



## ARVO 2018 Annual Meeting Emerging Trends and Hot Topics

**Honolulu, Hawaii** – In their own words, First Authors at the 2018 Annual Meeting of the Association for Research in Vision and Ophthalmology explain their findings. Their abstracts were designated as some of the newest and most innovative research being conducted in various specialties and are being presented on Monday, April 30. To view abstracts, enter the program number or title in the "Search" field of the [Online Planner](#) or [mobile app](#).

### **Clinical/Epidemiologic Research**

1601. Provision of Near Glasses Improves Productivity in Indian Tea Pickers: PROSPER Randomized Trial. 12:30pm

Giving inexpensive spectacles for free can benefit a large proportion of workers in Indian tea plantations, and leads to significant increases in productivity (24.4%), larger than have been reported for other health interventions in low and middle-income countries (vitamin pills: 0-10%; mosquito nets: 15%). Most workers wore their glasses, and income on these plantations was directly tied to productivity, meaning that this inexpensive intervention could sustainably increase income of these rural, mostly-female workers, in fulfillment of the UN Sustainable Development Goals of reducing poverty, improving health, providing decent work and improving gender equality.

### **Cornea**

2243 - B0197. K14+ epithelial-targeted Myc ablation induces  $\Delta$ DNp63 overexpression in corneal epithelium. 3:30pm

The report shows that elimination of MYC, a gene that is important for the control of growth and differentiation in corneal epithelium causes only subtle changes in the tissue at rest, but dramatically hinders the closure of corneal wounds. Additionally, the ablation induces a major increase in another gene controlling different aspects of corneal epithelium growth and differentiation. This latter finding is rather unexpected and suggests unknown interactions between the two genes, with potentially high value for the control of wound healing at the ocular surface.

2247 - B0201. Restoration of the epithelial stem cell population by the grafting of a tissue-engineered human corneal epithelium: a case report. 3:30pm

Some ocular diseases can cause visual loss over time. This is the case of the limbal stem cell deficiency (LSCD), that leads to corneal blurring. This pathology can be caused by chemical burns, genetic

mutations, chronic inflammation and other physical causes. To treat this condition, an epithelial graft can be performed to restore corneal transparency but to be effective, the epithelium must contain stem cells. Our study explored the ability of a human, tissue-engineered corneal epithelium to repopulate the limbal stem cells of an LSCD patient.

### **Eye Movements/Strabismus/Amblyopia/Neuro-Ophthalmology**

1552. Magnetic resonance imaging (MRI) demonstrates different patterns of horizontal extraocular muscle co-contraction in fusional divergence to near and distant targets. 11:30am

Side-by-side double vision is a common complaint. When the eyes start to cross, people normally avoid double vision by activating muscles to diverge the eyes' lines of sight. Magnetic resonance imaging (MRI) can show contraction and relaxation of eye muscles and revealed surprising results when normal volunteers diverged as required to maintain single vision through prisms. When the target was close to each volunteer, the lateral rectus muscle that rotates the eye away from the midline contracted as expected, but only the upper half of the oppositely-acting medial rectus muscle relaxed; this implies that half of the medial rectus was working against desired divergence. When the visual target was far away, the lateral rectus muscle again contracted as expected, but there was no relaxation at all in the medial rectus; this implies that the entire medial rectus muscle was working against desired divergence. Functional MRI thus suggests why many people cannot diverge to avoid double vision when viewing remote objects: their medial rectus muscles cannot relax enough. For double vision in the distance caused by eye crossing, this finding justifies logical treatment by surgical relaxation of medial rectus muscles, rather than previously advocated tightening of lateral rectus muscles.

1147. Adult Abducens Nerve and Lateral Rectus Muscle Regenerate in a Coordinated Fashion Following Injury, Revealing Important Biological Interactions. 9:30am

Repair of muscle function following injury requires participation of the nerve. The interactions between injured eye muscle and nerve can be studied in zebrafish, utilizing the genetic accessibility and regenerative prowess of adult zebrafish to better understand how to treat eye movement disorders.

### **Genetics Group**

1421 - B0340. Slc38A1 blockade inhibits angiogenesis and laser-induced choroidal neovascularization. 8:15am

Angiogenesis-related diseases are the leading cause of blindness in the United States. The pathologies of wet macular degeneration, diabetic retinopathy, uveal melanoma, corneal graft rejection, neovascular glaucoma and retrolental fibroplasia are all dependent on the growth of new blood vessels. Evidence from our lab and others indicates that the ability to respond to angiogenic stimuli is controlled by genetic variation. This difference in angiogenic responsiveness can affect susceptibility to a number of angiogenesis-dependent diseases. Our long term goal is a thorough understanding of the genetic basis of differences in angiogenic responsiveness. This will facilitate our ultimate aim of being able to better identify individuals at risk of angiogenesis-dependent disease as well as those likely to respond to angiogenesis-modulating therapies. Using the genetic diversity available in common inbred mouse strains, we have recently identified several candidate genes responsible for differences in angiogenic response. In this study we not only confirmed the role of Solute carrier 38A1 (Slc38A1) in angiogenesis, but also designed a potent inhibitor of endothelial cell function and angiogenesis by targeting Slc39A1 with a 6-amino acid blocking peptide. This gene and others in associated pathways can serve as

candidate genes for association studies in a wide variety of systemic angiogenesis-dependent diseases. As a result of these studies we expect to make a significant impact on our ability to diagnose and treat blinding angiogenesis-dependent diseases.

### **Glaucoma**

2112 - A0170. Pitfalls of Ganglion Cell Complex Analysis in Eyes with Vitreomacular Traction Syndrome. 3:30pm

Optical Coherence Tomography (OCT) scans are very useful in detecting glaucoma early, using automated analysis that identifies and measures the layers of the retina that are first affected. If such abnormalities are found, patients will either need to be monitored or treated long-term. The presence of a fairly common retinal condition (vitreomacular traction) may introduce errors that need to be taken in to account when interpreting OCT scan results. The effect of surgery and natural improvements does not necessarily make the scans any more useful. Being aware of this potential pitfall will avoid unnecessary treatment for patients in the future.

### **Lens**

1607. Lens epithelial cells rapidly initiate the innate immune response following cataract surgery. 12:30pm

Cataract surgery is a marvel of modern medicine. However, like all surgeries, this causes tissue injury that the body tries to heal. Unfortunately, this healing results in scar tissue formation. When that scar tissue blocks the path of light into the eye, it can cause the patient to perceive that their cataract re-occurs. This work found that lens cells robustly activate tissue inflammation after they are injured by surgery, which has the potential to both cause eye pain after surgery and start the process of scar tissue formation.

### **Multidisciplinary Ophthalmic Imaging Group**

1226. Deep-learning Framework for Summarization of OCT Volumes. 9:30am

Optical coherence tomography (OCT) volumes are frequently utilized to image the retina, and this imaging modality can provide high resolution images of important regions of the retina in 3D. These volumes often contain 128-200 slices - a large enough number that manual examination of every slice can be quite time consuming. More often than not, the disease-induced changes in retinal structure is frequently only seen on a few slices. Automatically detecting these "key" slices would allow for summarization of the OCT scans and could be used to draw a clinician's attention to the most important regions in the scan. Here, a transfer learning approach is utilized to achieve this, where a deep neural network that has been very successfully utilized in the past for image recognition tasks is repurposed for the current problem, and shows quite promising results!

### **Retina**

1442 - C0004. Sustained anti-VEGF activity of aflibercept (Eylea™) after storage in polycarbonate syringes used for intravitreal injection: a pathway to safety and efficiency in high volume clinics providing intravitreal therapy. 8:15am

Currently, aflibercept (Eylea TM, Regeneron), a drug used for treatment of ARMD and other retinal conditions, is often prepared in eye clinics by drawing the medication from manufacturer-supplied glass vials into syringes used for subsequent injection into the eye. Maintenance of sterility during preparation is often not standardized due to variations in the clinic environment and personnel, creating infection risk. Demonstration of sustained anti-VEGF activity after being stored in injection syringes can allow for preparation in safer, pharmacy-based sterile environments that may be distant from eye clinics, and in large volumes that can support efficient drug administration, with less concern that the medication would need to be discarded after brief periods of storage due to loss of drug potency. In this study, aflibercept stored in manufacturer-supplied polycarbonate syringes, refrigerated (at 4 degrees C) for up to 28 days, or frozen (at -20 degrees C) for up to 56 days, retained drug activity equivalent to aflibercept freshly drawn from the manufacturer-supplied vials. The demonstration of sustained activity can provide a pathway to safety and efficiency measures in aflibercept administration, particularly when large numbers of intravitreal injections are performed.

1448 - C0010. Subanalysis of data from rAAV.sFLT-1 phase 1 and 2a randomized gene therapy trials for wet age-related macular degeneration. 8:15am

This work shows how the development of a biofactory in the back of the eye can reduce the number of the painful, expensive, monthly/bimonthly injections into the eye for the treatment of wet-AMD.

### **Retinal Cell Biology**

1983. Monitoring the developing photoreceptors in the hiPSC-derived three dimension retinal organoid culture using bicistronic 2A-peptide-based co-expression reporter knock-in system. 3:30pm

The repair and regeneration of tissues using endogenous stem cells represents an ultimate goal in regenerative medicine. Retinitis pigmentosa (RP) is a genetic disorder characterized by affection and loss of photoreceptors, retinal thinning and decrease of visual acuity, until now without therapies. In this clinical study, we treated RP patients with the LRRT technique, a graft of autologous cells near the choroid able to release proteins, called growth factors (GF), into the surrounding tissues: they are able to promote survival and trophism of retinal cells and to block their apoptosis, the programmed cell death. This cellular mechanism subtends the ability to enhance or preserve visual performances in patients with retinal neurodegenerative diseases, as highlighted in our previous studies. The therapeutic benefits of GF are correlated to the cellularity in direct proportion: better outcomes in visual performances are found in patients with a greater amount of residual cells that is reflected by the thickness of the fovea, a retinal area responsible for sharp central vision. Subsequently, foveal thickness can be a prognostic criterion for patients undergoing LRRT treatment, that has been demonstrated to be useful to preserve the visual acuity not only in RP, but also in other neurodegenerative diseases.

2512 - C0216. Microglia suppression during hibernation prevents axonal injury-induced retinal ganglion cell death in the ground squirrel retina. 3:30pm

When animals are in hibernation, cells in the eye do not die even they are injured. We try to learn from hibernating animals to develop strategies to treat eye diseases.