Multifunctional Fiber Probes for Electrical, Optical, and Pharmacological Interrogation of Neural Activity
Technology #16279

Applications

- Real-time in vivo interrogation and monitoring of neural activity
- Localized drug delivery to the nervous system
- Neurostimulation
- Development of multifunctional neuroprosthetic devices

Problem Addressed

Research aimed at understanding the brain and nervous system’s activity depends on neural recording devices such as neural probes and implants. Current implanted neurological technologies are highly invasive in their nature and often prompt an immediate inflammatory response, indicating a need for more compact, yet functional, platforms that are capable of accessing specific parts of the brain in a minimally-invasive manner.

Technology

Novel optical fiber probes are designed and fabricated to perform a set of functions that includes monitoring of neural activity, neurostimulation, and the release of therapeutics. The fiber probes are made from polymer and polymer composites, and manufactured using a thermal drawing technique. Thermal drawing, the gold standard in optical fiber manufacturing, allows for fabrication of multimode optical fibers with a custom design that can incorporate a range of materials and functional elements. The fiber probes have hollow channels for drug delivery, microelectrodes for neural stimulation and a core/cladding configuration for excitation and detection of optogenetic signals in the visible part of the spectrum.

Advantages

- Ability to access individual groups of cells and specific parts of the nervous system
- Possibility for real-time monitoring of neural activity
- Ability to deliver drugs & therapeutic agents
- The probes are compact - all the functional elements are integrated within a microstructured optical fiber
- Minimally-invasive
- The probes are flexible and can be used to monitor neural activity in a moving animal
- A robust and inexpensive fabrication method that can be used to fabricate hundreds of meters of optical fiber with desired geometry and functions

Categories For This Invention:
Medical Devices
Diagnostic
Implantable/prosthetic
Therapeutic (Medical Devices)
Photonics
Sensors (Photonics)
Life Sciences
Diagnostics
Other (Diagnostics)
Research Tools
Microfluidics (Research Tools)

Intellectual Property:
Methods and apparatus for stimulating and recording neural activity
Issued US Patent
9,861,810

Inventors:
Polina Anikeeva
Yoel Fink
Xiaoting Jia
Andres Canales
Ulrich Froriep
Chi Lu
Christina Tringides

Publications:
Multifunctional Fibers for Simultaneous Optical, Electrical and Chemical Interrogation of Neural Circuits in Vivo
Nature Biotechnology
2015
A Swiss Army Knife for Neuroscience
MIT Technology Review
April 21, 2015
Optogenetic Brain Interfaces
Biomedical Engineering
2014
Polymer Fiber Probes Enable Optical Control of Spinal Cord and Muscle Function In Vivo
Advanced Functional Materials
August 26, 2014
Pioneering Bioelectronic Interfaces
MIT News
September 2, 2014

External Links:
Bioelectronics Group
http://www.rle.mit.edu/bioelectronics/
Fibers@MIT
http://www.rle.mit.edu/pbg/

Image Gallery: