Neuroprosthetics

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Neuroprosthetics is an electrical stimulation technology that replaces or assists damaged or malfunctioning neuromuscular organ systems. It attempts to restore normal body processes, create or improve function, and/or reduce pain. These systems are either implanted or worn externally on the body. The neuroprosthetic seeing the most widespread use is the cochlear implant, with approximately 100,000 in use worldwide as of 2006. There are three main types of neuroprosthetics, the sensory prosthetics, motor prosthetics, and cognitive prosthetics.

Visual prosthetics is a branch of neuroprosthetics and one of its main goals is visual supplement. Roughly 95% of all people who are consider blind suffer some sort of significant impairment but still may possess the capability of seeing a type of blur. By the 1940s, research had established the theory of artificial electrical stimulation of the visual cortex. Then in the late 1960s a British scientist found a system for placing electrodes on the brain's surface. This finding sparked areas of the brain to be stimulated in the blind volunteers and have all report seeing phosphenes which show where they would have appeared in space. The National Institutes of Health worked on a project to develop and deploy an interface based on ultrafine wire densely populated with electrode sites that could be implanted deep into the visual cortex. Auditory prosthetics deal with the cochlear implant (or "bionic ear") which is a surgically implanted device that can help provide a sense of sound to a person who is profoundly deaf or severely hard of hearing. Unlike hearing aids, the cochlear implant does not amplify sound, but instead works by directly stimulating functioning auditory nerves inside the cochlea with electrical impulses. The main parts of the external components of the cochlear implant include a microphone, speech processor and transmitter.

Motor Prosthetics are used for the conscious control of movement. Researchers are attempting to build motor neuralprosthetics that will help restore movement and the ability to communicate with the outside world to people who suffer from spinal cord injuries and wasting diseases. Scientists have developed microelectrode arrays which can be implanted into the skull to record electrical activity and sending the information out through a thin cable. Researchers are also beginning to build robotic limbs which patients can control by thinking about movement. Motor prosthetic developments continue by replacing lost arms with cybernetic replacements using nerves normally connected to the pectoralis muscles. These arms allow for a slightly limited range of motion, and reportedly are slated to feature sensors for detecting pressure and temperature.

Sensory and motor prostheses deliver input to and output from the nervous system respectively. While the third class of prostheses is aimed at restoring cognitive function by replacing circuits within the brain damaged by stroke, trauma or disease. This type is known as cognitive prosthetics.

Although the technology behind neural prostheses is still in its infancy, investigators and study participants continue to experiment with different ways of using the prostheses. Their preliminary clinical trials suggest that these devices are safe and that they have the potential to be very effective.

References:

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