Overview
- nerve implantation that stimulates the peripheral nerve (sciatic nerve) by combining electrical leads with a scaffold
- electrical stimulation blocks the pain receptors, which stops the pain messages from being sent to the brain
- powered by an external battery placed near the knee — connected by a wire that goes through the leg
- remotely controlled with an app for when PLP is felt

scaffold
- using hydrogel-SIS scaffold to encase the threads
  - Biodegradable
  - will dissolve and be replaced by regrown axons
- wrapped in a small intestinal submucosa (SIS) to replace damaged tissues in the human body
  - enable restorative growth + reduce the foreign body reaction
- scaffold coated in nerve-growth factors
  - glial cell line-derived neurotrophic factor (GDNF) to promote growth
- Scaffold optimized to have large surface area to volume ratio for largest uptake of growth factors

SMALL INTESTINAL SUBMUCOSA (SIS)

electrical
- guide nerve growth and embedded into the nerve
- structure allow for greater volume of the nerve to be covered & greater chance of hitting more nerve fascicles
- electrodes covered in silk — combat the mismatch between the mechanical components and the tissue — prevent foreign body reaction
- powered by a 4.1V rechargeable lithium battery (made specifically for neuromodulation devices)
  - superior reliability; almost no passive discharge — can be stored for decades and still operate to full capacity
  - small size and weight: 2.5g
  - can operate at 100% capacity for 1,000 cycles and then 80% capacity afterwards.

battery
- measures

app (User Interface)
- controlled wirelessly via bluetooth
- different levels of stimulation can then be selected
- track electrical stimulation — does not exceed the threshold amount — avoid tissue damage
- threshold ~2 hours of stimulation/day for 3 years
- notify of potential tissue damage that may occur based on their record of stimulation
- alert when the batteries are running low

HYDROGEL

statics
- scaffold reduces foreign body reactions
- more direct control of nerve stimulation through implantation and nerve growth
- Electrode structure reaches higher voltage per nerve — more likely to reach all/most fascicles
- User controls stimulation amount & tracking information
- Only tissue engineering device directed towards phantom limb pain specifically

Carbon Nanotube Platelet Microcontroller Battery

Prototype: Depicting amputated leg portion with StimuNerve implant

SCAR NS NSC NS

SCIENTIFIC DEVELOPMENT

<ref>See next page</ref>
Gerald’s Leg

- sciatic nerve
- scaffold
- wire
- battery
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References


