Advanced, Wireless, Implantable Neural Recording and Stimulation Microsystem (Case 2032)

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Technology description

Brief Description:

With the advent of advanced materials, MEMs, microfluidics, nanotechnology and interdisciplinary research programs between engineering fields and the biomedical sciences, miniaturized, next generation devices are now being developed for implantation in the body for more effective, targeted monitoring and treatment of diseases, disorders, and injuries. A targeted treatment has fewer, if any, undesirable, peripheral side effects on normal cells, and often requires less drug or fewer doses. The ability to more closely monitor conditions in real-time to enable near real-time treatment is a goal of medicine. As such, the ability to respond more timely has important implications to affect preventive medicine and, in the case of neurostimulation, enable mobility or mental functioning for better patient quality of life; better control of healthcare costs is yet another advantage. Moreover, such a ‘mobile’ implantable device can be used in the ambulatory clinic, hospital, home, or any other mobile, point-of-care, or remote setting. This is a relatively nascent research field, and there have been many challenges in terms of biocompatibility, use of wires, surgical implantation procedures, overall safety of implanted electronic device, and precise electromechanical control parameters.

The invention is a fabrication method for a fully implantable, wirelessly - powered and communicating -, integrated neural device/microsystem that can, continuously and bi-directionally, sense/receive, record, convert, transmit and stimulate from within the body and in/near the brain for therapeutic/ treatment or research purposes. This compact, hermetically sealed microsystem acts to interface an implanted microelectrode array with an external computer for neural control applications. It enables direct multi-channel broadband neural recording from multiple locations in the brain by converting recordings to a signal for wireless transmission (e.g., radio-frequency, digital stream of infrared light pulses for transmission through skin). Stimulation is achieved by using electrical signals, or other media, and can be in response to information gathered by the neural device. Benefits of this novel invention include the ability to monitor many aspects of brain function through the use of sensor and probes and the ability to use this information to provide stimulation and treatment. Moreover, this miniaturized rechargeable [battery] system can employ/integrate any number of power supply modalities. This flexible, biocompatible and safe device is packaged with portions of the electrical components within a medical grade metal casing and can accommodate multiple component formats,

connection types and techniques. Transmission of signals is through skin induction (transcutaneous) eliminating the use of wires through the skin.
The market niches are pharmaceutical diagnostics and drug delivery; medical devices – implantables, microsystems, neurostimulatory, prosthetics; electronic microdevices; scientific R&D. Applications are in the monitoring and treatment of a wide variety of human or animal diseases, disorders, and injuries in which direct,in situneurostimulation would be advantageous, for example, in the musculoskeletal system and/or prostheses development for fine-tuned motor control, CNS (brain/spinal cord) for sensory perception, drug delivery, endocrine system for hormonal control in metabolic diseases and diabetes management through drug delivery, control of epilepsy and neurodegenerative diseases. Further applications are in scientific R&D in the fields of electronics, MEMs/microfluidics, microdevices, materials, and/or nanotechnology, as well as in biomedical research, drug discovery and development for improved medical devices, diagnostics/monitoring, and drug delivery and/or treatment approaches.

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