instability to Dry Eye Symptoms** Jun Zhang Dr. Begley's Lab Indiana University Bloomington, IN Dry eye symptoms are common but their etiology is poorly understood. Dry eye can be classified into multiple subtypes, but two categories of symptoms, ocular discomfort and visual disturbance, are common to all types of dry eye. Dry eye patients are known to suffer from chronic tear instability, which is considered to be a core mechanism of dry eye. However, its relationship to symptoms and its sensory impact on the ocular surface remains unclear. The purpose of this study was to develop a human-based laboratory model by repeated episodes of extended eye opening to create tear film thinning and/or symptoms. We hypothesize that this will stress the ocular surface and produce a sensory pain response, due to stimulation of ocular surface nociceptors, generating symptoms of ocular irritation and discomfort.
Fri, Mar 8 12:00-1:00 PM OPT Rm 105	**Wavefront Measurement of Refractive State: the 2012 Prentice Award Lecture (reprised)** Larry Thibos, Ph.D. Emeritus Faculty Indiana University

	Bloomington, IN Modern efforts to define and measure the refractive state of aberrated eyes has led to new insights about the nature of refractive error, the quality of the retinal image, the interplay of the crystalline lens and the eye's pupil during accommodation, dynamic changes in optical quality of eyes caused by tear film deterioration, and outcome assessment of refractive therapies. The aim of this lecture (first presented to the American Academy of Optometry in 2012) is to make such advances broadly accessible to educators, clinicians and patients by explaining in simple terms the underlying optical concepts of wavefront aberrometry.
Fri, Mar 15 12:00-1:00 PM OPT Rm 105	**No Presentation (Spring Break)**
Fri, Mar 22 12:00-1:00 PM OPT Rm 105	**The Utility of Intermediate Level Feature Representations** Tom Busey & Chen Yu Indiana Psychological and Brain Sciences Indiana University Identification tasks often require the specification of the diagnosticity of individual features. This in turn requires a specification of the feature set. Rather than rely on global technique such as principle component analysis (PCA), we have computed an intermediate level feature representation using independent component analysis (ICA) on small regions of image detail. Our particular application is fingerprints, although the methods are general enough to apply to a variety of identification tasks. The intermediate level representation allows for a number of different computations, including automatic clustering of different regions and region matching. More importantly, the activations from the basis set can be combined with information theory (first proposed by Bruce and Tsotsos, 2009) to provide estimates of diagnosticity for individual features. These diagnosticity maps are then validated against eye gaze data from fingerprint examiners. The ICA representations also allow explorations of the relation between temporal and spatial information. Examiners often report combining together several individual features into 'target groups' to increase the diagnosticity of the impression. We explore this using temporal and spatial clustering algorithms that are built on hidden markov modeling and coding theory. Our most recent work builds on models of V1 and V2 from Karklin & Lewicki (2009) and may improve the classification accuracy.
Wed, Mar 27 12:00-1:00 PM Psychology conference room (PY 128)	**Embodied Memory: Perceiving Effectively with Optic Flow and Image Structure Information** Jing Samantha Pan Cognitive Sciences Indiana University Optic flow and image structure are two sources of visual information that allow us to perceive spatial relations in a crowded 3D environment. In this talk, we will discuss some recent studies showing that efficient and stable perception of object locations relies on a unitary visual system using both optic flow and image structure information. The two interact: optic flow calibrates image structure; image structure yields an embodied memory for spatial information contained in optic flow. This theoretical

	development is further applied to understanding effective perception with low vision, which impairs image-based vision, but not the detection of optic flow.
Fri, Mar 29 12:00-1:00 PM OPT Rm 105	**Lipofuscin in the Retinal Pigmented Epithelium: origin, impact, and clinical measurements** Francois Delori Schepens Eye Research Institute Harvard University
Fri, Apr 5 12:00-1:00 PM OPT Rm 105	**The Single Unit Doctrine for treating disorders of binocular vision: 1. Measuring suppression in amblyopes using random-dot kinematograms** Ben Backus SUNY School of Optometry Amblyopia and strabismus are disorders of the binocular visual system. A theoretically fruitful approach is to assume that binocular neurons in cortex do not have correct receptive field (RF) structures. I make this assumption. It follows that two things are essential to treat amblyopia: overcoming suppression to get sufficient signal into cortex from the affected eye, and using the non-amblyopic eye to train each neuron separately about how it should respond to input from the amblyopic eye. To measure suppression, Hess, Thompson, and colleagues have recently used dichoptic random-dot kinematograms. We have replicated and extended their findings to show that the method is robust to details such as display size and percent coherence, and that it captures the expected fall-off in suppression in peripheral vision.
Fri, Apr 12 12:00-1:00 PM OPT Rm 105	**ACCOMMODATIVE INSTABILITY OF THE INFANT VISUAL SYSTEM** Tawna Robert, OD Indiana University, School of Optometry The purpose of this study is to investigate the stability of retinal image quality of 3- to 5-month and 7- to 10-month-old infants longitudinally, using eccentric photorefraction. Two competing hypotheses were tested: H1 = Motor theory: Infants with greater accommodative response have greater accommodative instability H2 = Sensory theory: Infants with greater retinal blur have greater accommodative instability **Methods:** Fifty-six infants 3-5 months of age and forty-six infants 7-10 months of age viewed a broadband spatial frequency target (cartoon video) moving between stimulus positions of 90cm (1.1D) and 35cm (2.85D). **Analysis:** The right eye's mean and root mean square (RMS) responses to the stable target at each viewing distance were calculated. The mean response was converted into accommodative lag and accommodative response incorporating refractive error. Linear regression was performed to determine if there was a relationship between RMS and accommodative lag as well as RMS and accommodative response. Repeated measures ANOVA was used to determine if age or target distance had a significant effect on measured RMS. **Results:** For the 3- to 5- month old infants, in comparing the RMS as a function of accommodative lag and accommodative response, regression analysis showed there was a significant relationship between both accommodative lag ($R2 = 0.239$, $F(1,54) = 16.951$, $p < 0.001$) and accommodative response ($R2 = 0.189$, $F(1,54)=12.621$, $p =0.001$) with RMS values when the subject was viewing the more distant target (1.1D). While viewing the near target (2.85D), regression analyses yielded a significant relationship only between accommodative response and RMS ($R2 = 0.184$, $F(1,54)=12.186$, $p = 0.001$), suggesting that when subjects viewed the closer target, the accommodative stability was influenced by the magnitude of the accommodative response. For the 7- to

	10-month old infants, there was a significant relationship between RMS and accommodative lag ($R2 = 0.208$, $F(1,44)=11.581$, $p = 0.001$), but no significant relationship with accommodative response (p-value) at the 1.1D distance. There was a significant relationship at 2.85 D distance when RMS was regressed against the accommodative response ($R2 = 0.260$, $F(1,44)=15.461$, $p << 0.000$), but no significant relationship with accommodative lag. Repeated measures ANOVA revealed a significant effect of both target distance and age on accommodative stability. **Discussion:** Based on the analysis performed, there appears to be support for both the motor and sensory theories in infants less than 1 year of age. Further analysis needs to be performed to better understand the underlying mechanism of accommodative instability in the developing visual system.
Thu, Apr 18 5:00-6:00 PM Vistakon Conf Room	**Pathophysiologic abnormalities that lead to glaucomatous optic nerve damage, particularly the vascular physiology abnormalities** Douglas R. Anderson, MD, FARVO Professor of Ophthalmology Bascom Palmer Eye Institute University of Miami Miller School of Medicine In glaucoma, the optic nerve structure is damaged, ultimately with loss of axons and stretching of the lamina cribrosa, as well as the scleral support tissue around the optic nerve head. The pathogenic process has been studied, and turns out to be very complex. There is a cascade, probably branching, of events or perhaps several pathways of events in the ganglion cells, their axons, and support tissues such as astroglia and collagenous structures. The characteristic feature of glaucoma is that the rate (and severity?) of these events is affected by the level of tissue pressure in the areas where the pathogenic processes occur, or at least the pressure within the globe, in most but perhaps not all cases. In this lecture, we will not focus on the many cellular and molecular events that have been shown to behave abnormally in glaucoma, but on what may be the common initiating event, ischemic insult to the tissues in the optic nerve head. Ischemia will be presented in terms of an inadequate ability to regulate blood flow in a manner that, within limits, maintains blood flow to the tissue in face of a challenge, such as reduced perfusion pressure in the arterio-venous system that supplies the optic nerve head. The ischemia may occur transiently and intermittently with re-perfusion injury. They several ways in which regulation can become deficient, at least hypothetically, will be explored.