TECHNOLOGY

Neuroparticle with a Spin-Torque Device

OVERVIEW

Background:

The brain is a complex network of interconnected circuits that exchange signals in the form of action potentials. These action potentials hold the key to understanding how the brain processes information and generates complex thought. Currently, the most advanced method for performing highly localized measurements of neuronal action potentials in humans and other primates requires implantation of electrodes to target areas of the brain. Optical methods based on voltage sensitive contrast agents (dyes, quantum dots) have also been demonstrated. However, focused optical beams cannot penetrate the skull or deep tissue and cannot access deep-brain regions. In contrast to light, microwave frequency signals can efficiently penetrate through deep tissue and the skull and are thus ideal for studying the inner workings of the brain. An example of microwave-enabled study is functional magnetic resonance imaging (fMRI), which has shed tremendous insight on human cognition. However, fMRI has severe limitations. It cannot directly measure electrical action potentials. The ability to non-invasively detect localized currents from individual neurons or small clusters remains one of the grand challenges of neuroscience and is essential for attaining an improved understanding of the inner workings of the brain.

Innovation:

Researchers at the University of Maryland have designed a less invasive measurement method to probe local action potentials at the cellular level with micrometer spatial resolution in order to improve our scientific understanding of brain function in humans and non-human primates. This approach will enable the measurement of individual neuronal activations at precisely known positions in the brain. By taking advantage of recent advances in spintronic devices, this method uses injectable nano-reporters that will measure weak electrical signals in the brain and convert them to microwave signals that can be detected wirelessly outside the body.

APPLICATIONS

Neuronal current measurements

ADVANTAGES

Less invasive
Micrometer precision
Real time sensing

CONTACT INFO

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Additional Information

INSTITUTION

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EXTERNAL RESOURCES

- US Patent 10,034,633

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