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Optical Neural Control: Engineering Therapeutic Circuit Dynamics: Application to Post-Traumatic Stress Disorder

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The ability to control specific cell types and neural circuits will open up the ability to test the role of specific patterns of activity in neural computations and behaviors. It also will enable us to develop a new generation of neurological and psychiatric therapies, based on precise reprogramming of neural circuits. Our lab both invents novel methods for controlling neural circuits and discovers principles for how to use them to systematically sculpt neural dynamics. We will talk about our recent development of methods for controlling very precise neural functions using light and optical sensitizers, such as channelrhodopsin-2, halorhodopsin, and other molecules, and their application to studying and engineering normal and pathological neural circuit dynamics, specifically in relationship to post-traumatic stress disorder. We also will discuss the translational prospects for cell-type specific optical neural control, based on early pre-clinical work, which may open up a new generation of very precise, powerful, and side-effect-free therapies.

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