Optical nanoscale semiconductor array for parallel wireless neural electrophysiology

Technology #m11-125

In order to study the parallel nature of information processing in neural systems, acute sensing and recording of the electrical activity of many neurons simultaneously in vivo is required. While current analytical techniques have increased our understanding of neuronal processing on the single cell level, large-scale parallel analysis of a large number of neuronal cells for broader interpretation has thus far been elusive. This technology comprises an array of nano-probes capable of recording large-scale neural activity of multiple cells in vivo.

An array of nanoscale neural probes captures electrophysiological activity from several different neurons in parallel and in real-time.

The primary roadblocks to neuronal investigation on large-scale have been the relative size and weight of conventional probes, as well as the technical challenges of recording data from a mobile specimen. This technology addresses current limitations by employing nanoscale probes based on photonic crystal nanocavity lasers that can be used for untethered neural sensing and recording in vivo. Nanocavity lasers are used in conjunction with newly developed methods of wireless real-time data transmission to facilitate rapid data collection. A computer is then used to store and analyze the gathered information. Due to its relatively small size, the device can be implanted for convenient data collection in mobile animals. An array of such probes operating at hundreds to thousands of different wavelengths may allow one to record and analyze massive amounts of neural activity in parallel and in real-time.

Prototype nanoscale laser probes have been manufactured. The array of nanoprobes will be tested by performing electrophysiological recordings in vivo from a population of olfactory sensory neurons in the fruit fly during rest and in flight.

Lead Inventor:

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Applications:

• Recording activity of multiple neurons in parallel in response to stimulus (in vivo).
• Offers electrocardiographic and electromyographic measurements in insects and mammals.

Advantages:

• Nano-scale device dimensions.
• Provides enhanced brain-machine interfaces.
• Allows for finer control mechanism in ‘opto-genetics’ studies.

Patent information:


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Related Publications:


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