

Building a biodegradable implant out of silk fibroin to support neuro-regeneration after severe brain injuries

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Hospitals daily face the tremendous number of strokes or large brain trauma victims that suffer from blood brain barrier disruption, causing large disturbances in brain tissue. Once stabilized, those patients face motor disorder with a low rehabilitation rate.

Today progresses in neurons regeneration understanding [1] and recent advances in that field at GIN Grenoble demonstrate the positive incidence of light, mechanical and biochemical stimulation on the speed and success of axonal regrowth.

Used for centuries as a stitching material, silk fibroin is a natural protein, extracted from bombyx mori cocoons, that can be assembled into films, hydrogels or sponges. It's an FDA approved biocompatible and biodegradable material, that is thus a material of growing interest to build implantable devices carrying physical and biological functions [2].

By gathering light stimulation, mechanical guidance and biochemical activity on a rolled-up fibroin film/hydrogel 3D implant, we aim at building and testing an axonal highway to support large network rehabilitation in vivo. By reconnecting disturbed brain layers together, this technology might improve patients recovery after dramatic brain injuries.

[1] B.Zhou, Facilitation of axon regeneration by enhancing mitochondrial transport and rescuing energy deficits. J Cell Biol. 2016 Jul 4;214(1):103-19

[2] DL Kaplan, Silk as a Biomaterial, Prog Polym Sci. 2007; 32(8-9): 991-1007