ERA-NET NEURON

NEWSLETTER 43

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Announcements from Neuron Cofund2

NOW OPEN!

2024 Call for Proposals on: "Bi-directional Brain-Body Interactions"

Pre-proposal submission deadline:
8th March 2024 | 14:00 CET

DETAILS

RECENTLY LAUNCHED!

CSA BrainHealth

"Towards designing a European brain health landscape"

STAY POSTED

From the desk of the coordinator | December 2023

Dear Readers,

Welcome to issue number 43 of the NEURON newsletter, in which we unveil the advancements and unknowns in the exciting field of brain-body interactions, as presented by scientific experts in our latest foresight symposium. In May, we were delighted to hold our traditional foresight symposium in Bratislava, Slovakia. The topic of the symposium was 'Bi-directional brain-body interactions' and it was organized by NEURON partners Etienne Hirsch (INSERM) and Bernard Poulain (CNRS). The symposium included presentations from renowned scientific experts and a discussion panel, led by NEURON's coordinator, Marlies Dorlöchter, in which scientists and representatives from patient organizations discussed the key issues that need to be addressed in research on this topic. More on the Foresight Symposium on page 3.

Funded by the European Commission

More information can be found on our website
http://www. neuron-eranet.eu/index.php
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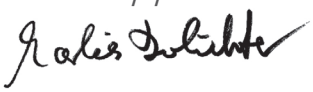
In this edition, we also take pride in our continued support in young researchers whose pursuit of knowledge has been nurtured by NEURON, as they participated in specialized Cajal training courses, thus exemplifying our commitment to fostering the next generation of researchers in the field of brain health. Impressions from three such young researchers, who participated in the Cajal training course on 'Neuro-vascular function in health and disease' can be found on page 9.

Finally, an important message: The ERA-Net NEURON is happy to take part in the new Coordination and Support Action (CSA) BrainHealth, which celebrated its kickoff on November 7th. Maintaining, promoting, and restoring the health of our brains is a common and global challenge that requires collaborative and integrative efforts. This CSA is the preparatory phase to form a common vision of a future European Partnership on BrainHealth towards support of citizens living with mental or neurological brain diseases/disorders. This vision is developed by NEURON and other main players in the field – e.g. JPND, EBC and EBRAINS – sharing common objectives towards structuring the landscape in Europe for research into the brain. The aim is to create a platform for involvement of all pertinent stakeholders (ministries and funding agencies, researchers, persons with brain disorders, health care providers and payers, regulators, industry) and their convergence around an ambitious Strategic Research and Innovation Agenda. We will keep you posted on important developments from CSA BrainHealth as work proceeds.

With this, we invite you to explore our accomplishments and keep up with our activities on our website, by following us on X and by joining our LinkedIn community.

Sincerely yours



Foresight Symposium on Bidirectional Brain Body Interactions

May 10th, 2023

The Foresight Symposium on 'Bidirectional brain-body interactions', which was organized by NEURON partners Etienne Hirsch (INSERM) and Bernard Poulain (CNRS) last May in Bratislava, was an educational full day of lectures by five experts in the field, whose lecture summaries can be found following this introduction, and two patient representatives: Orla Galvin from EFNA (European Federation of Neurological Associations) and Raluca Nica from Gamian Europe. The symposium included enriching discussions with the speakers, five scientific advisory board (SAB) members who attended the meeting, local invited guests, patient representatives and NEURON partners.

It has become increasingly evident that bidirectional communication between the central nervous system and the body has significant implications for maintaining both homeostatic and brain function. Aberrations in brain–body interactions linked to genetic, environmental or lifestyle factors encompass a wide range of conditions affecting millions worldwide. Dysregulation of the brain-body axis can potentially contribute to or exacerbate various neurological and psychiatric disorders.

The Foresight symposium program has been conceived to bring forward a lot of different lectures and to integrate as many major topics related to brain-body interactions as possible: circadian rhythm and body; interaction between the immune and nervous systems; brain-gut axis microbiota; vagus nerve stimulation impact on the brain; body representations and mental disorders; proprioception alteration and CNS plasticity.

Following this symposium NEURON funding organizations, agreed on the importance of working towards better understanding of the bi-directional interactions of the brain, the body and the environment. This symposium served as an important consultation step for the NEURON funding organizations to receive a scientific update on the topic and to develop the upcoming call text for JTC2024. We are grateful to the experts, whose insights greatly assist us in developing valuable activities for brain research.

Matthew R. Longo

Body representations and mental disorders

Prof. Matthew R. Longo

University of London, UK

There's different facets of body representation in mental disorders (body dysmorphia, phantom limbs, etc.). In the context of body dysmorphia (e.g. eating disorders), individuals fixate on specific parts of their body, perceiving them as aesthetically undesirable and suffering of body image distortions. After various studies focusing on sensory-motor control, researchers shown a complex interplay between sensory perception and motor control. In the case of stroke patients, the "disturbed limb ownership" is a fascinating phenomenon where people after a stroke deny ownership of an affected limb. Studies discovered a correlation between alterations in experienced body representation and specific brain regions involved in sensory motor control.

However, these fields of research need to be developed further, and to understand these distortion phenomena, neuroscientists have developed new approaches. For example, with the "hoop task" (for eating disorders), that provides patients with a multisensory experience, augmented reality systems which modify images of the hand to align with the patient's perception and virtual reality that demonstrate the malleability of body perception. Nevertheless, neuroscientists lack a comprehensive understanding of how different patterns of distortion and enlargement of body representation functionally impact individuals.

Nils Kroemer

Vagus nerve stimulation and impact on the brain

Prof. Nils Kroemer

University of Bonn & University of Tübingen, Germany

Understanding the impact of vagus nerve stimulation on the brain is very important when considering broader applications, particularly in the early stages of a disease.

Stimulation of the vagus nerve efferent pathway generates strong activation in the brainstem. Downstream areas are probably involved in the influence of behaviour. However, further studies are needed, integrating stimulation with specific tasks and behaviours, to better understand these mechanisms. Recent research using 3D models of vagal fibres has led to surprising findings. However, in real-world applications some patients do not respond as expected to invasive vagus nerve stimulation, even when targeting the same fibre bundles. This variability seems to result from the unique fusion and splitting patterns of these fibres beyond the location of the electrodes, leading to different brain stimulation effects. To address this issue, optimized imaging protocols, such as optical or ultrasound imaging can provide valuable information, although these methods have not yet been widely explored.

Although, it is encouraging to see that this form of stimulation is effective in different laboratories and protocols. The effects observed on brain activity, pupil dilatation, stomach-brain communication and gastric frequency all point to vagal modulation.

Carmen Schröder

Circadian rhythm and body

Prof. Carmen Schröder

STRAS&ND Centre, Strasbourg, France

All species on Earth are influenced by circadian rhythms. This day/night alternation greatly influences lifestyles and brain functions. Sleep represents almost a third of our lives, and its deregulation can have dramatic repercussions on the brain.

The importance of the study of sleep and circadian rhythms in neuroscience is highlighted by their high frequency in various psychiatric and neurological disorders. Strong evidence consistently shows that sleep and circadian rhythm disturbances increase the probability of developing psychiatric disorders. Recent studies in psychiatry and neurology have explored the use of light therapy potential in the treatment of a range of conditions including depression, insomnia, autism spectrum disorders and Attention Deficit Hyperactivity Disorder (ADHD). Researchers are adjusting various factors with the aim of improving patient outcomes in these areas.

More than just recovering energy, research on both animal and human models shows that sleep not only helps eliminate neuronal waste, but also plays a crucial role in neurodevelopment, memory and metabolic balance. Poor-quality sleep can also increase emotional sensitivity and irritability, which in the long term can lead to anxiety and depression, which is why further research in this field is so important.

Anne-Katrin Pröbstel

Brain-gut axis including microbiota

Prof. Anne-Katrin Pröbstel

University of Basel, Switzerland

In the field of neuroimmunology and brain research, a subtle distinction has emerged between a healthy blood-brain barrier and a damaged one, characterized by a delicate balance of immune cells. Recent revelations have highlighted the ability of the microbiota to influence this system, whether through direct interaction with the brain or indirect modulation via the immune system.

In neuroimmunological diseases, genetics and environmental factors play essential roles. Factors like genetics, diet and microbiota have become increasingly influential. The gut-brain connection, facilitated by the vagus nerve, offers a pathway for microbiota to impact brain function. New approaches with technological advancements in sequencing have revolutionized microbiota research, allowing for detailed genomic analysis.

The microbiota also has influence on neurodegenerative diseases. For example in Alzheimer's disease, specific oral microbiota toxins contribute to neurotoxicity. Targeting these toxins with a small molecule shows promise in reducing neurodegenerative symptoms in animal models. However, questions remain, especially concerning dysbiosis in immune-related diseases.

Other research has shown a role for gut-based IgM-producing cells in controlling inflammation during neuro-inflammatory conditions. These cells may also impact systemic inflammatory diseases and tumour-associated inflammation.

It is essential to note that our understanding of all these phenomena is still in its very early stages in various fields (infectious, inflammatory and autoimmune diseases).

Fosco Bernasconi

Proprioception alteration and CNS plasticity

Dr. Fosco Bernasconi

EPFL, Switzerland

Parkinson's Disease (PD), characterized as a motor disorder, presents with three primary motor symptoms: bradykinesia, rigidity, and tremor. Nevertheless, numerous non-motor symptoms may also manifest. Among these non-motor symptoms, 50% of the patients suffer from hallucinations. There are two types of hallucinations in PD, minor and complex hallucinations. However, the biggest problem with hallucinations is that they are highly subjective and private experiences. The patient must therefore interpret the hallucination as an association and report it correctly to the clinician or scientist, and the scientist must interpret it to finally classify it.

Subjective reports of hallucinations may be influenced by patients' fear to be labelled as schizophrenic. Since these reports cannot be measured objectively, researchers use other methods as epileptic monitoring or robotic system adapted to an fMRI scanner.

Several current projects are dedicated to the study of hallucinations in Parkinson's disease. For example, virtual reality is being used to induce complex visual hallucinations at different stages of the disease, enabling a global approach to hallucinations and cognitive decline in PD. This new approach represents a great promise for research and treatment.

Impressions from the Cajal Training on 'Neuro-vascular function in health and disease'

20 Mar – 7 Apr, 2023, Bordeaux, France

The CAJAL Advanced Neuroscience Training Programme's aims to teach basic and fundamental neuroscience concepts, as well as state-of-the-art techniques, data analysis and computer skills, to train the next generation of top-notch neuroscientists. ERA-NET NEURON has partnered with FENS in the organisation of the Cajal Training Programme since 2018, aiming to promote high-quality neuroscience training by sponsoring neuroscience courses. Each year a Cajal course is sponsored that thematically aligns with the scope of the ongoing projects funded in ERA-NET NEURON joint transnational calls. In addition, the partnership entails support for participants from ERA-Net NEURON funded consortia and travel support for course directors.

This advanced experimental course on Neuro-vascular function allowed students to acquire basic knowledge and hands-on experience on the most important techniques used to study the neurovascular unit, such as in vivo/in vitro high-resolution imaging, magnetic resonance imaging, and rodent models of cerebrovascular disease. The course also focused on the critical topics of data reproducibility and open science.

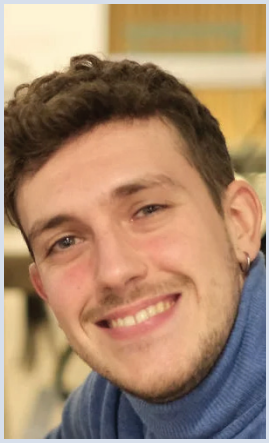
We asked Gülin Baran, Klaudia Csikós and Edoardo Mazzone to tell us a little about themselves, their impressions from the Cajal course on 'Neuro-vascular function in health and disease' that they recently participated in, and about the importance of support for early career researchers, like them, to participate in such courses. A small taster from their impressions are shown below – the full interviews can be read on the NEURON website.

Gülin Baran, PhD student in the Mustafaoglu lab at Sabanci University, Turkey

"In the past three weeks I've gained a huge amount of knowledge through impressive scientific talks, wet lab techniques and data analysis approaches. Besides the rapid growth of my scientific knowledge, I'm extremely grateful for the opportunity to improve my social network with highly skilled researchers."

Klaudia Csikós, Student at the TTK Research Centre for Natural Sciences, Hungary

"The Cajal course was an unforgettable experience that exceeded my expectations. The mix of lectures, hands-on experiments, and networking opportunities provided me with a unique and inspiring learning environment... The course provided me with an opportunity to expand my experimental toolbox...The support from ERA-NET NEURON was instrumental in my participation and success in the Cajal Training Course"



Edoardo Mazzone, Researcher at the Mario Negri Institute, Italy

"The most significant aspect I derived from this experience was a substantial personal growth; the unique opportunity to engage with keynote scientists in the field provided me with new insights, and the frequent opportunity to speak in public allowed me to become more self-confident... Thanks to ERA-Net NEURON, I was able to benefit from funding that economically supported this three-week course. Therefore, I can say that this generous support has allowed me to access a fantastic experience that will be crucial for my future."