Contribution ID: **22** Type: **not specified**

High resolution in-vivo imaging of the mouse retina using an adaptive optics system with MEMS segmented piston/tip/tilt deformable mirror.

Tuesday, 3 September 2013 12:00 (20 minutes)

Abstract content
(Max 300 words)
Special Chars

High resolution in-vivo retinal imaging of small animals is becoming an increasingly important tool in developmental biology and vision science. It is especially attractive for studying temporal changes in animal models of retinal diseases and for monitoring disease progression in response to different risk factors or treatments. To achieve the best possible resolution of retinal structures for precise monitoring and quantification of changes at cellular resolution, one has to measure and compensate for ocular aberrations of the mouse eye over a large pupil. The mouse eye with dilated pupil has a numerical aperture (NA) 2.5X that of the human eye, enabling the possibility of imaging with optical coherence tomography (OCT) or scanning laser ophthalmoscopy (SLO) at resolutions much higher than available in human eyes.

In our prototype instrument, we used Iris AO adaptive optics (AO) system that includes the PTT111 deformable mirror (with inscribed aperture of 3.5 mm consisting of 37 hexagonal segments and 5 um stroke (tip/tilt/piston)) and Hartmann-Shack wavefront sensor (WFS) with 37 lenslets, working in a 1:1 optical mapping of DM segments to WFS lenslets. We evaluated performance of this system by measuring and correcting aberrations of the mouse eye. Additionally, images of the microscopic morphology of the retina in-vivo have been acquired with both AO-OCT and AO-SLO modalities. During imaging, mice were anesthetized by inhalation of 2-3% isoflurane delivered in oxygen.

Measurements of the wavefront error from a typical mouse eye with fundus contact lens and the best focus (AO off) was on the order of 200nm RMS error. By activating the AO system, the measured wavefront was reduced to < 50nm RMS error. This corresponds to diffraction-limited imaging as defined by RMS error < $\lambda/14$. Representative images of the mouse retina will be presented. Application of general anesthesia allowed for relatively long imaging sessions of up to 60 minutes without producing adverse effects. Additionally, several measurements of the same animals were performed every other day with no negative effects on the mouse.

Primary author: Dr ZAWADZKI, Robert J. (UC Davis)

Co-authors: Prof. PUGH, Edward N. (UC Davis); Prof. WERNER, John S. (UC Davis); Dr SARUNIC, Marinko (Simon Fraser University); Mr JIAN, Yifan (Simon Fraser University)

Presenter: Dr ZAWADZKI, Robert J. (UC Davis)

Session Classification: Session II : Imaging and Microscopy

Track Classification: Oral Presentation