The Research

The main focus of Elio Raviola’s laboratory is the biology of the eye. The two main venues of investigation include research into the role of visual experience in postnatal eye development and studies of how the retina of mammals analyzes the visual world and encodes information about it for sending to the brain. In particular, we investigate the cellular composition and function of retinal neuronal networks. This work led to the identification of the neuronal pathway that carries rod signals to ganglion cells. Most recently, our efforts in this area were focused on the dopaminergic amacrine neurons. We use transgenic mice, electrophysiological techniques, and modern molecular biology to understand the role played by this type of amacrine cell in the processing of the visual input. Our research into the effect of the environment on the postnatal eye growth was triggered by the discovery that degradation of the visual input leads to the excessive growth of the posterior segment of the eye, causing a refractive error very similar to human myopia. We demonstrated that the initial event leading to excessive elongation of the eye in response to form deprivation resides in the retina. We employ a combination of molecular biological, genetic, and histochemical techniques to gain insight into the molecular basis of postnatal eye plasticity and myopia.

neuro.med.harvard.edu/site/faculty/raviola.html

The Technique

We have recently conducted a large-scale gene expression analysis with the purpose of identifying changes in gene expression in experimental primate myopia. The results of this experiment suggested that, contrary to the current belief, postnatal primate retina harbors proliferating cells and that proliferation is increased in the retina of the myopic eye. To analyze proliferation in the postnatal retina, it is critical to have a reliable and efficient protocol for visualization of proliferating cells in retinal whole mounts. The only protocol currently available for the detection of BrdU-labeled nuclei in whole mounts involves incubation of the specimen in hydrochloric acid, which has a detrimental effect on the tissue and results in poor penetration of antibodies into the deep cell layers of the specimen, which precludes quantitative analysis of proliferation. We therefore developed a reliable and efficient protocol for the visualization of BrdU-labeled nuclei in whole mounts. The procedure utilizes a limited digest with DNase I to expose BrdU-labeled epitopes. We currently use this method in our laboratory for identifying proliferating cells in the postnatal mammalian retina and for studying their identities.

Whole-mount BrdU staining of proliferating cells by DNase treatment: application to postnatal mammalian retina, p. 29.