Optogenerap

Optogenetic Protein Therapy for Multiple Sclerosis

Development and pre-clinically validation of the first wireless cell-based biophotonic implantable device for IFN- ß protein delivery for treating patients suffering from Multiple Sclerosis

Optogenerapy Project

Optogenerapy project develops and demonstrates pre-clinically a sub-cutaneous bio-electronic implant as an alternative therapy to improve the quality of life and treatment adherence of patients with Multiple Sclerosis.

Optogenerapy solution combines wireless powered optogenetics technology, optics and genetic techniques to control the activity of cells in a living tissue with light, controlling the response of genetically engineered cells. IFN-ß protein, a drug used for relapsing Multiple Sclerosis, is produced and safely released to the system.

The solution is being validated through suitable sterilisation protocols and supported by modelling tools to assist the cells' activation, a light pathway for optical performance and the development of surgical instruments for its implantation and explantation.

The innovation includes:

- **Optoelectronics** miniaturisation, autonomy and optical performance.
- **Micro-injecting moulding innovative** technologies.
- **Polymeric biomaterials** with strong optical, biocompatibility and barrier requirements.
- **Cellular engineering design** for stability and performance of the synthetic optogenetic gene pathway over long-term implantation.

Multiple Sclerosis in figures

Multiple Sclerosis (MS) is the most common demyelinating disease, in which the body's immune system attacks myelin, the substance that surrounds and protects the nerve fibres of the central nervous system, forming scar tissue and distorting or interrupting the nerve impulses travelling to and from the brain and spinal cord.

700.000
people have MS in Europe

2/3
of the people affected are women

€2.3 bn
MS therapies' market revenue in Europe

Solution Concept

Drug Delivery Cell Chamber

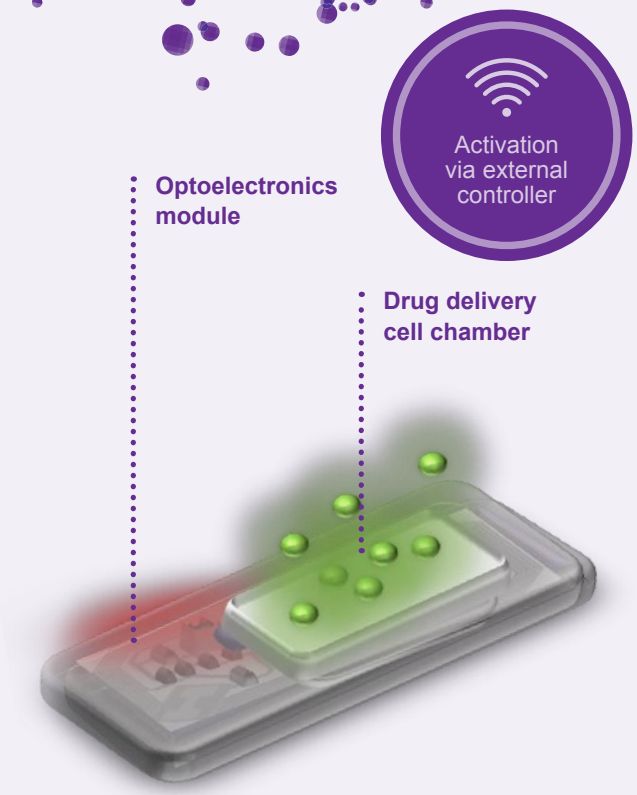
Composed of a frame of biocompatible optical polymers with the upper and lower surfaces closed by flat membranes, and a lateral filling port to load cells in the cell chamber.

Optoelectronics Unit

Compact and flexible low-resistance screen-printed NFC antennas of high quality factor, as well as the footprint and interconnections, on which the components are hybridised electronics controling the generation of the IFN-ß drug.

External Controller

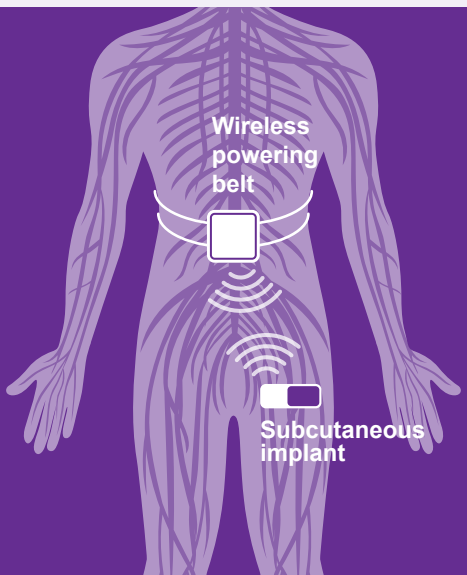
Device to activate the electronics encapsulated in the implant via electromagnetic energy.



Use Scenario

After in vivo validation, the solution will **move forward towards a translation** into a final human implantable device.

Implantation would require an ambulatory surgical procedure, with local anesthetics. The practitioner will be able to regulate the drug delivery using an external controller module, combined with a wireless powering belt.



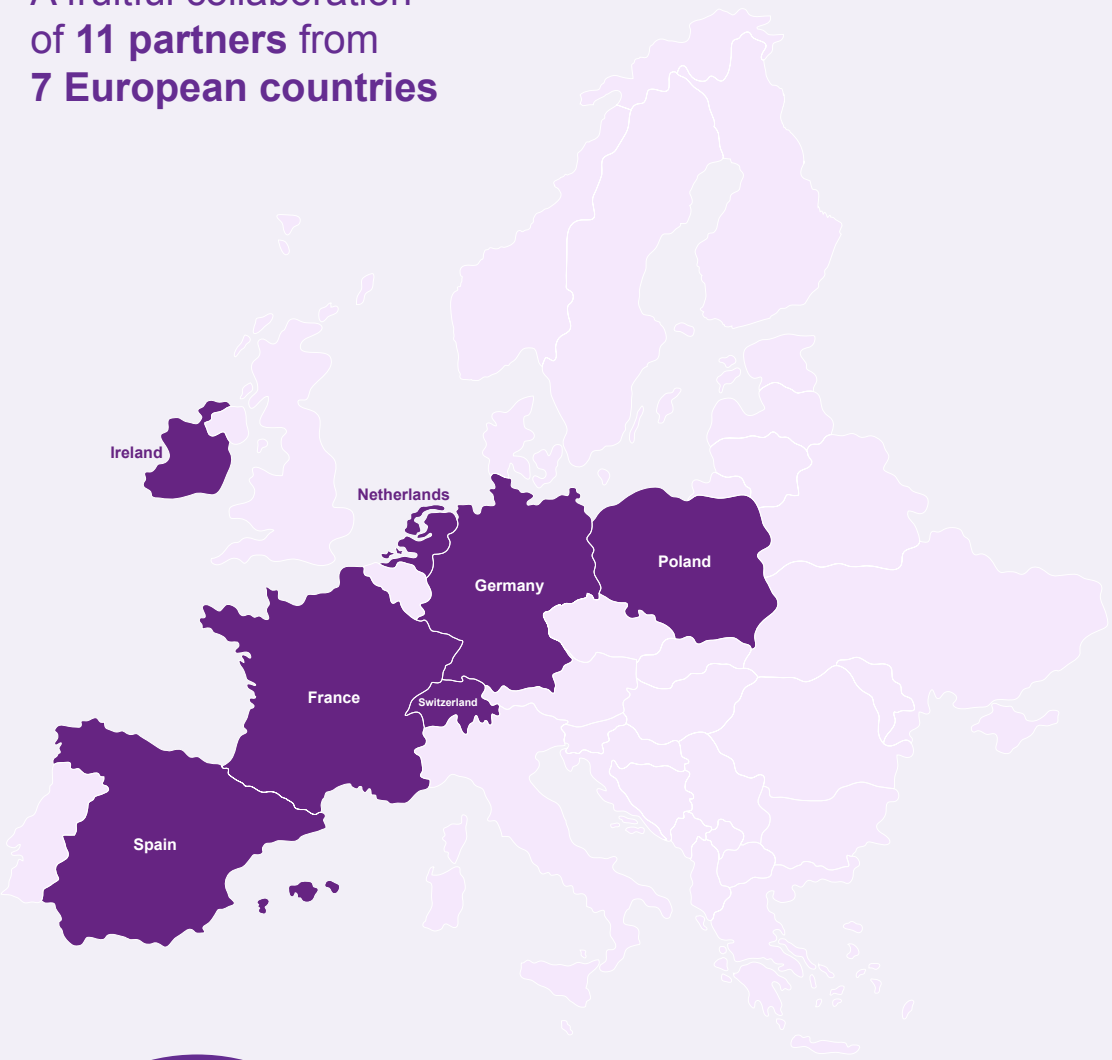
Potential benefits for MS patients

- Reliable ON/OFF switch to externally start and interrupt the drug delivery
- Steady drug flow eliminating drug peaks
- Cell-produced IFN-β not causing the immune reactions of current injection treatments in the long-term
- Reduction of direct and indirect healthcare system costs related to Multiple Sclerosis

Optogenerapy

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 720694

A fruitful collaboration of **11 partners** from **7 European countries**



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