Lecture

Introducing Kirill A. Martemyanov, the 2014 Recipient of the Cogan Award

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It is a great pleasure to introduce this year's Cogan Award winner, Kirill Martemyanov, currently an associate professor of neuroscience at the Scripps Research Institute.

Kirill completed his undergraduate and graduate education in Russia. His PhD project, conducted at the Institute for Protein Research, was devoted to understanding the regulation of protein biosynthesis. Kirill was remarkably productive, especially considering the limited resources available to him at the time. He published 12 first-authorship papers and was recognized by several student awards.

Kirill joined my laboratory in 2000 to study visual signal transduction. It was an interesting time for the field because it was just turning a corner from identifying major protein components involved in phototransduction to understanding how these proteins function as a single well-tuned molecular ensemble. Kirill's most exciting contributions related to elucidating how the temporal resolution of our vision is defined on a molecular level. It has been known for quite a while that electrical responses of photoreceptor cells are very fast: they turn on rapidly and turn off rapidly as well. However, it had just become known that the latter relies on the activity of a protein called RGS9, which precisely controls the lifetime of activated G protein, transducin. RGS9 knockout slows down photoresponse recovery, which greatly impairs the temporal resolution of our vision. However, RGS9 is not functioning alone, and a number of additional proteins are required to make photoresponse fast. Kirill made some of the most important contributions to our understanding of how all of them work together as a single, well-tuned molecular machine. He showed that without its partners, RGS9 has low affinity for transducin and, even when bound, does not inactivate it rapidly enough. Furthermore, without its partners, RGS9 cannot be delivered to photoreceptor outer segments and instead is rapidly proteolyzed in photoreceptor cytoplasm.

The culmination of Kirill's postdoctoral studies was the discovery of a novel RGS binding protein, which he named R7BP (R7 family of RGS binding protein). Later, in his own laboratory, Kirill showed that R7BP targets four RGS proteins, closely related to RGS9, to their subcellular functional sites in the brain. This is a beautiful example of how studies of the retina continuously fuel a broader understanding of cellular signaling.

Understanding the complex regulation of G protein signaling has subsequently become a major theme in Kirill's own laboratory. In 2005, he was recruited as an assistant professor of pharmacology in Minnesota and in 2011 moved to the newly established Department of Neuroscience at Scripps-Florida. The productivity of Kirill and the members of his laboratory is truly exceptional: They published about 40 papers uncovering many fundamental mechanisms in G protein signaling. In addition to the Cogan Award, Kirill has received the McKnight Land Grant Professorship and the Independent Scientist Award from the National Institutes of Health.

One of the most successful directions of Kirill's laboratory is to understand how the signals generated in photoreceptors are transmitted to bipolar cells at the first synapse of the retina. Kirill identified novel RGS protein complexes, even more elaborate than those in photoreceptors, that are responsible for generating the electrical responses of ON-bipolar cells and are vital for supporting dim light vision. Kirill's laboratory also provided critical insights into the functional roles of less understood synaptic proteins that are often mutated in patients suffering from congenital night blindness, such as nyctalopin and orphan G protein-coupled receptor (GPCR) GPR179.

This introduction would not be complete without saying that, more than anyone in his generation, Kirill was able to demonstrate that molecular insights first obtained in the retina often represent the most fundamental principles defining cellular signaling in multiple tissues and organs. Kirill is particularly instrumental in applying the lessons learned in the retina to studying complex functions of the brain, such as regulation of movement, nociception, and reward behavior. One of Kirill's major contributions was showing that RGS protein complexes regulate the timing of postsynaptic responses in the hippocampus, thereby playing an important role in the process of memory formation. Kirill also established the novel roles of RGS proteins in regulating opioid receptor signaling in the striatum. Moreover, he showed that the membrane anchor R7BP, which he discovered in 2005, controls reward and motor pathways that are disrupted in many neurological and psychiatric disorders. This ability to fearlessly cross the boundaries of smaller subfields has brought Kirill wide recognition in the greater GPCR signaling community, which makes him not only an emerging leader in that very large field but also a great advocate for the value and importance of basic vision research.

I conclude by adding that Kirill is an outstanding community citizen, instrumental in establishing and maintaining successful collaborations with many colleagues in the vision community. Outside of his life in science, he enjoys spending time with his family, including two school-age daughters.

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