€8m Research Project Aims to Develop New Cure for Epilepsy

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A new European research project which aims to heal epilepsy by regenerating brain tissue and 'training' neurons is getting underway.

The five-year, €8m Hybrid Enhanced Regenerative Medicine Systems project - HERMES, brings together 12 partners from 7 EU countries to heal brain disorders using transplants which combine biological and artificial components.

Epilepsy is a brain disorder characterized by the progressive damage of some brain areas, which results in an abnormal functioning of the brain. To date, epilepsy affects 50 million people worldwide, 8 million of whom live in Europe.

HERMES researchers will study temporal lobe epilepsy, the most common form of epilepsy, which can be resistant to current pharmacological therapies. Temporal lobe epilepsy affects areas of the brain that are involved in learning, memory and emotions, such as the hippocampus.

HERMES will aim to rebuild the part of the hippocampus damaged by this form of epilepsy. Researchers will generate hippocampal tissue in the laboratory and develop a neuromorphic neuroprosthesis - an electronic device that mimics the normal function of the brain's neurons.

The two components - one biological and the other artificial - will be implanted in the damaged brain area in an animal model with the aim of rebuilding the damaged hippocampus. The neuromorphic neuroprosthesis will be equipped with artificial intelligence to guide the implanted tissue towards the correct integration within the brain.

The device will then serve as a "trainer" for the tissue recreated in the laboratory and will be discontinued upon complete regeneration and functional recovery of the brain area. The new paradigm introduced by HERMES is called enhanced regenerative medicine.

The HERMES project is supported by the European Commission's FET-Future and Emerging Technologies funds, among the most ambitious and competitive in Europe, and is coordinated by Istituto Italiano di Tecnologia (IIT) in Italy and involves partners from Italy, Spain, Denmark, United Kingdom, Finland, Belgium and The Netherlands.

In the UK, researchers from the University of Glasgow will work to make the microelectronic chip implantable into the brain. Dr Hadi Heidari, of the University's School of Engineering, will lead the study and development of biocompatible materials to accommodate the miniaturized microelectronics as well as the fabrication of the final implantable chip.

Dr Heidari said: "We're thrilled to be part of this innovative project, which has the potential to truly change the lives of people living with disabling brain disorders like epilepsy.

“The aim of HERMES is to enable biomedical interventions to move from treating patients to healing patients, and we’re looking forward to playing our part in that over the next five years.”

Dr Gabriella Panuccio, IIT researcher and HERMES coordinator, said: "Our project is very ambitious, but if we succeed, we will be able to open new research perspectives for brain disorders and step beyond the limits of current treatments. Our goal is to demonstrate that it is possible to establish a dialogue between biological and artificial systems and obtain biohybrid technologies to cure the diseased brain. We intend to go beyond the canonical concept of regenerative medicine as a purely biological approach: it is necessary to leverage innovative technologies in order to help the new tissue integrate itself properly in the brain".

The perspective of interfacing biological and artificial systems leads to ethical and philosophical reflections, which will be addressed during the project, thanks to the involvement of experienced partners in the field, as well as during dedicated public events throughout Europe.

In the future, HERMES technologies will have a long-term impact on people's lives, on their health and well-being.

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