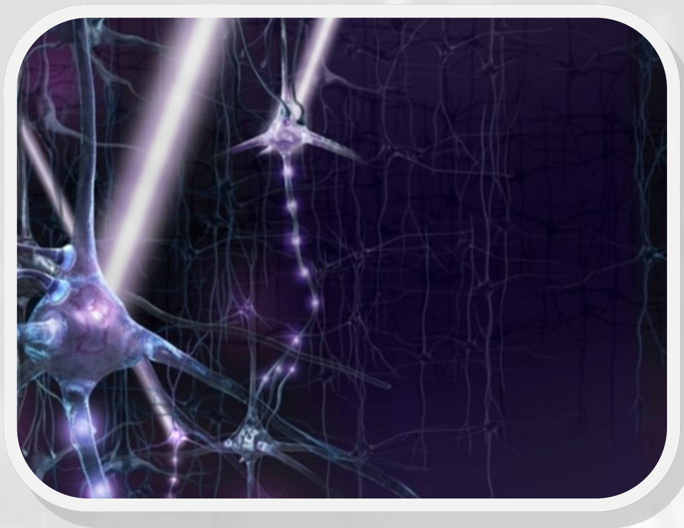
Opto-Genetics

Brain which is the most complex organ of human



body now can be controlled through lights. The human brain is composed of neurons, glial cells, neural stem cells and blood vessels. The number of neurons is estimated at roughly 100 billion. The adult human brain is estimated to contain 86±8 billion neurons, with a roughly equal number (85±10 billion) of non-neuronal cells. Out of these, 16 billion (or 19% of all brain neurons) are located in the cerebral cortex (including subcortical white matter), 69 billion (or 80% of all brain neurons) are in the cerebellum. Neuroscientists and psychologists can observe how brains respond to various kinds of stimuli, and they have even expressed throughout the brain.

At the same time researchers are facing difficulties to control individual neurons and other kinds of brain cells turn on and off and so its difficult to explain exactly how brains do what they do,

Scientists tried using electrodes to record neuronal activity, and that works to some extent. But it is a crude and imprecise method because electrodes stimulate every neuron nearby and cannot distinguish among different kinds of brain cells. A, when neurogeneticists demonstrated a way to use genetic engineering to make neurons respond to particular colours of light. The technique, known as opto-genetics, built on research done in the 1970s on pigment proteins, known collectively as rhodopsins and encoded by the opsin gene family. These proteins work like light-activated ion pumps. Microbes, lacking eyes, use rhodopsins to help extract energy

By inserting one or more opsin genes into particular neurons in mice, biologists are now able to use visible light to turn specific neurons on or off at will. Over the years, scientists have tailored versions of these proteins that respond to distinct colours, ranging from deep red to green to yellow to blue. By putting different genes into different cells, they use pulses of light of various colours to activate one neuron and then several of its neighbours in a precisely timed sequence. and information from incoming light.

The invention of opto-genetics greatly accelerated the pace of progress in brain science. But experimenters were limited by the difficulty of delivering light deep into brain tissue. Now ultrathin, flexible microchips, each one hardly bigger than a neuron, are being tested as injectable devices to put nerves under wireless control. They can be inserted deep into a brain with minimal damage to overlying tissue. Opto-genetics has already opened new doors to brain disorders, including tremors in Parkinson's disease, chronic pain, vision damage and depression.

The neurochemistry of the brain is clearly important for some brain conditions, which is why drugs can help improve symptoms—up to a point. But where the high-speed electrical circuitry of the brain is also disturbed, opto-genetic research, especially when enhanced by emerging wireless microchip technology, could offer new routes to treatment. Recent research suggests, for example, that in some cases non-invasive light therapy that shuts down specific neurons can treat chronic pain, providing a welcome alternative to opoids.

With mental disorders affecting one in four people globally and psychiatric diseases a leading source of disability, the better understanding of the brain that advanced optogenetics will provide cannot come soon enough.

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"When one door of happiness closes, another opens, but often we look so long at the closed door that we do not see the one that has been opened for us."

Helen Keller