Nanoscale and Microscale Wireless Stimulating Probes Precisely Deliver Electrical Current to Cells

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing nanoscale or microscale wireless probes for studying neurons and other cells.

Overview

Studying how neurons and other cells work may require stimulating individual or small clusters of cells. The cells conventionally are stimulated through the use of fine electrodes inserted into or near the cells and connected by leads to external equipment.

However, such electrode systems are not practical for long-term placement in living organisms. The cells must be stabilized using potentially intrusive systems, and interference between the support structures for adjacent electrodes prevents close electrode spacing and the placement of electrodes in three dimensions.

The Invention

UW-Madison researchers have developed freely dispersable microscale and nanoscale probes that can be activated without a direct wired connection. Instead, these probes can be triggered remotely by electromagnetic radiation from a laser or other source.

The probes consist of small tubes of strained semiconductor material that overlaps to form a heterojunction semiconductor device. The overlap region may comprise n and p type doped regions to form a versatile p-n junction, such as a photodiode, which is capable of absorbing electromagnetic radiation.

The probes receive electromagnetic radiation, such as light, which they then convert to a local electrical potential and subsequently to an electrical current flow. The current flow could be used to directly stimulate neural cells. Alternatively, it could be used to trigger the chemical or mechanical release of compounds held by the probes, or to activate a biological system, such as an ion channel.

Applications

- Local delivery of electrical current at extremely small scales for use in cellular research or novel therapies that require long-term electrical stimulation of neural cells
- Remote wireless triggering of more complex electrical circuitry
- Remotely controlled delivery of chemicals as triggered by electrical current flow

Key Benefits

- Provides multidimensional stimulation of tissue without the need for connecting wires, which eliminates the potential for interference between the wires and supporting structures

- Probes may be chemically compatible with tissue or chemically targeted to particular tissue structures or types.
- Provides multifunctional trigger/sensor elements
- Provides a simple method of fabricating a versatile p-n junction, such as a photodiode, for the generation of local electrical currents

Stage of Development

Tubes of different shapes and sizes have been built and shown to be steerable.

Additional Information

For More Information About the Inventors

- Max Lagally

Tech Fields

- Medical Devices : Neurological devices
- Research Tools : Detection

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854