

Motivation

"Human-machine interfaces" HMI can restore nervous system functions in case of impairments. They are essential for bidirectional neurocontrolled hand prostheses and other types of neuroprostheses dedicated to restore sensory-motor functions and can be also exploited in other conditions normally treated by stimulation of the peripheral nervous system by using active implantable medical devices, i.e. chronic pain and incontinence.

Human-machine interfaces, neural interfaces, are currently the bottleneck for these devices, concerning their biocompatibility and long-term implant stability/functionality. In fact, chronic implant of electrodes in the peripheral neural system (PNS) leads to the formation of scar-like fibrotic tissue and low axonal health, determining a loss of functionality after few months from the implant, thus strongly limiting their clinical use.

Objective

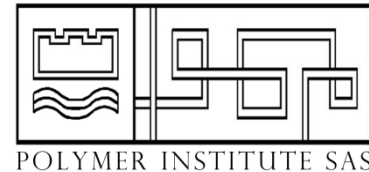
The aim of M2Neural is to develop a multifunctional coating for peripheral neural interfaces. The target is a non-degradable hydrogel that will minimize the mechanical mismatch between the implanted device and the tissues, promote electrode biocompatibility and axonal health thanks to the gradual release of neurotrophic and anti-inflammatory factors, and provide neurons with indirect electrical stimuli, by means of piezoelectric nanoparticles embedded in the hydrogel and periodical external ultrasound stimulation of the implant.

The Consortium

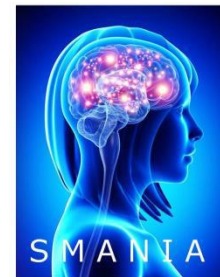
❖ **The BioRobotics Institute - Scuola Superiore Sant'Anna, Italy (Coordinator)**



❖ **Polymer Institute – Slovak Academy of Sciences, Slovakia**



❖ **SMANIA S.r.l. (SMArt Neural Interfaces and Advanced neurotechnology), Italy**



www.m2neural.eu

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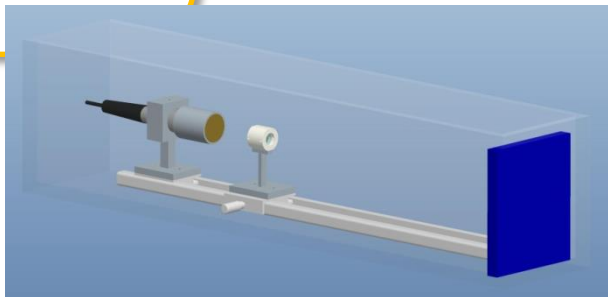
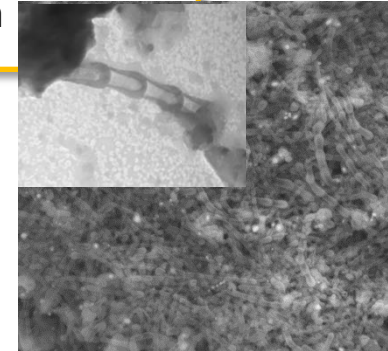
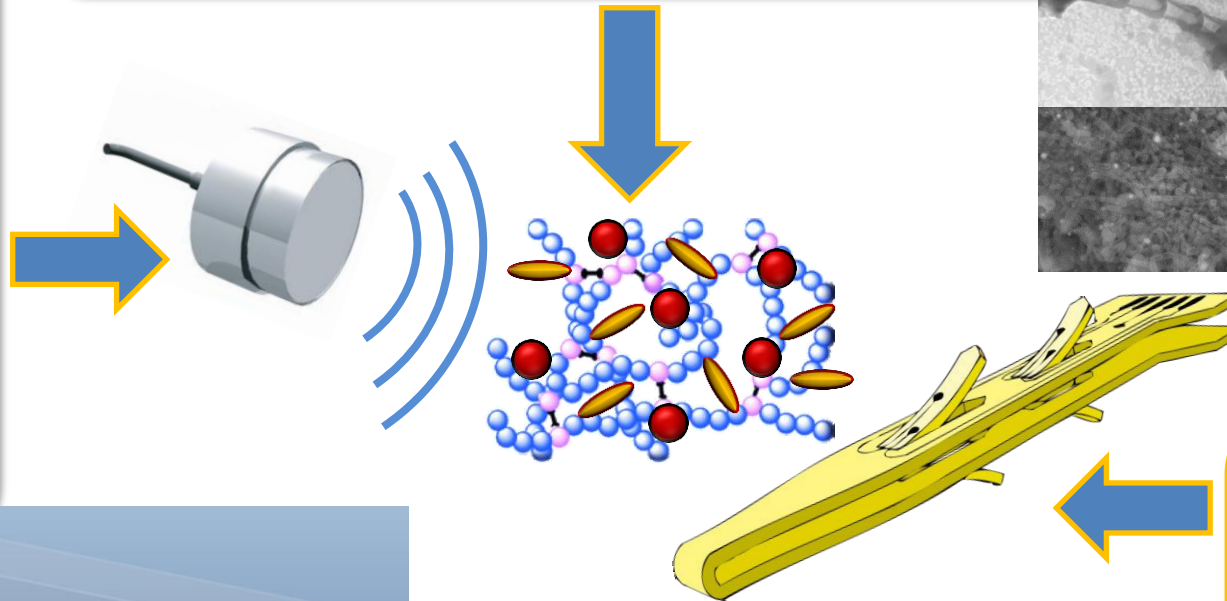
M2Neural
Multifunctional
Materials for advanced
Neural interfaces

Starting: November, 1st 2014
Duration: 36 Months
3 Partners from 2 EU countries

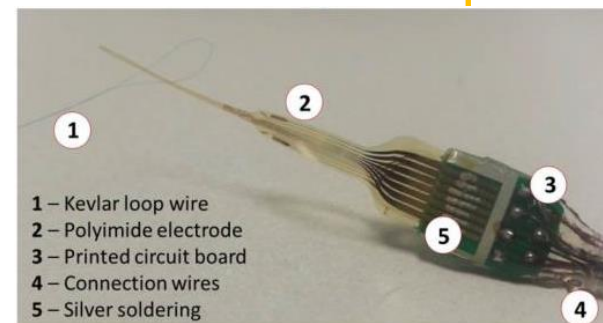
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FP7 M-ERA.NET Transnational
framework

A biocompatible and non-degradable polymeric coating doped with anti-inflammatory/neurotrophic factors (dexametasone, BDNF, NGF) and piezoelectric nanoparticles (boron nitride nanotubes) to reduce inflammation and promote neural health

Tunable external ultrasound (US) source to cause local mild hypertermia, to activate piezoelectric nanoparticles (generating local electric fields), hence triggering or accelerating drug release from the coating, besides directly stimulating neural tissue



Coating of a polyimide-based electrode used for interfacing the PNS, called SELINE (SELF-opening Intrafascicular NEural interface) commercialized by SMANIA S.r.l.



Expected Result

A advanced stable long-term peripheral neural interface whit the potential to revolutionize neuroprosthetics, providing enormous benefits for people with neurological disorders or amputations, exploitable to face other diseases normally treated by stimulation of the peripheral nervous system.