Neural Prosthetic Microdevice and Methods for Brain Repair

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Technology description

The invention is a device capable of bridging remote brain areas through real time brain microstimulation to promote rapid functional recovery after brain injury.

Overview

Existing Brain-Machine-Interfaces (BMIs) use brain signals as input commands to control external devices, or device-generated electrical signals to stimulate the nervous system. Emerging Brain-Machine-Brain-Interfaces (BMBIs) combine neural recording, signal processing, and electrical stimulation in one device for smart stimulation with potentially enhanced clinical efficacy. KU Medical Center researchers have developed a therapeutic implantable microdevice. This is the first such device capable of bridging remote brain areas through real time brain microstimulation to promote rapid functional recovery after brain injury.

Why it is better

Proof-of-concept experiments demonstrated that the device can restore function in brain-injured animals. A prototype application-specific integrated circuit (ASIC) has been fabricated in two-poly four-metal complementary metal-oxide-semiconductor (CMOS). The prototype device comprises the ASIC, assembled and packaged on a miniature rigid-flex substrate and external components for programming, supply regulation and wireless operation. The microdevice has been tested in ambulatory rats, converting neural signals recorded from microelectrodes in one part of the brain to electrical stimuli delivered to distant microelectrodes in other parts of the brain in real time, forming an effective communication bridge in an injured brain. In-vivo testing demonstrates rapid recovery of motor behavior in rats after brain injury (traumatic brain injury, stroke) followed by microdevice operation.

Application area

Potential applications include any injuries to the brain that result in disruption of cortical communication, including stroke, traumatic brain injury, neurosurgical resection, tumors or epilepsy. Emerging applications such as guiding plasticity in an injured brain.

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