Boffins use pulses of yellow light to reversibly silence overactive neurons

From our ANI Correspondent

Washington, March 28: US scientists have invented a way to reversibly silence brain cells by using pulses of yellow light.

The work of boffins at Massachusetts Institute of Technology (MIT) offers the prospect of controlling the haywire neuron activity that occurs in diseases such as epilepsy and Parkinson's disease, and may lead to the development of optical brain prosthetics to control neurons, eliminating the need for irreversible surgery.

"In the future, controlling the activity patterns of neurons may enable very specific treatments for neurological and psychiatric diseases, with few or no side effects," said Edward Boyden, assistant professor in the Program in Media Arts and Sciences and leader of the Media Lab's new Neuroengineering and Neuromedia Group.

Published in the online journal Public Library of Science ONE (PLOS One), the study takes advantage of a gene called halorhodopsin found in a bacterium that grows in extremely salty water, such as the Great Salt Lake in Utah. In the bacterium, Natronomas pharaonis, the gene codes for a protein that serves as a light-activated chloride pump, which helps the bacterium make energy.

The scientists say when neurons are engineered to express the halorhodopsin gene, their activity can be inhibited by shining yellow light on them as light activates the chloride pumps, which drive chloride ions into the neurons and lower their voltage and silencing their firing.

Boyden believes that such an inhibitory effect may be extremely useful in dealing with diseases caused by out-of-control neuron firing.

"In such diseases, inhibition is more direct than excitation, because you can shut down neural circuits that are behaving erratically," he said.

Last year, Boyden had devised a technique to stimulate neurons by shining blue light on them. So with blue and yellow light the researchers can now exert exquisite control over the stimulation and inhibition of individual neurons.

Boyden says that the new technique also offers a way to study other brain diseases and normal brain circuitry, besides offering insight into which brain regions and neurons contribute to specific behaviours or pathological states.

Although the halorhodopsin gene was originally discovered in the 1980s, Boyden did not think that its full potential had been explored. The protein expressed by the gene turned out to have exactly the right characteristics to make it useful in neuron inhibition.

"Often if you are patient and think carefully about what you want to do, you can find a molecule that is very close to what you want, and with a little bit of luck it will turn out to work," Boyden said.