EPILEPSY
A WINDOW ON THE
BRAIN

Optogenetics – Emerging Technology Bringing New Light to Epilepsy

Scientists estimate that the human brain contains upwards of 86 billion neurons, neatly assembled into channels of a complex communication network. It is the role of neuroscience to unravel the mysteries of these intricate channels – but when one of the channels is damaged or misfiring, it becomes that much more complicated to unravel.

One of the hottest research tools in neuroscience today is optogenetics, a technique that uses gene therapy to deliver light-sensitive proteins to specific cells. Optogenetics combined with imaging techniques such as functional Magnetic Resonance Imaging, or fMRI, will help reveal how the brain works and deliver new treatments.

What's radical and novel about optogenetics is that it allows scientists to interact with a single cell, or a network of cells, with exquisite precision. Imaging and other technologies allow researchers to watch the brain in action; optogenetics enables them to influence that action, tinkering with specific parts of the brain at specific times to study the response.

Over the past 10 years, neuroscience has been transformed by optogenetics. The speed of discovery and its application to human conditions is running at a pace rarely seen in science. This relatively new technique already has second-generation applications and technologies in development.

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Researchers now use optogenetics to target–and control–specific sections of the brain related to seizures. Some scientists liken this new tool to flipping a light switch within the brain. With this innovative technique, it is now possible not only to record neuronal activity during and between seizures, but also to test causality and identify potential new therapeutic approaches.

AES member and University of California researcher Ivan Soltesz, Ph.D., received one of the first NIH BRAIN awards for his work with optogenetics and epilepsy. "Seizures occur when brain cells start firing abnormally and rapidly, like a car speeding out of control," said Soltesz. "Using optogenetics, we can deliver a pulse of light that activates the brain's own system for slowing down runaway cells. We either decreased the activity of the gas pedal or increased the activity of the brake. In this way, we succeeded in making the seizures stop when the light came on."

Sources:

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