

Making Connections: Introducing the Artificial Nerve

Summary

ABSTRACT

Background: Injury of the peripheral nerve is an understudied yet often highly devastating ailment, with an estimated 20 million patients in the United States suffering from peripheral neuropathy. While there are several available treatments for nerve damage, there is currently no cure.

Objective: The purpose of this project was to design and build a model of an artificial nerve which can be used as an implant for patients who have been diagnosed with nerve damage.

Design: The artificial nerve is designed to replace damaged neuronal axons. The design consists of specialized electrodes to attach to the inside and outside of the nerve fibre at the proximal end of injury (negative and positive terminals respectively), followed by an amplifier, light emitting diode, grin lens, single-mode optical fibre, photodiode, and electrodes to attach to the distal end of the nerve in this order. This system is applied to each damaged nerve fibre in order to rebuild the damaged nerve.

Analysis: A proof of principle model was constructed to demonstrate the application of the first half of the design. Based on the successful derivation of an output signal in keeping with simulated conditions in vivo, the experiment was deemed successful. Further research regarding the use of this innovation includes the building of the distal end connection of the device, testing for signal accuracy, and finally testing the model on a small animal model*.

Conclusion: Based on the success of the proof of principle model, as well as availability of scale materials, it can be stated that the fibre-optic nerve is a very promising option to cure nerve damage. However, as this project has merely scratched the surface of potential, more research must be done to further develop this breakthrough device.

*PLEASE NOTE: I am currently attempting to test the device on a small animal model. Though I have attempted to contact the Science Fair Administration in charge of approving animal testing several times, they have not replied and therefore I have not completed this part of the project yet. I would like to state that I am seeking the possibility of performing the testing of the project with the help of the Queens Animal Care Facility, and only under the condition that it is approved.