A Living Biosynthetic Peripheral Nerve Interface

Background

There are approximately 1.7 million people in the U.S living with limb loss. With 6% of them being upper extremity amputees. Most of these amputees are fitted with prosthetics ranging from basic hook systems, to electrically operated robotic arms. The more sophisticated prosthetics have evolved to be capable of sensing motor muscle signals, allowing the user to have functionality of motor movement. However, even with all the advancements in finely controlled prosthetics, they all still lack the ability of touch sensitivity. The ability to relate the sense of touch via a prosthetic is the final piece necessary to complete a truly ‘smart’ prosthesis.

Technology

A team of researchers at the University of Michigan has developed a regenerative peripheral nerve interface (RPNI). This innovation, shown in rats and tabletop demonstrations, brings the sense of touch back to those who have lost it. The interface combines successful advances in biology, surgical techniques, material science, modeling and electronic systems. The RPNI can be implanted into an amputee’s residual limb where skeletal muscle grafts are surgically attached to nerves. These nerves once innervated the motor and sensory fascicles of the arm and hand of the amputee. An electroconductive polymer on the surface of scaffold, which is wrapped around the RPNI, serves as the electrode that records and stimulates the neuromuscular bundle and keeps it electrically insulated from surrounding tissues. The RPNI functions based on a sophisticated algorithm, which decodes and codes the motor and sensory signals, sent to and from the limb nerves. The team has demonstrated the efficacy of the RPNI, successfully replicating the sense of touch in a true closed-loop form.

Applications and Advantages

Applications

• Sensory feedback for advanced prosthetic arm and hand

Advantages

• Replicates actual sensory and motor signals for closed loop feedback
• Biological stability for long term use
• Designed to be integrated with current smart prosthetics

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