Implantable Electrostimulation and Recording Devices from Gold Nanoparticle Composites

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Neural prosthetic devices (NPDs) in next-generation therapeutics

Neural prosthetic devices, commonly found in the form of artificial pacemakers, spinal cord implants, and cochlear implants, are showing much promise in treating neurological conditions and traumas. A major problem with using these devices lies in the body’s rejection of foreign implants; accumulation of scar tissue from immune response lowers the effectiveness of implants. To drastically reduce inflammatory response and to improve the junction between electrodes and neurons, devices have to be made to be smaller than 10 um. Mechanical signal transduction of the devices within neural tissues stimulate additional immune response; as such, smaller, more flexible devices tend to perform better in this regard. The U.S. market for neurostimulation implants is currently valued at $700 million, and is ripe for products with revolutionary technology to make their entries.

Gold composites revolutionary in eliminating immune rejection of NPDs

Gold nanoparticle composites have been shown to be extremely promising in the development of neural prosthetic devices. They have minimal toxicity, are highly conductive, and are easy to fabricate. Researchers here at the University of Michigan have compared the performance of gold composites to conventional carbon nanotubes (CNT), which were deposited onto glass substrates. They found that the conductivity of the gold films (8.6 x 10^6 S/m) was an order of magnitude higher than that of the carbon nanotubes. The impedance of gold films was four times lower than CNT and the charge storage capacity was an order of magnitude higher, and the biocompatibility of the gold nanoparticles was found to be excellent when tested with in-vitro mouse neurons.

Inventors

Nicholas Kotov