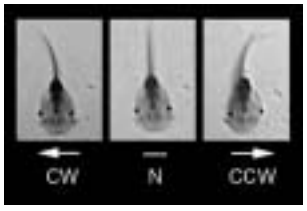
Eduardo C. Solessio, Ph.D.

Feedback Loops in the Retina

When your speedometer reads 65 miles per hour (mph), you are traveling at the speed limit on most highways. The speedometer provides "feedback" on how fast you are moving. If your speed reaches 70 mph and you wish to avoid a $100 speeding fine, you reduce your speed. By slowing down, you have responded to the negative feedback of your speedometer. If the posted minimum speed is 40 mph and you are driving a tractor-trailer at 35 mph, you increase your speed in response to your speedometer. The posted speed laws, your speedometer, your desire to avoid a traffic fine, your brakes, and your gas pedal are all parts of a feedback mechanism or "loop" that regulates how fast you travel on a highway.

Electrode approaches rod photoreceptors protruding from the retina (left). By introducing part of a rod into the electrode, Dr. Solessio can record its response to light (right).

Feedback loops also exist in the retina. When light enters the eye, photons travel to the retina where specialized cells—rods, cones, bipolar cells, amacrine cells, and ganglion cells—convert the light signals to electrical signals that go to the brain. In his research, Dr. Eduardo Solessio is asking how intercellular feedback loops regulate the electrical properties of bipolar cells, which relay information from rods and cones of the outer retina to the amacrine and ganglion cells in the inner retina.



Testing the vision of Xenopus tadpoles: they turn either CW or CCW in response to moving stripes if they can see them.

On a more basic level, Dr. Solessio is developing transgenic frogs to study how retinal feedback mechanisms develop and function. Since genetic mutations in these mechanisms can lead to eye disease, understanding how they develop will establish a molecular foundation for normal and abnormal retinal function.

Dr. Solessio has co-authored chapters in two textbooks. His work is published in *Nature*, *Nature Neuroscience*, *Journal of Physiology (London)*, *Journal of Neurophysiology*, *Visual Neuroscience*, *Journal of Cell Biology*, *American Zoologist*, *Progress in Brain Research*, *Molecular and Cellular Neuroscience*, and *Revista Telegrafica (Argentina)*. He collaborates with Drs. Shobana Mani, Robert Barlow, and Barry Knox of SUNY Upstate Medical University; Gustav Engbretson of Syracuse University, and Nicolas Cuenca of Universidad de Alicante in Spain.

The results of Dr. Solessio's research will have far-reaching significance in both basic and health research communities. His research is funded by the National Eye Institute, Research to Prevent Blindness, and the Lions Club of Central New York. He has received the Research to Prevent Blindness Career Development Award, the Fight for Sight-Prevent Blindness America Research Award, and an IBM Award at the Institute of Electrical and Electronic Engineers Student Convention in Buenos Aires, Argentina. He is a member of the Association for Research in Vision and Ophthalmology.

Dr. Solessio is also producing transgenic frogs that express rhodopsin with two mutations that alter the function and sensitivity of rod cells. He is using behavioral assays developed to evaluate changes in visual sensitivity of transgenic frogs.

"Neural feedback has a critical role in how we see, but little is known about how feedback pathways are established and function in the visual system."