

Update in Genetics

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Genetics is perhaps the specialty with the greatest discoveries and transformations in recent years, that were the basis for understanding the different mechanisms underlying various disorders and the possible treatments which benefit human health.

Optogenetics, as a new branch of genetics, is a recent field in rapid progress. For the first time the term of „optogenetics“ was applied by a team at Stanford University in California led by Karl Deisseroth in 2005 for probing and controlling genetically targeted neurons within intact neural circuits using new optical methods. The importance of optogenetics as a research tool, particularly in conjunction with other technologies, continues to grow rapidly (<http://www.scientificamerican.com>)

Optogenetics is the combination of genetic and optical methods to achieve gain or loss of function of well-defined events in specific cells of living tissue. Researchers can probe how the nervous system works using this technique and also other nonneuronal systems, including glial, muscle, cardiac and embryonic stem cells.

This technology consists of light-inducible gene expression in neurons to probe neural circuits at the high speeds, with millisecond precision, and to understand brain information processing. Genes, such as those for channelrhodopsin-2 and halorhodopsin, are transplanted into nerve cells by opening the skull and applying a nonreproducing adenovirus to the desired brain area. These genes result in light-activated gates that control how particular ions, such as sodium or chloride, enter a nerve cell. The result of all this genetic manipulation is a system in which specific parts of the brain are turned off or turned on in response to blue or yellow light signals (<http://www.optogenetics.org>).

Parkinson disease, depression, blindness or spinal cord injuries are some aims to use optogenetics. We are still far from knowing which cells do what, but the success of the efforts will depend on the ability to safely and effectively send genes and light to neurons.

Optogenetics, a complex method which combines genetic engineering, lasers, neurology and surgery, was selected as the Method of the Year 2010 by Nature Methods Journal (Nature Methods 2011; 8 (1)).

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