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Advancing the Arizona State University Knowledge Enterprise

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Conductive and Biocompatible Electrodes that Prevent Fibrotic Capsule Formation

Implanted electrode leads deliver a current from a powered device to tissue that requires electrical stimulation. A host of complications can arise from surgical implantation of electrode leads; however, foreign body responses and the rapid formation of a fibrotic capsule around the lead are the most frequent. Even with surface coating modifications and other enhancements, fibrotic capsules of up to 100 µm size frequently build up around the implanted device. This reaction can cause pain to the patient and impede the performance of the lead, consequently, additional surgeries are needed to maintain device. This puts the patient at increased risk and results in additional healthcare costs.

Researchers at Arizona State University have developed nanoengineered conductive electrodes having drug-free, biocompatible materials to prevent buildup of fibrotic capsules upon implantation. The electrodes possess excellent conductivity and the inert coatings on the electrodes resist adsorption and protein adhesion to enhance their biocompatibility. The electrodes have been characterized in terms of electrical conductivity, structural integrity and mechanical robustness.

These leads with their optimized coatings and superior conductivity abilities are excellent candidates for the next generation of implantable electrodes.

Potential Applications

- Cardiac electrode leads
- Neural electrode leads

Benefits and Advantages

- High electrical conductivity - the coatings provide excellent conductivity to and from the electrode lead
- Greater efficiency reduces power consumption – longer battery life, fewer procedures, lower costs
- Antifibrotic and antifouling - the coatings create a neutral, inert surface

which will not generate an inflammatory response

- Easy fabrication and modification processes
- Easy conjugation of the coating to an electrical lead
- Cost effective
- Does not need steroid elution

For more information about the inventor(s) and their research, please see Dr. Nikkhah's laboratory webpage