TwinBrain Summer school 2.0

Neuroscience of Movement: Exploring Brain Dynamics in Parkinson's Disease and Related Disorders

TWINBRAIN

Key information:

When? 5 - 9 July 2022

Where? Piran, Slovenia / Online

Who? Students (Masters and PhD), and post docs from the field of kinesiology and movement science, physiotherapy, psychology, cognitive (neuro)science, biomedical engineering and related disciplines.

What? Summer school to bridge the disciplines for a comprehensive understanding of brain complexity in health and disease

Pre-requirements? Registration (free), motivation letter for on-site students (limited up to 20) [1]

Website: www.twinbrain.si

Registration form (deadline 25 May 2022): https://forms.gle/iFi3q9GBXi1DrT8g7

Summer school overview:

Is it time to start bridging the fields in a multidisciplinary fashion to create new approaches for comprehensive assessment of complex brain dynamics in everyday situations? Can this offer further insides into preventive and rehabilitative approaches? These questions and many more will be addressed in the TwinBrain summer school 2.0 with international speakers from Slovenia, Germany, Switzerland, Italy, France, Belgium, Czech Republic, Bosnia and Herzegovina, and USA.

In our daily lives, we do many things automatically. And although we often seem to react without the slightest mental effort, there are a multitude of complex processes going on in our brains. We do not

[1] The registration for on-site participation is limited to 20 participants (send motivational letter) and 100 for online participants

The current schedule is tentative, and the final schedule is subject to change.

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realize how difficult the task is until we (re)learn a particular cognitive-motor task, such as keeping our balance on skis or while surfing or even grasping a spoon after a stroke. On the other hand, we know of several neurodegenerative diseases that are progressive and prevent the smooth performance of everyday tasks. James Parkinson already recognized that progressive Parkinson's disease (PD) is associated with debilitating features of postural instability and gait difficulties (PIGD) such as falls and freezing of gait. PD initially causes physical symptoms. Later, problems with cognitive function, including forgetfulness and difficulty concentrating, may occur. As the disease worsens over time, many people develop dementia. In the current summer school, we will have an international team of experts covering the latest discoveries to the topics and offering an insight into how brain imaging technology might contribute to understanding brain function and disease development. Recent advancements in wireless and wearable technologies allow us to take a step further into real life. Therefore, the latest developments in the Mobile Brain/Body Imaging (MoBI) approach will be presented.

Students (mainly PhD students and post-docs) will have the unique opportunity to attend a 5-day summer school with five different but interconnected modules. Moreover, the networking opportunities and the informal part will certainly open new avenues for future research in the field of neuroscience of movement. The brain is indeed an amazing organ, the most complex according to itself (YourBrain et al., 2022).

Teaching Methods:

The TwinBrain Summer School will be a hybrid between on-site and online students. Teaching methods will include a mix of theoretical lectures, hands-on sessions, and discussions. There will be a topic moderator for each module and full IT support. Each module will conclude with a final quiz.

Learning Outcomes:

Upon successful completion of the summer school modules, participants will:

- Know insides how the brain controls movement
- Understand the interaction between cognition and motor control
- Have an overview of clinical assessments and new biomarkers of neurodegenerative diseases
- Have an overview of state-of-the-art methodologies to study the brain/body interactions
- Have an overview of the most effective countermeasures for fall prevention, injuries, and rehabilitation
- understand the importance of interdisciplinarities
- Be able to critically appraise, evaluate and discuss

Key literature:

Provided by each speaker prior to the summer school initiation

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Summer school program

Times according to CEST (Central European Summer Time)

Monday 4 July 2022

2:00 – 4:00 PM	Registration
4:00 – 5:30 PM	Ice-breaking activities: Saša Pišot (Slovenia)
6:30 – 8:00 PM	Welcome drink

Tuesday 5 July 2022 – Module 1: Mobile Brain/Body Imaging (MoBI) – linking human behavior with brain responses (Moderators: Claudia Voelcker-Rehage, Uroš Marušič & Klaus Gramann)

8:00 – 9:00 AM	*Registration (on-site students) and ZOOM log in (online students)*
9:00 – 9:15 AM	Welcome note & summer school opening: Uroš Marušič (Slovenia) & Klaus Gramann (Germany)
9:15 – 9:45 AM	Neuroscience of Movement: Exploring Brain Dynamics in Parkinson's Disease and Related Disorders: Uroš Marušič (Slovenia)
9:45 – 11:15 AM	Linking human behavior with brain responses using Mobile Brain/Body Imaging: Klaus Gramann (Germany)
	Hands-on: Demonstration of mobile EEG: Anna Wunderlich (Germany)
11:15 – 11:30 AM	*Coffee break*
11:30 – 12:30 PM	Variability in motor performance: Claudia Voelcker-Rehage (Germany)
12:30 – 2:00 PM	*Lunch break*
2:00 – 3:30 PM	Measuring neuronal correlates of walking using fNIRS: Robert Stojan (Germany)
6:30 – 8:00 PM	Keynote lecture: "A walk through a century of Alzheimer's disease diagnosis and treatment": Bruno Giordani (USA)

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Wednesday 6 July 2022 – Module 2: Biomarkers of cognitive decline and dementia (Moderator: Bruno Giordani)

8:45 – 9:00 AM	*Registration (on-site students) and ZOOM log in (online students)*
9:00 – 10:00 AM	Biomarkers of neurodegenerative diseases: Martin Rakuša (Slovenia)
10:00 – 11:15 AM	Cortical biomarkers for detecting cognitive decline and dementia: Voyko Kavcic (USA)
11:15 – 11:30 AM	*Coffee break*
11:30 – 12:30 PM	Comparing the brain of a healthy elderly person with mild cognitive impairment: A mathematical perspective: Rok Požar (Slovenia)
12:30 – 2:00 PM	*Lunch break*
2:00 – 3:30 PM	Development of scalable and non-invasive diagnostic tools for mild cognitive impairment and dementia: Jurij Dreo (Slovenia/Malta)
	Hands-on: Demonstration of mild cognitive impairment screening using EEG

Thursday 7 July 2022 – Module 3: Neuroplasticity after injury and neurorehabilitation: Bio- and neurofeedback technologies (Moderator: Bart Roelands)

8:45 – 9:00 AM	*Registration (on-site students) and ZOOM log in (online students)*
9:00 – 10:00 AM	Cortical adaptations after musculoskeletal injuries: Florian Giesche (Germany)
10:15 – 11:15 AM	Physical and Mental Fatigue: from the fundaments to the application: Bart Roelands (Belgium)
11:15 – 11:30 AM	*Coffee break*
11:30 – 12:30 PM	Application of biofeedback/neurofeedback technology: Duško Lepir (Bosnia and Herzegovina)
12:30 – 1:30 PM	*Lunch break*
1:30 – 3:00 PM	Hands-on: Application of biofeedback/neurofeedback technology: Duško Lepir (Bosnia and Herzegovina)

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Friday 8 July 2022 – Module 4: Multisensory integration and attention in aging and disease (Moderator: Jeannette Mahoney)

8:45 – 9:00 AM	*Registration (on-site students) and ZOOM log in (online students)*
9:00 – 10:30 AM	Attentional focus and motor learning - from theory to hands-on: Reza Abdollahipour (Czechia)
10:30 – 10:45 AM	*Coffee break*
10:45 – 12:15 PM	Virtual reality research – assessing speed of processing: Darko Katović (Croatia)
	Hands-on: Demonstration of VR assessment tool
12:15 – 1:45 PM	*Lunch break*
1:45 – 3:15 PM	Multisensory integration in healthy and pathological aging: Links to cognitive and motor functioning: Jeannette R Mahoney (USA)
	Hands-on: Demonstration of mobile-based clinical multisensory assessment tool

Saturday 9 July 2022 – Module 5: Exercise and the brain in health and disease (Moderator: Kevin De Pauw)

8:45 – 9:00 AM	*Registration (on-site students) and ZOOM log in (online students)*
9:00 – 10:30 AM	Analyzing motor performance data – different variability measures: Julian Rudisch (Germany)
10:30 – 10:45 AM	*Coffee break*
10:45 – 11:45 AM	Biosignal-based brain-controlled devices: applications in neurorobotics: Kevin De Pauw (Belgium)
11:45 – 12:30 PM	Implementation of neuroscientific research results into clinical practice: Paolo Manganotti (Italy)
12:30 – 2:00 PM	*Lunch break*
2:00 – 3:00 PM	Preparing to move - contribution of anticipatory brain activities in healthy and clinical populations: Valentina Bianco (Italy)
3:15 – 3:30 PM	Closing: Uroš Marušič (Slovenia), Klaus Gramann (Germany), Paolo Manganotti (Italy)

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Summer school speakers:

Bart Roelands (Belgium)

Kevin De Pauw (Belgium)

Duško Lepir (Bosnia and Herzegovina)

Darko Katović (Croatia)

Reza Abdollahipour (Czechia)

Florian Giesche (Germany)

Klaus Gramann (Germany)

Julian Rudisch (Germany)

Robert Stojan (Germany)

Claudia Voelcker-Rehage (Germany)

Valentina Bianco (Italy)

Paolo Manganotti (Italy)

Jurij Dreo (Malta)

Uroš Marušič (Slovenia)

Bruno Giordani (USA)

Voyko Kavcic (USA)

Jeannette R Mahoney (USA)

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