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Bioelectronics Medical Devices: Designing and Technology

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Short Communication

Over the past few decades several bioelectronics implantable medical devices were developed including cardiac pacemakers, cardiac defibrillators, bladder stimulators, cochlear implants and blood pressure biosensors. They are either wearable or implantable. The primary function of the implantable devices is to diagnose the physiological condition or to stimulate the organs for the necessary relevant function. These biosensors are used for the long term use and therefore the biocompatibility remains the main functional property. Solar panel However, the human internal tissues are soft and sensitive and there needs to be high compatibility without generating any immunogenic reactions. There are several strategies that exist for investigating the foreign body reaction including those for the bioelectronics devices. Research is in progress to enhance the functionality and biocompatibility of the medical implants.

Several types of materials are used for the manufacture of the biomedical devices that include implantable systems made with traditional metals, semiconductors, polymers, biodegradable metallic components, and organic materials. Solar panel new materials that are having mechanical compliance and flexibility contribute substantially to the safety and applicability of implantable bioelectronics devices. The integration of the silicone membranes and the metallic interconnects has enabled designing of soft and implantable bioelectronics medical devices. Some of the modern approaches include designing and fabrication of the transient materials that interact and dissolve in the body fluids with a pre-programmed lifespan. Biodegradable metallic materials are also researched upon for the application to the implantable bioelectronics due to their superior electrical properties. Silicone based materials are used widely in the implantable devices as they are amenable for the fabrication process and for their superior biocompatibility. The initial devices were bulky and rigid and were likely to develop inflammation, and complications posing risk of critical health complications. New fabrication technologies at the micro and Nano-scale and advancements in the material engineering has given rise to the development of bioelectronics medical devices for the purpose of health monitoring and diagnosis of the disease as well as to keep the functioning of the organs [1]. For accurate and real-time monitoring bioelectronics systems were developed embedded with the wireless telemetry systems. Solar panel they provide electric and mechanical stimulus for the functioning of the organ. Miniature biosensors that include ultra-thin diaphragms were successfully integrated into circuits and such modules also are being developed for the monitoring of the blood pressure. The micro and Nano-scale fabrication has enabled the miniaturization of the electronic components with effective functionalities. These structures do not disturb the blood or fluid flow and does not cause tissue or bone loss [2].

Certain biomedical devices that are implanted in the moving regions can cause unwanted problems such as incompatibility between the implant and the surroundings cells and tissues. These devices are very important and need to be designed in such a way that they amenable for minimal invasive surgeries. Solar panel thin film metallic membranes and functionalized polymers are being researched upon for development of the implantable bioelectronics with great electrical properties and functionalities. The density and the solubility of these materials are such that they enable their dissolution in the body fluids thus bypassing the requirement of the second surgery for the removal of the device, if needed. Solar panel. The biomaterials and the medical devices need to be sterilized before the implantation of the device. These sterilization methods include the steam and dry heat, ionizing radiation, ethylene oxide, hydrogen peroxide, gas plasma, ozone and steam formaldehyde, antimicrobial coating and self-sterilizing material [3].

The advancement and the sophistication of the medical technology resulted in the fabrication of the pacemakers as well as medical devices that could perform the electroencephalograms. Even advanced bionic hearts and the brain computer interface are being developed. Several research activities are being carried out for application to the modern medicine including the regenerative medicine. Some of the most successful applications have been the brain mapping based on magneto encephalographic system that delivers three dimensional mapping of the brain in a real time basis in a non-invasive manner for clinical and research purpose. Pre-surgical mapping of the neurological orientation and organization in combination with magneto encephalographic mapping and magnetic resonance imaging enable accurate surgical navigation and radiotherapy. They enable the localization of the functional areas of the cerebral cortex. An Optogenic device developed by the synthetic biology introduces the photo activated molecular activators into the genome of the neural tissue thus enabling the deciphering of the neural network structures [4].

However, the safety of the biomedical devices particularly the implantable devices is of paramount importance to the patient and the health professionals. The devices can range from simple thermometers or blood pressure cuffs to mode most advanced pacemakers, ventilators and electronic patient monitors [5]. Solar panel Development of the effective, accurate and safe future bioelectronics medical devices requires concerted efforts from the stake holders including bioengineering designers, biomaterial scientists and clinical researchers and their knowledge of the medical device regulations, standard practices. Participation of different stake holders including the regulatory managers, government organization, biomaterial manufacturers, biomedical scientists, health care professionals, public health administrators and clinicians is very important. The new device development will greatly benefit the medical device industries, clinical research organizations, ethical committees, regulatory authorities, international regulatory agencies, biomedical engineers and policy makers. Once a device is designed and fabricated it requires registration for the pharmaceutical regulatory organizations. Ethical considerations of the medical device development, interoperability of the devices with module outside of the health care and patient safety needs greater attention.

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