Modular device for nervous system regenerations

DESCRIPTION OF INVENTION

There is currently no effective clinical therapy for the recovery of nerve lesions that affect nerve lengths greater than 2 cm. In minor lesions, a nerve graft is used, usually from the patient himself (autograft), or from a donor. This alternative has the disadvantages of requiring an additional incision, loss of donor nerve function, size mismatch between donor and injured nerve, and the limited availability of donor nerve. Allografts overcome several of the drawbacks of autografts, but require immunosuppression or decellularization to prevent immune rejection, as well as surgical intervention, rehabilitation, and the use of anti-inflammatories. Furthermore, they have not had satisfactory results when the lesions are greater than 2 cm in length.

We have designed and validated in the laboratory some modular neural cables made up of support glial cells in inside cylindrical structures of natural and synthetic origin, for their use in the regeneration of neural tracts of the central nervous system (CNS), of the peripheral nervous system (PNS), or in surgery of large nerves such as the brachial plexus or the sciatic nerve.

Neurocables are cylindrical structures, of variable length between 0.6 cm and 50 cm, formed by one or more independent or branched parallel bundles. Each bundle consists of cylindrical elementary modules of shorter length, and all of them are joined by continuous microfilaments located inside its lumen, which use a structure at each end that provides them with a longitudinal arrangement to facilitate attachment to the end of the nerve and its suture, maintained by rings strings. Each neural cable is capable of viable supportive neural cells (Schwann cells, oligodendrocytes) and the axonal extensions of neurons located at its ends, with functional neuronal connectivity from end to end of the neural cable.

BUSINESS APPLICATIONS

- Treatment of pathologies derived from injuries to the SNP and CNS, which occur due to various causes such as trauma, firearm wounds, neurodegenerative diseases, traffic and work accidents, etc. The clinical translation of this technology will have repercussions in surgeries that require donation or transfer of nerves of great lengths, in particular in neurotization (the transfer technique from donor nerves) of the brachial plexus, in oncological surgeries such as lumpectomy for breast cancer that affect the brachial plexus, and in the treatment of spinal cord injuries.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

- This technology provides directionality to axonal growth on synthetic guide elements, which improves the efficiency of regeneration from nerve stumps and makes very long regeneration distances possible compared to currently available systems.
- Microfibers can be electrically conductive to stimulate axonal growth.
- The fixation structures at the ends of the neurocable maintain the separation between microfibers and facilitate the suture of the ends of the device to each end of the sectioned nerve.
- Use of synthetic biomaterials in the manufacture of ducts and microfibers, which avoids technical and regulatory issues associated with the use of biomaterials of animal or human origin.

STATE OF TECHNOLOGY DEVELOPMENT

The technology has been developed in vitro so far, with implant prototypes with modules of up to 10 cm that have shown that the axonal projections of seeded neurons cover lesion lengths to a much greater extent than those possible with other methods or other commercial implants.

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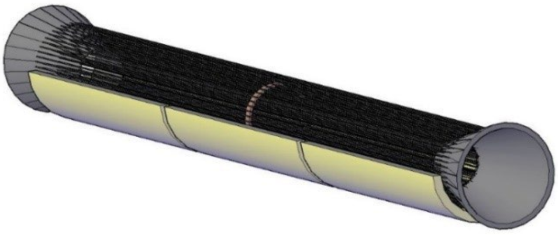

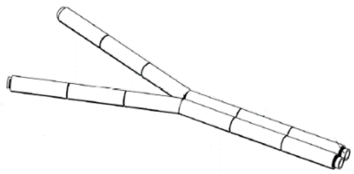

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