Optogenetics

Fundamentals and Opportunities on Single Photon CW Lasers (non MPE)

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What is Optogenetics?

Optogenetics is the combination of genetics and optics to control well-defined events within specific cells of living tissue.

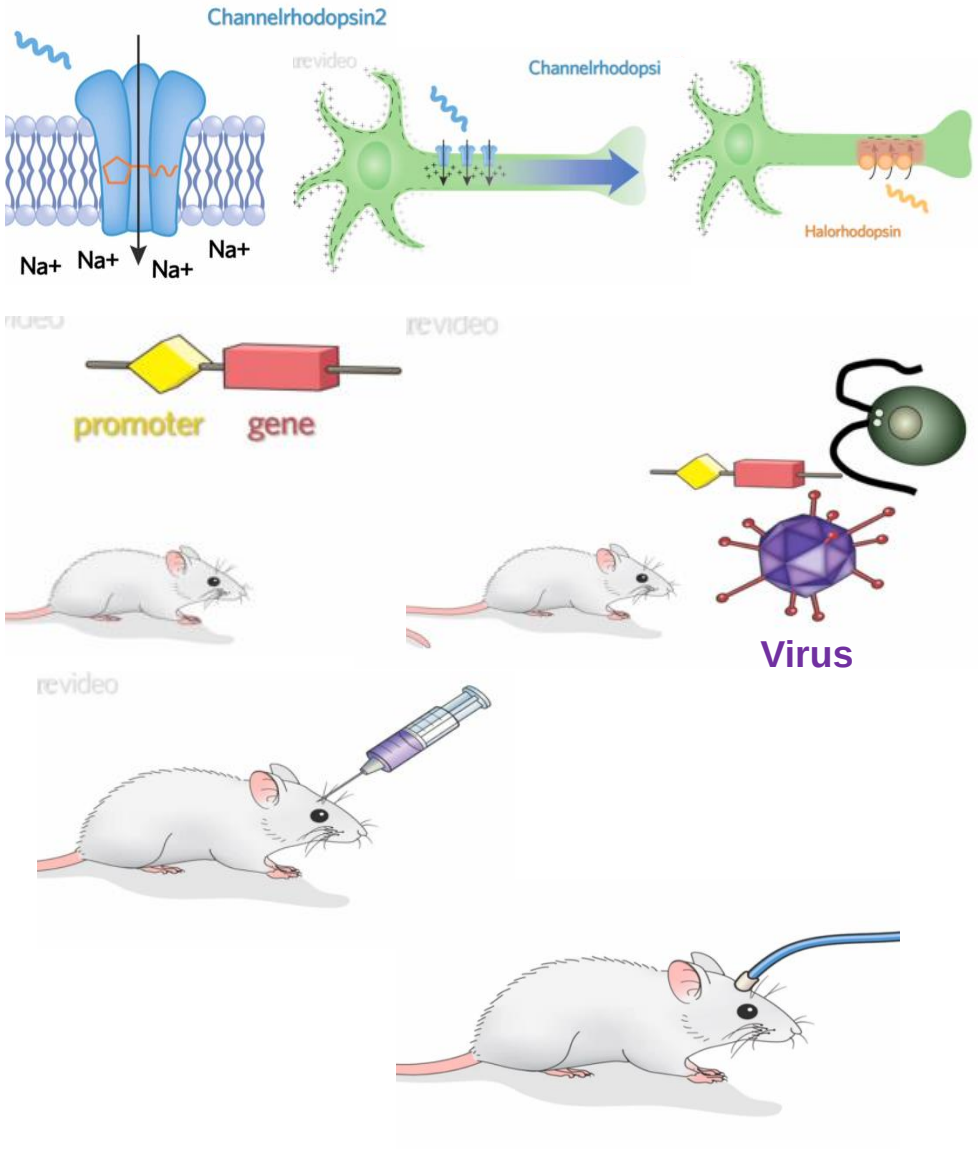
- Light-responsive proteins are allowing scientists to turn neurons on or off selectively with unprecedented precision.
- First ChR protein was isolated from a species of green algae in 2002.
- Key benefit is control over defined events within defined cell types at defined times. A level of precision that is most likely crucial to biological understanding even beyond neuroscience.
- Better than Electrophysiology as the electrical stimulation interferes with signals measured.
- 'Optogenetic' tools also hold clinical promise, with the potential for modulating activity of brain circuits involved in neurological disorders or restoring vision loss. (Source: http://www.mpg.de/18011/Optogenetics).

Optogenetics Basics

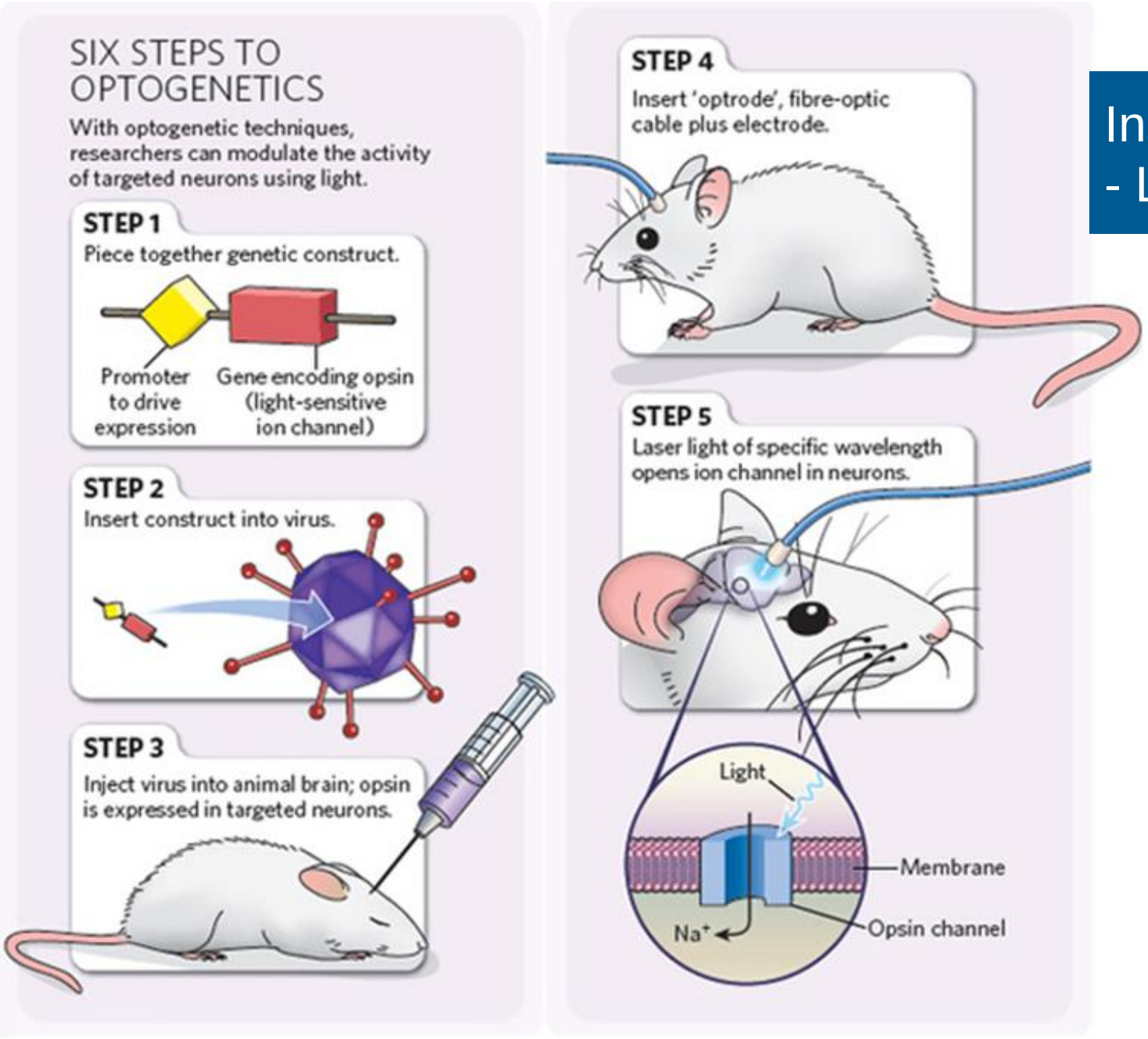
- In proteins such as Channelrhodopsin, light opens the channel for flux of positive ions into the cell. Activate neuron. Halorhodopsin does the inverse (negative ions). Deactivate neuron.

- Genetic engineering is necessary: Take the gene that encodes the protein and another piece of the DNA, the promoter, and put those into a virus.

- Inject the virus. Virus infects neurons and delivers the genes to express in the cell membrane. Light switches motion neurons.



In Vivo
- Living Animal

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