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Presentation Abstract

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Title:	Millisecond-timescale optical control of specific genetically-targeted neurons and neural circuits in primate cerebral cortex
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Abstract:	Nonhuman primates such as rhesus macaques have neural architectures that share many properties with those of humans, and thus are preferred animal species for investigating neural computations, behaviors, and pathologies at the most complex levels of emotion, cognition, and action. To resolve how these phenomena emerge from the contribution of multiple cell types and circuits, ideally one would be able to activate and silence specific cell types and neural pathways at the millisecond timescale in a safe, effective, and reliable fashion. Here we demonstrate that the light-activated cation channel channelrhodopsin-2 (ChR2), when lentivirally targeted to excitatory neurons of the macaque cortex, enables optical activation of pyramidal cells over the natural range of frequencies. We show that the expression is safe and does not incur an immune response, despite repeated viral injections over a period of many months. Thus, we open up the use of these technologies for the investigation of neural computation in a brain similar to the human brain, and furthermore open up the serious possibility that cell-type specific optical prosthetics may enable a new generation of ultraprecise neurological and psychiatric therapies.
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