High-resolution adaptive optics fluorescence imaging of retinal cell function

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Abstract

The long-term goal of our research is to manipulate and/or record the physiological activity of retinal neurons optically in the living eye, both in the high-acuity, perceptually capable macaque, and in the experimentally more tractable mouse. The fine spatial scale of adaptive optics imaging makes it attractive to use recently developed neuroscience methods, such as genetically encoded calcium indicators or light-gated channels, introduced into retinal neurons, to study the function of these cells. Such studies will be fruitful if they achieve: 1. high efficiency transduction of retinal cells in order that imaging or control of neurons can be achieved with light levels low enough to be consistent with retinal safety, 2. uniform transduction of the cells across the retina, which in macaque is hampered by the dense inner limiting membrane barrier, and 3. selective transduction of chosen cell types among bipolar, amacrine or ganglion cell classes.

This talk will describe the progress we are making in reaching these goals. In collaboration with the Flannery laboratory we are developing viral vectors for intravitreal injection that are tailored to the unique requirements of the mouse and macaque retina. In collaboration with the Callaway lab we are exploring the use of viral vectors that are retrogradely transported from intracranial injections to retinal neurons. A major focus of this work is the development of cell-type selective transduction, which can be accomplished by focal injection of retino-recipient nuclei that are receive input from only a single type of retinal neuron.

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