Docket #: S07-203

Implantable Multisource Optical Stimulators

Researchers from Prof. Karl Deisseroth's laboratory have developed techniques for specifically modulating the activity of excitable cells in vivo. This approach introduces light-responsive proteins to create photo-sensitive cells. Then fiber optic technology activates these proteins deep within tissues. The general methods can be used to selectively either stimulate or inhibit a variety of cells, including neurons, heart, and muscle cells, even when the target cells are embedded within a community of other cells.

This technology relies on numerous small light sources, in different positions and pointed in different directions to provide multiple sources of cellular control within one device. Because this invention offers a privileged channel of communication with specific cells, it offers precise control with less side effects on non-targeted cell populations.

Stage of Research:
The inventors have developed a prototype device for testing this approach in vivo.

Related Technologies:
The Deisseroth lab has identified a variety of rhodopsin-like proteins that can be used in neuromodulation. These are described in Stanford Dockets S05-170, S06-398 , S08-105 and S08-348.

Applications

- **Therapeutic** - stimulation or inhibition of specific cells to treat:
  - neurological or neuropsychiatric conditions, including Parkinson's disease, depression, and epilepsy
  - cardiac rhythm management
  - neuromuscular disorders

- **Research** - tools for elucidating function of excitable cells

Advantages

- **Specific** - light used to selectively modulate targeted cells only and not surrounding milieu, lowering the chance of side effects
- **Temporally precise** - millisecond time scale
- **Minimizes tissue disruption:**
  - separates resistive heat-generating elements from the target tissue
  - once implanted, selective activation or inhibition of the photo-sensitive cells can be achieved non-invasively
- **Low risk of signal attenuation** - compared to existing electrical or magnetic technologies, fiber optic device is less susceptible to signal attenuation due to gliosis
- **Favorable depth penetration from light source**

Publications

- "Optical Deconstruction of Parkinsonian Neural Circuitry." Gradinaru V, Mogri M, Thompson KR, Henderson JM, Deisseroth K. *Science*, 2009.

Patents

- Published Application: 20090118800
- Published Application: 20130317575
- Published Application: 20200139153
- Issued: 10,434,327 (USA)
- Issued: 10,426,970 (USA)

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