Flipping a switch on neuron activity

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All our daily activities, from driving to work to solving a crossword puzzle, depend on signals carried along the body's vast network of neurons. Propagation of these signals is, in turn, dependent on myriad small molecules within nerve cells -- receptors, ion channels, and transmitters -- turning on and off in complex cascades. Until recently, the study of these molecules in real time has not been possible, but researchers at the University of California at Berkeley and the University of Munich have attached light-sensing modules to neuronal molecules, resulting in molecules that can be turned on and off with simple flashes of light.

"We get millisecond accuracy," says Joshua Levitz, a graduate student at Berkeley and first author of the study. According to Levitz, the "biggest advantage is that we can probe specific receptors in living organisms." Previous methods using pharmacological agents were much less specific, affecting every receptor in every cell. Now, investigators can select individual cells for activation by focusing light. And by attaching light-sensing modules to one class of molecules at a time, they can parse the contributions of individual classes to neuronal behavior.

Levitz will be presenting a system in which G-protein-coupled receptors, molecules that play key roles in transmitting signals within cells, can be selectively activated. He is planning to use the system to study the hippocampus, a region of the brain where memories are formed, stored and maintained. There may be clinical utility to the system as well, he points out. G-protein-coupled receptors are also critical for vision in the retina, and light-sensing versions could potentially be introduced into

people with damaged retinas in order to restore sight.

More information: The presentation, "Design and Application of a Light-Activated Metabotropic Glutamate Receptor for Optical Control of Intracellular Signaling Pathways" will be presented at 8:30 a.m. on March 7, 2011 in Room 309 of the Baltimore Convention Center. ABSTRACT: tinyurl.com/4lf9dse

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