CorTec's Brain Interchange™ system: Revolutionizing brain therapy with closed-loop neuromodulation

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CorTec's Brain Interchange™ system offers closed-loop neuromodulation, revolutionizing brain therapy by precisely adapting treatment based on individual needs

The central nervous system is a complex organ that receives, computes and forwards information using bioelectrochemical processes.

Particular networks of brain cells are associated with various functions, e.g. cognitive or motoric capabilities. Disruption of network functionality, caused by injury or disease, leads to impaired brain function, which then causes multiple conditions such as motor disorders, e.g., Parkinson's disease (PD), or mood/mental disorders, e.g., anxiety, schizophrenia, and depression.

An alternative approach to brain therapy: closed-loop neuromodulation

The definitive treatment of these conditions uses pharmaceutics, but the therapeutic outcome in these conditions is not always satisfactory.

An alternative approach to drugs is modulating the network activity using electrical neuromodulation techniques. Electrical neuromodulation implants have successfully been clinically applied to some conditions (e.g., PD, dystonia, chronic pain) and are an established clinical treatment option today.

However, most of the available devices operate in open-loop mode: the clinician sets the parameters that define how stimulation is repetitively applied to the selected biological target location at the beginning of the brain therapy. Then, parameters are refined on demand when the therapeutic effects or potential side effects require to do so.

Although CorTec acknowledges the success of these therapies and their considerable impact on the patient's quality of life, we are convinced that neuromodulation can be used to treat many more brain conditions, given the brain therapy is auto-adaptively operating in closed-loop mode.

This will allow for precisely regulating the therapeutic doses according to the patient's individual need, which constantly changes, sometimes within seconds, due to the condition itself but also due to the environment and the mental and motoric activity of the patient. Such a closed-loop system operates continuously by analyzing the therapeutic need, refined brain therapy delivery, and therapeutic outcome measurement.

Closed-loop therapy relies on identifying the therapeutic need

A critical element of such a closed-loop brain therapy is identifying the therapeutic need for which at least one reliable biomarker is required.

For example, a biomarker clinically used for triggering brain stimulation to prevent epileptic seizures is a measurable electrical voltage known as local field potential that is locally generated by networks of millions of nerve cells of the affected brain.

The FDA approved Responsive Nerve Stimulator of NeuroPace, Inc. uses this biomarker clinically to treat drug refractory epilepsy. The clinical research community has already provided evidence for biomarkers that allow closed-loop neuromodulation of Parkinson's Disease with a clinical outcome superior to that of today's open-loop neuromodulation implants. Many more closed-loop applications are on the horizon for which the biomarkers today are still unclear and require clinical research to be identified and evaluated. CorTec has developed a tool for biomarker identification and discovery of new therapies.

The CorTec Brain Interchange™ system consists of an implanted electronic device that provides coupling to the brain using 32 electrical contacts that can be located on and in the brain. Each contact can be used for sensing of network activity as well as for electrically modulating this biological circuitry.

Sensed activity data is amplified and digitized by the implanted electronics and wirelessly sent through the skin to a portable computing unit which runs researcher-defined analytical algorithms. Based on this data processing, a therapeutic need is calculated, and an electrical stimulation command is wirelessly sent to the implant where it is executed. A cycle of brain signal recording, processing and stimulation can take as little as 0.02 seconds.

Body-external signal computing gives the researcher freedom. Algorithms can quickly be adapted, and additional information, e.g. supplied by smartwatches, can be used to define brain therapy.

Also, the algorithms could involve heavy "data crunching" since the computing power is not limited by battery size, which was the case if the algorithms ran directly on the implant.

Currently, we provide the CorTec Brain Interchange™ system as a therapy discovery platform to researchers worldwide, addressing mental, mood and motor disorders. It is also planned to use it as a brain-computer interface to permit heavily impaired patients to communicate again and to control assistive devices like a wheelchair. Many more applications can be thought of, and CorTec is constantly searching for experts in their field for future cooperation.

CorTec and the development of a novel stroke therapy

A major focus of CorTec is the development of a novel stroke therapy utilizing the CorTec Brain InterchangeTM system: Patients will receive the implant with electrodes located subdurally on the cortex in the stroke-affected area.

The system will record local field potentials and will electrically stimulate the brain in synchrony with the patient's beta band activity, which are electrical oscillations generated by the brain with a characteristic frequency of 15 to 25 Hz. This stimulation paradigm, carried out for a few months after stroke, approximately two hours per day, will induce increased network plasticity.

Plasticity describes the ability of the brain to (re-) learn the processing of particular tasks. Based on recent literature and clinical data acquired using stationary and heavy body-external laboratory equipment, CorTec and partners developed a therapeutic approach using our implant that allows the restoration of body functions lost by stroke, helping the brain reorganise itself.

The National Institutes of Health and continued research opportunities

The National Institutes of Health (US) scientifically supports our stroke project. Clinical studies are planned to start in 2024, while the translation of our brain therapy discovery platform to an implantable medical device is supported by a European Innovation Council (EIC) Accelerator grant.

Please Note: This is a Commercial Profile

More About Stakeholder

CorTec, neurotechnology and the Brain Interchange System
CorTec's mission is "communicating with the brain – for the cure of disease". By using their Brain Interchange System, they hope to develop stroke rehabilitation.