

CNB Newsletter

06 / 2023

Dear CNB members,

With the CNB Newsletter, we intend to inform you about upcoming CNB events, ongoing projects and give insights into the research topics of selected CNB members. In this edition we look back on the Brain week 2023 and are looking forward to the 18th Annual Meeting 2023 which will take place on September 8th. The CNB annual meeting will again have a poster session, that is open to all types of research and all career stages. Please note that graduate students may obtain a credit for presenting their posters.

CNB provides excellent opportunities for exchanging ideas and building novel collaborations within the University of Bern neuroscience community. This issue introduces two research groups within the CNB, spanning the *Experimental Neurology Center (ZEN)* and the *Cognitive Psychology, Perception, and Research Methods*.

Dr. Carolina Gutierrez Herrera and Prof. Dr. Fred Mast are researchers who contribute to the CNB activities. Micaela Borsa is PhD Student and reports as a young researcher *a look into the lab*.

Please reach out to us, if you would like to showcase your research in the next newsletter. Please also indicate if new groups should be included in the CNB platform.

Please also note that we are updating and upgrading the CNB-Website, so please feel free to contact Ms. Alessia Carlucci (alessia.carlucci@unibe.ch) if you want to make changes on your research group-site (e.g. add photos, videos, members etc.).

We hope you enjoy reading the June 2023 edition.

Prof. Dr. Sebastian Walther
President CNB

① Brain week Bern

Monday, 13th of March 2023 – Thursday, 14th of March 2023

In the following section, we look back on the Brain week 2023. During this week, we were able to welcome up to 224 people per evening in the audience. The focus of this year's brain week was on brain health and mental health as central components of well-being. We talked about how to maintain brain health and mental health. This year's Brain week highlighted multiple aspects of this topic in inspiring lectures and lively discussions. On Wednesday, a movie presentation at the Rex cinema was dedicated to fascinating brain states. At the end of the week, the panel discussion tackled the myths and truths around popular conceptions of the brain.



CNB Newsletter

06 / 2023

CLINICAL NEUROSCIENCE BERN

Monday, 13th of March 2023

Moderation: Prof. Dr. Daria Knoch

Sponsor of the day: Cerebral

On Monday the three talks covered brain health and mental health across the life span:

"Healthy development of a child's brain"

PD Dr. med. Sebastian Grunt (Research Focus: Neuropediatrics)

Dr. Grunt presented the structure of the brain and explained the various stages involved in the development of a cell to the formation of the brain. He also highlighted the similarities and differences to other vertebrates/mammals. Furthermore, he discussed the prenatal imaging of a child's brain using magnetic resonance tomography. At the end, he gave an overview of brain development from neurulation to adulthood.

"Mental health in midlife"

Prof. Dr. med. Sebastian Walther (Research focus: Psychiatry, Psychiatric neuroscience)

Prof. Walther introduced the audience to the development of mental illnesses and talked about the beginning of common mental disorders and the long-term impact and consequences. He introduced the vulnerability-stress model and mentioned the increase of cases of mental disorders during the pandemic. Moreover, he explained the curve of the age distribution of depression in the population that mirrors the curve of general well-being (lowest at age 45). Finally, he provided evidence based advice to maintain good mental health, i.e. light physical activity and real-life social contacts.

"How to stay healthy in old age?"

Prof. Dr. med. Reto W. Kressig (Research focus: Neurology, geriatric Medicine)

Prof. Dr. Kressig explained the aging process of the human body and brain in his lecture. He also discussed specific measures to promote cognitive health in old age, focusing on mindfulness, web-based brain training, exercise, and muscle training. In addition, he emphasized the importance of nutrition and provided examples of studies showing the effect of leucine-enriched food on muscle mass.



CNB Newsletter

06 / 2023

Tuesday, 14th of March 2023

Moderation: Prof. Dr. Sebastian Walther

Sponsor of the day: FRAGILE BERN

On Tuesday we had two talks about national brain health plans.

"The European and Swiss brain health plans"

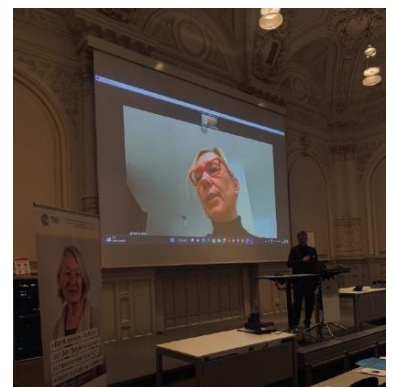
Prof. Dr. med. Claudio L. A. Bassetti, (Research focus: Neurology and decoding sleep)

In his speech, he introduced position paper of the World Health Organization (WHO) on brain health. Furthermore, Prof. Bassetti demonstrated the current status of such initiatives. Additionally, he explained the collaborations in social and health systems to maximize prevention, therapy, and rehabilitation. He addressed what affects our brain and the frequencies of brain diseases and their consequences. He emphasized that brain health strategies could become a revolution in aging societies. While the European brain health initiative is making first progress, the Swiss brain health initiative is about to get started.

"The German brain health plan's agenda 2030"

Prof. Dr. med. Ulrike Schara-Schmidt (Research focus: Neuropediatrics and neuromuscular diseases)

Prof. Dr. med. Schara-Schmidt explained the importance of a national brain plan to join forces for the implementation of preventive measures. She also reviewed brain health across the human lifespan with the example of five common brain diseases. During her presentation, she introduced the audience to the German brain plan's agenda 2022-2030. As one key step, informing the general public about brain health is among the first milestones.



Wednesday, 15th of March 2023

"Eternal Sunshine of the Spotless Mind"

The input lecture of Prof. Dr. Thomas König to the film "Eternal Sunshine of the Spotless Mind" at the Kino Rex introduced the audience to the mental health as a state of well-being that enables the person to cope well with their everyday life. He also gave the input and asked the audience, how we could deal with this and discussed the roles and limits of medicine. The movie presented this tension in a fascinating and humorous way, inspiring the audience to think about possible ways to handle our personal challenges in a healthy way.

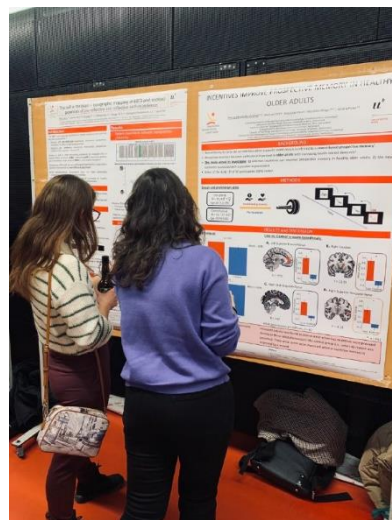
CNB Newsletter

06 / 2023



CNB Poster Session

On Wednesday, the poster session was held at UniS. The event was well-attended, and we had over 30 scientific projects presented by students and researchers of the GHS, GCB and institute of psychology. It was a great opportunity for students to exchange ideas and present their current research. There was also delicious food and some drinks, which made the event quite enjoyable for all attendees. A big Thank you to all poster presenters! We're looking forward seeing you next year! Mark your calendar for the next Poster Session: **Wednesday, 13th of March 2024.**



CNB Newsletter

06 / 2023

CLINICAL NEUROSCIENCE BERN

Thursday, 16th of March 2023

Panel discussion "Myths and Truths"

Moderation: Prof. Dr. Tobias Nef

Panel discussion: Prof. Dr. med. Mirjam Heldner, Prof. Dr. med. René M. Müri, Prof. Dr. med- Andreas Raabe, Prof. Dr. med. Roland Wiest, Prof. Dr. phil. Leila Maria Soravia

On Thursday, there were 223 people in the audience once again, who attended the panel discussion on the topic of Myths and Truths. Firstly, Prof. Dr. med. Mirjam Heldner discussed stroke and its compensation. Prof. Dr. med Müri talked about the creativity skills of left-handed and right-handed people. On the one side, there was a presentation on whether robots will replace neurosurgeons and on the other side whether drugs can cause holes in the brain. Lastly, Prof. Dr. phil. Leila Maria Soravia discussed mental illnesses and their treatment options. Afterwards, a lively discussion took place, with many options to ask questions and receive valuable answers by the experts.



The next Brain week Bern will take place from the **11th to the 14th of March 2024**. The program and further information will be published on the Brain week homepage: www.brainweekbern.ch. You also find the programs and impressions from past events on that site.

CNB Newsletter

06 / 2023

② A look into the lab – meet the CNB members

Micaela Borsa, PhD Student, TidisLab, Zentrum für Experimentelle Neurologie (ZEN,) Dept of Neurology, Inselspital/UniBE

Short Bio:

Originally from Bellinzona (Ticino, Switzerland), I obtained my Bachelor's degree at the University of Fribourg and Master's degree at the University of Bern, both in Biomedical Sciences. Currently, I am a PhD candidate in Neuroscience at the University of Bern in the lab of Prof. Antoine Adamantidis (TidisLab) at the Zentrum für Experimentelle Neurologie (ZEN,) Dept of Neurology, Inselspital/UniBE. My project focuses on the investigation of sleep-related circuitries from single cell to whole brain levels and their contribution to the modulation of sleep and cognition.

How did you get to do research?

As far as I remember I have always been intrigued by how the human body operates and how aberrations of these functions could lead to a diseased state. It was thus quite obvious what I wanted to do "when I grew up", however there were different possible ways to achieve it. In this line, I luckily discovered the field of study of Biomedical Sciences, which essentially prepare you to this immense world of research with a special focus on the human body.

While following this study path, I had to narrow my curiosity to a specific field of research for my PhD. Even if it may sound like an impossible task, I have to admit that choosing the "brain science" (i.e., neuroscience) was quite a straight forward decision based on pure personal interest which growth during the studies.

What is the topic of your research project?

My research project focuses on the retrosplenial cortex and its role in rapid eye movement (REM) sleep, as well as the potential cognitive outcomes associated with its sleep-related cellular activity. The retrosplenial cortex is known to be involved in various cognitive functions, including memory, spatial navigation, and the processing of contextual information. By examining the neural activity patterns and studying the interactions between the retrosplenial cortex and other brain regions during REM sleep, my goal is to understand the cognitive processes and functions that might be influenced by this cortical area. This research has the potential to enhance our understanding of the broader mechanisms underlying REM sleep and its implications for cognitive functioning and potentially help in the development of treatments for cognitive, sleep and sleep-related disturbances including dementia.

And how important is teamwork to get ahead?

As a PhD student you are challenged to put individual efforts on your project, but this does not exclude the teamwork completely. In general, exchange of ideas/points of view, sharing expertise and all kind of supports are the leading points for enjoying the research in its entire and overcome possible pitfalls that **one has to face in her/his project. Personally, all the lab members are of a big support in both practical, theoretical and also personal side of the daily routine.**



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CLINICAL NEUROSCIENCE BERN

CNB Newsletter

06 / 2023

What are you especially looking forward to?

I am particularly excited to see my project evolving and contribute, in my own small way, to the advancement of the field. In details, I look forward to finalize my PhD thesis and sharing my findings through a publication and conferences. Finally, I can't wait to discover what the future holds, but I strongly believe that neuroscience research will be part of it!

CNB Newsletter

06 / 2023

③ Selected Research Groups

Experimental Neurology Center (ZEN)

Dr. Carolina Gutierrez Herrera

Dr. Carolina Gutierrez Herrera is currently a Group Leader at the Zentrum für Experimentelle Neurologie (ZEN) within the Faculty of Medicine at the University of Bern in Switzerland. She developed her technical and scientific background training in the USA and Canada, and she is currently developing a promising translational career at the Neurology department of the the University of Bern. Her groundbreaking research in the field of sleep has led to significant advancements, particularly in understanding the neural circuits that regulate sleep and sleep stability.



The primary focus of Dr. Gutierrez Herrera's research is to elucidate the cellular and circuit mechanisms underlying sleep alterations that are commonly observed in various psychiatric disorders. Her work at the interface of sleep and psychiatry has received recognition within the discipline, as evidenced by her invitations to deliver lectures, organize symposiums, and present at international conferences. To support her research endeavors, she has employed innovative technological and computational approaches, overcoming crucial limitations and enabling her group to address pivotal questions relevant to psychiatry. Notably, she has utilized sleep as a window to manipulate local neuronal-astrocytic networks and study whole brain dynamics across different vigilance states and behaviors. Some of the key questions her research group explores include: 1) the neural circuits governing sleep stability, 2) their role in cognitive processing during sleep, and 3)

the potential of utilizing sleep to treat atypical brain dynamics associated with neurological and neuropsychiatric disorders.

Significant findings from Dr. Gutierrez Herrera's research group and collaborative efforts have identified vulnerable neuronal networks susceptible to oxidative stress as the underlying basis for sleep fragmentation and alterations in sleep homeostasis, particularly in relation to schizophrenia. Furthermore, they have developed pharmacological interventions to restore sleep alterations in this model. Additionally, her team is working on implementing non-invasive therapeutic strategies by manipulating slow wave oscillations during sleep to facilitate the recovery of cognitive dysfunctions in a mouse model of sleep fragmentation, which is relevant to thalamic stroke.

CNB Newsletter

06 / 2023

Mentoring students holds great importance for Dr. Gutierrez Herrera and is an integral part of her daily activities. Over the past eight years, she has trained numerous young investigators as a direct supervisor, co-supervisor in co-mentoring programs, through collaborations, and by hosting visiting students. Her leadership style aims to inspire her group members and young scientists by providing extensive scientific networks to support their technological, academic, and scientific ambitions. She places particular emphasis on the development of women in science and has actively participated in the COMET program at the University of Bern. This selective career program focuses on training, mentoring, and coaching young female scientists to enhance their success in academia. Furthermore, she actively contributes to the Equal Opportunity Board at the Inselspital, where she advocates for policy changes that promote the participation and retention of women in academic career tracks.

CNB Newsletter

06 / 2023

Cognitive Psychology, Perception, and Research Methods

Fred Mast, Institute of Psychology, University of Bern
www.kog.psy.unibe.ch

Perception is much more than what meets the senses, and it is the best field to investigate how the brain creates the world that appears to surround us. During the process of perception, we need to constantly infer the state of the world by relying on sensory information and prior beliefs. The sensory information is the only connection to the physical world we live in. Prior knowledge about the world is independent of the actual sensory input. Examples of prior beliefs are (explicit and implicit) expectations and knowledge about the physical properties of the world (naïve physics) or future events (e.g., knowing that event B is much more likely to happen with 90% than event A with 10%). We investigate the interplay between the processing of sensory information and cognitive processes in various ways, and we provide here a few examples from our most recent and ongoing research.

The influence of Sensory Loss and Deafferentiation on Cognition

When the usual intake of sensory information is absent or diminished, the brain will react to the altered input. Corina Schöne and several collaborators from Neuroradiology at the University Hospital were able to show morphometric changes in patients with peripheral vestibular loss (Schöne et al., 2022). Vestibular loss also entails cognitive problems. Ivan Moser in collaboration with Dominique Vibert (Insel-Spital, HNO) has designed experimental settings to show cognitive



problems in vestibular patients (Moser et al., 2017a,b), and Corina Schöne is currently analyzing data on the influence of vestibular loss on executive functions and mental body rotations, including fMRI in vestibular patients and aged matched controls. A previous study has provided interesting results in healthy subjects showing that the left inferior parietal lobe is a hot zone of cognitive and vestibular interaction (Klaus et al., 2020a). Ongoing collaborations with the HNO and neuroradiology departments made it possible to further investigate the connection between vestibular and cognitive processes in a 7 T scanner at Sitem-Insel (Wyssen et al., 2023). In the future, we will be exploring new research collaborations to investigate cognitive functions in paraplegic persons, to extend the research on deafferentiation to yet another domain.

Improvements via Perceptual Learning

Perceptual learning has been well demonstrated in the visual and auditory domain. In essence, it means that sensory thresholds change with increasing amount of training in specific tasks. After training, participants can reliably distinguish between two stimuli that were perceived as the same prior to training. We are exploring percep-

CNB Newsletter

06 / 2023

tual learning in the vestibular domain. Participants make a left-right discrimination task while they were exposed to near threshold leftward or rightward motion stimuli. In previous studies, we were able to demonstrate perceptual learning in young and healthy adults (Klaus et al., 2020b), and Matthias Ertl and Daniel Fitze are now testing a group of healthy older adults over 70 years. This group is particularly interesting because they are faced with an increased risk of falls. Falls in older adults often have quite dramatic consequences for the individual, leading to loss of autonomy, mobility and social contacts, and they will be an important factor in rising health costs.

Lowered thresholds after perceptual training imply a better detection of small body movements that potentially challenge postural stability, and this will help to counteract falls at the earliest possible level. Perceptual learning will not stop the decline of sensory receptors in the inner ear but it can help to compensate the loss by an improved ability to more efficiently analyze the remaining sensory input. Perception just as several other cognitive functions like memory and attention can improve as a function of training. Matthias Ertl and Daniel Fitze are currently comparing changes in perceptual thresholds with other measures of stance and balance, and Christa von Dach investigates the role of sleep and memory consolidation in perceptual learning.

Immersion in Virtual Reality (VR) and Changes in Perception

Immersive VR scenarios are an interesting tool to study neurocognitive mechanisms and exploit the mechanisms that underlie behavioral and perceptual plasticity. As a Co-PI of the Interfaculty Re-

search Cooperation “Decoding Sleep” with Claudio Bassetti (PI), I was involved in a project with Thomas König (Psychiatric University Hospital), in which we were creating a virtual reality (VR) scenario that resembles a dream-like bizarre experience. Simone Denzer developed this VR environment (Denzer et al, 2022), and she measured EEG in freely walking participants while they were exposed to a bizarre or non-bizarre virtual world. The results are quite intriguing in that EEG microstate analysis revealed similar alterations that were previously found in impaired reality-monitoring or psychopathological states. This means that we were able to create a world that behaved - to some extent - so as if the participants were in a dream. The scenario was convincing, and the violations of expected regularities of the true world affected participants’ experience (Denzer et al, in prep). Other research from my group suggests that VR can be used successfully in learning scenarios (Chiquet et al, 2023), and recently, Marius Rubo joined us as Ambizione Fellow, and he is using VR to investigate social anxiety. A conceptual overview of VR can be found in Weber, Weibel and Mast (2021).

Mental simulation as off-line Perception

The nature of mental images has been debatable issue over several decades. Neuroimaging provided interesting insights in that early visual and retinotopically organized areas are activated when people generate visual mental images. This activation is conveyed to visual areas via feedback projections from higher areas to early visual areas. While the results speak for a picture-like and spatial nature of mental images, the bigger question is how the ability to create mental images relates to visual perception. The assumption that mental imagery is the inside-out part of visual

CNB Newsletter

06 / 2023

perception, raises several questions. One of which is about eye-movements. There is firm empirical evidence that systematic eye movements accompany mental imagery, particularly the spatial correspondence has been shown in several studies from our group and other researchers. In addition to this, we began to look at the temporal characteristics of eye movements during imagery and perception. Interestingly, eye movements are specific to the imagined stimulus, but they differ in several parameters from the perceptual counterpart (Gurtner, Bischof & Mast, 2019; Gurtner, Hartmann & Mast, 2021). On the one hand, mental images share neuronal resources involved in perception, but, on the other hand, it is important not to confuse mental images with percepts (e.g., by making source attribution errors). We will continue to do this research with SNF funding starting in fall 2023. In addition to this, Lukas Huber with an independent SNF stipend for his doctoral dissertation will investigate the impact of mental imagery on object recognition, also by using computational modeling.

Cognitive psychology aims to better understand the human mind, and it requires sound behavioral experimentation, technical skills to investigate the underlying neuronal mechanisms, and profound knowledge about statistics and computational modeling. A case in point is Daniel Schlunegger's recent work on serial dependencies of decisions, and he found that humans tend to consider previous responses when making a later decision under uncertain conditions (Schlunegger & Mast, 2023). Cognitive Psychology and Psychophysics are promising approaches capable of making quantitative predictions about subjective events, and therefore help to better understand the nature of human beliefs, decisions, thoughts and judgments.

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CNB Newsletter

06 / 2023

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CNB Newsletter

06 / 2023

④ Upcoming events

8. September 2023	Annual Meeting “Modulating the brain”
11 th -14 th March 2024	Brain week Bern
13 th March 2024	CNB Poster Session with Apéro

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