Optogenetic control of brain circuits mediating reward and aversion

Researchers in Prof. Robert Malenka's laboratory have developed a light-activated animal system that could be used to identify compounds that treat certain psychiatric disorders. This optogenetic technology employs light-responsive opsins to precisely induce or modulate the brain circuits (ventral tegmental area dopamine and GABA neurons) involved in reward- or aversive-behaviors. This invention could be used to screen for therapeutic agents that treat conditions such as drug addiction, depression or schizophrenia.



Optogenetic stimulation of a specific set of afferents to the ventral tegmental area can either elicit (A) conditioned place preference or (B) conditioned place aversion.

Applications

- **Drug screening** to identify compounds that may treat drug addiction or many other psychiatric disorders (e.g. schizophrenia, depression, bipolar disorder)
- **Optogenetic therapy** targeted control of brain circuits to influence motivation and treat psychiatric disorders

Advantages

• **Precise control** - by using light, optogenetic methods can control specific cells in the millisecond timescale

Publications

- U.S. Published Patent Application 20140271479, <u>"OPTOGENETIC CONTROL OF</u> <u>INPUTS TO THE VENTRAL TEGMENTAL AREA"</u>.
- Lammel S, Lim BK, Ran C, Huang KW, Betley MJ, Tye KM, Deisseroth K, Malenka RC. <u>Input-specific control of reward and aversion in the ventral tegmental area</u>. *Nature.* 2012 Nov 8;491(7423):212-7.

Patents

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