Regulation of Brain Activity by a Minimally Invasive Neural Drug Delivery System

Technology #19172

Applications

This miniaturized neural drug delivery system (MiNDS) combines drug delivery techniques with intracranial electroencephalogram (EEG) recording. In clinical practice, MiNDS could improve therapeutic outcomes and minimize adverse effects over currently available drug delivery methods to treat psychological disorders or neurological disorders such as Parkinson's disease and epilepsy.

Problem Addressed

Many current physical drug delivery technologies to the brain utilize catheters which commonly deliver drugs to the ventricular system. However, penetrance with these technologies tends to be uneven and severely compromised by the distance between the target site and the ventricular system. Probes are another physical drug delivery technique; however, they pose their own set of challenges such as off-target diffusion. Large dimension probes can reach deep brain structures, but they cause significant gliosis and related deleterious tissue reactions. Smaller probes have mainly been applied intracortically, penetrating only into superficial regions of the brain due to a low bending stiffness. There is a need for a robust drug delivery mechanism, such as MiNDS, that is capable of accessing deep brain structures without causing significant tissue damage or off-target drug distribution.

Technology

MiNDS is a micro-fabricated, minimally invasive, implantable, remotely controllable drug delivery device. It utilizes pumps under wireless control to deliver nanoliters of drugs. This permits the adjustment of therapeutic regimens with pin point accuracy. MiNDS has a minimally invasive, yet robust, stainless steel Hamilton needle capable of penetrating deep brain structures without mechanical failure for chronic implantation. It is 200 µm in diameter, preventing significant tissue damage; and it has an aspect ratio of 500 (depth to diameter) limiting off-target drug diffusion. MiNDS also utilizes a tungsten electrode to record neuronal activity at the single-cell and population level to help analyze the effects of delivered drugs.

Advantages

- Minimally invasive
- Remotely controllable
- Dynamic adjustment of therapy
- Pinpoint spatial accuracy
- Mechanically robust allowing for chronic implantation

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Categories For This Invention:

Medical Devices
Implantable/prosthetic
Other (Medical Devices)
Surgical
Therapeutic (Medical Devices)
Life Sciences
Clinical Applications
Mental Health
Neurology
Therapeutics
Drug Delivery

Intellectual Property:

Systems and methods for neural drug delivery and modulation of brain activity
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2018-169955
Systems and methods for neural drug delivery and modulation of brain activity
US Patent Pending
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Publications:

Miniaturized Neural System for Chronic, Local Intracerebral Drug Delivery
Science Translational Medicine
(January 24, 2018). Volume 10

External Links:

Cima Lab
https://cima-lab.mit.edu/
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Image Gallery:

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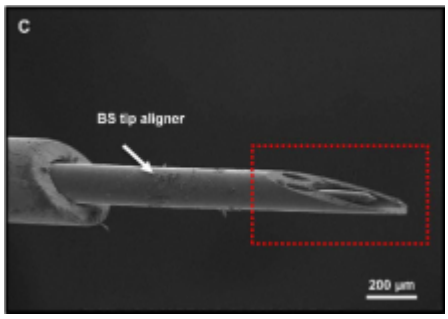

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