PROGRAMME DOCTORAL ROMAND EN PSYCHOLOGIE

DOCTORAL PROGRAM IN PSYCHOLOGY | WESTERN SWITZERLAND

LE PROGRAMME EST OUVERT AUX DOCTORANTS EN PSYCHOLOGIE ET OFFRE LA POSSIBILITÉ DE:

- Développer des savoir-faire méthodologiques
- Acquérir des compétences dans le domaine de la recherche qui soient transférables sur le marché du travail non-académique
- Favoriser le réseautage scientifique

THE PROGRAM WELCOMES ALL PHD STUDENTS IN PSYCHOLOGY AND GIVES THE OPPORTUNITY:

- To develop methodological skills
- To acquire research expertise that is transferable to the non-academic job market
- To favor scientific networking

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Theory meets data: Computational models of brain imaging and behavior

3rd - 5th November 2025, UNIL

Around 25hrs of education (1 ECTS)

Organisers and support

BEAM Lab (Dr. Paolo Ruggeri, Dr. Jérôme Barral)
PND Lab (Prof. David Pascucci, Dr. Maëlan Menétrey, Junlian Luo, Léa Zamora)
Translational Psychiatry Lab (Prof. Philipp Sterzer)

Invited speakers

Andria Pelentritou, Post-doctoral researcher, LREN, UNIL/CHUV; Athina Tzovara, Prof. Dr., UNIBE; Joao Barbosa, Group Leader, Institute for Neuromodulation and Neurospin, Paris; Sandra Iglesias, Head of Clinical Research Management, Translational Neuromodeling Unit, ETH Zurich; Charles Findling, Post-doctoral researcher, UNIGE, Group of Prof. Pouget.

General information

This course is designed for PhD students who use or plan to combine computational, behavioral and brain imaging methods, particularly EEG, to test models of brain function in both healthy and clinical populations. It aims to provide a foundation for integrating computational models with brain and behavioral analysis techniques. The first two days will focus on interactive sessions exploring computational and neurobehavioral approaches, followed by a third day featuring short talks on key topics presented by a panel of national and international experts.

Requirements for participation

The primary objective of this course is to promote the consolidation of knowledge related to computational modeling approaches and brain imaging (EEG) in the study of brain functions, both in healthy and clinical populations.

Students often face the challenge of testing predictions from computational theories while navigating the overwhelming variety of available brain imaging analysis techniques and features. The course aims to foster an integration of the two approaches, where theory meets data, through an interactive structure that is built from the ground up. The goal is to address the specific research needs of the participants.

By engaging with experts through the various activities offered, participants will gain a broad and integrative approach that is tailored to their own ongoing or future projects.

Considering the context, it is essential for prospective participants to be able to articulate research hypotheses based on theoretical and computational models and/or on data they currently have or the research projects they aim to establish. To ensure this prerequisite is met, we kindly request that individuals interested in enrolling complete the form by ***30/09/2025 :*** ***https://sphinx2.unil.ch/index.php/787126?lang=en***

The information provided will serve two purposes: first, to ensure that all participants come with their own research objectives, and second, to tailor the proposed activities on Monday, 3rd November, and Tuesday, 4th November, to meet these specific needs. This will allow us to align the course content with the individual goals and interests of each attendee.

Evaluation

Write a concluding report that addresses the original research question and hypotheses, integrating insights from the workshop.

Registration

https://psychologie.cuso.ch/les-cours/

Pedagogic design

MONDAY 03.11.2025 (morning)

This is our reason to be here

Participants engage in an open discussion about their individual research motivations and the collective goal of integrating computational models with neuroimaging data. This session sets the stage for the workshop by articulating the translational aims of the field.

MONDAY 03.11.2025 (afternoon)

This is how we learn—by mastering and explaining to peers

Participants are divided into two groups, each assigned to attend a lecture by an expert on one of the two core topics: Computational Models in Psychiatry or Neuroimaging Approaches. Each subgroup then synthesizes the material and prepares a presentation to explain their topic to the other group, fostering peer teaching and cross-topic understanding.

TUESDAY 04.11.2025 (morning)

We re-explain to consolidate what we have learnt

Each sub-group present the topic prepared to the other, in a reciprocal knowledge exchange under the supervision of the experts.

TUESDAY 04.11.2025 (afternoon)

Bring it all back home

Each participant creates a personal document explaining how the knowledge gained from the lectures and discussions can be applied to their own research questions, outlining both theoretical insights and practical steps.

EVALUATION

Programme

	Time	Agenda Item	Intervener
Monday 03.11.2025	Morning (Geopolis 2218)		
	8:30 - 9:10 AM	Introduction and Explanation of Course Objectives & Overview of Expertise	BEAM + PND + Sterzer's Lab
	9:10 - 12:20 PM	Open Discussion with Experts (with 30 minutes break)	PND + Sterzer's Lab
	12:20 - 12:30 PM	Summary and Next Steps	BEAM + PND + Sterzer's Lab
	Afternoon (Geopolis 2218 & 2230)		
	1:30 - 1:40 PM	Recap of Morning Session	BEAM + PND + Sterzer's Lab
	1:40 - 3:40 PM	Group Work with Experts (2 groups of 8 max)	PND + Sterzer's Lab
	3:40 - 4:00 PM	Break	-
	4:00 - 5:00 PM	Group Preparation for Tuesday Session	BEAM + PND + Sterzer's Lab
Tuesday 04.11.2025	Morning (Geopolis 2152)		
	8:30 - 8:40 AM	Recap of Previous Day's Afternoon Session	BEAM + PND + Sterzer's Lab
	8:40 - 9:40 AM	Group Work to Complete Previous Day's Tasks	BEAM + PND + Sterzer's Lab
	9:40 - 10:00 AM	Break	-
	10:00 - 12:00 AM	Group Presentations and Knowledge Consolidation	BEAM + PND + Sterzer's Lab
	Afternoon (Geopolis 2152)		
	1:00 - 5:00 PM	Initial Project Work Session	BEAM + PND + Sterzer's Lab
Wednesday 05.11.2025	Morning (Geopolis 2129)		
	9:00 - 10:00 AM	Investigating auditory functions in sleep and wakefulness with iEEG	Prof. Athina Tzovara
	10:00 - 11:00 AM	From synapses to EEG: a travel through the neural mechanisms of working memory	Dr. Joao Barbosa
	11:00 - 11:20 AM	Break	-
	11:20 - 12:20 PM	Brain-wide representations of prior information in mouse decision-making	Dr. Charles Findling
	Afternoon (Geopolis 2129)		
	2:00 - 3:00 PM	Computational modelling of learning across exteroceptive and interoceptive domains	Dr. Sandra Iglesias
	3:00 - 4:00 PM	Cardiac signals shape auditory stimulus processing in conscious and unconscious states	Dr. Andria Pelentritou
	4:00 - 4:30 PM	Wrap up and closing information	BEAM + PND + Sterzer's Lab

Abstract talks

Investigating auditory functions in sleep and wakefulness with iEEG

Prof. Athina Tzovara
Head of Cognitive Computational Neuroscience group (CCN) – UNIBE

Brain dynamics unfold over multiple timescales and are organized in anatomical and functional hierarchies. Spontaneous and evoked dynamics co-exist in the human brain, and are drastically re-organized when consciousness fades away, during sleep. The study of intrinsic and evoked brain dynamics has vastly profited from intracranial electroencephalography (iEEG) recordings in humans, which provide unique windows to the human brain with unprecedented spatio-temporal resolution. In this talk, I will present a series of studies where we use iEEG recordings in patients with epilepsy to investigate the organization of spontaneous neural activity in wakefulness and sleep, along a hierarchy of brain regions. I will then show work investigating how auditory responses are shaped by spontaneous dynamics in wakefulness and also how sleep oscillations modulate auditory processing along the medial and lateral temporal lobe.

From synapses to EEG: a travel through the neural mechanisms of working memory

Dr. João Barbosa
Group leader – Institute for Neuromodulation and Neurospin, Paris

I will review the evidence for two dominant hypotheses of working memory and how to use biophysical models to test them in neural data. If there's time, I will show how these models can be relevant in computational psychiatry.

Brain-wide representations of prior information in mouse decision-making

Dr. Charles Findling
Postdoc - Laboratory of cognitive computational neuroscience, UNIGE

The neural representations of prior information about the state of the world are poorly understood. To investigate them, we examined brain-wide Neuropixels recordings and widefield calcium imaging collected by the International Brain Laboratory. Mice were trained to indicate the location of a visual grating stimulus, which appeared on the left or right with prior probability alternating between 0.2 and 0.8 in blocks of variable length. We found that mice estimate this prior probability and thereby improve their decision accuracy. Furthermore, we report that this subjective prior is encoded in at least 20% to 30% of brain regions which, remarkably, span all levels of processing, from early sensory areas (LGd, VISp) to motor regions (MOs, MOp, GRN) and high-level cortical regions (ACAd, ORBvl). This widespread representation of the prior is consistent with a neural model of Bayesian inference involving loops between areas, as opposed to a model in which the prior is incorporated only in decision-making areas. This study offers the first brain-wide perspective on prior encoding at cellular resolution, underscoring the importance of using large scale recordings on a single standardized task

Computational modelling of learning across exteroceptive and interoceptive domains

Dr. Sandra Iglesias
Head of Clinical Research Management -TNU – ETH Zürich

Understanding how the brain learns from both external sensory inputs and internal bodily signals is central to current models of perception and to the development of computational assays for psychiatry. In this talk, I will present a series of fMRI studies that apply computational learning models to investigate learning across exteroceptive and interoceptive domains. Grounded in the Bayesian Brain theory, the studies explore how the brain integrates sensory evidence with prior expectations to update beliefs about the world and the body. Furthermore, I will discuss how computational learning models can be applied to neuroimaging data to link latent computational variables (e.g., prediction errors) with activity in brain regions of relevance for extero-/interoception. Finally, the talk will also illustrate the practical benefits of the Bayesian workflow, including improved statistical transparency and robust modelling of behavioural data.

Cardiac signals shape auditory stimulus processing in conscious and unconscious states

Dr. Andria Pelentritou
Postdoc – Laboratoire de techerche en neuroimagerie (LREN), UNIL/CHUV

As the human brain processes stimuli in its environment, it also receives continuous internally generated inputs from organs such as the heart. Herein, I will present a series of studies in which we acquired simultaneous electroencephalography and electrocardiography and investigated whether the brain utilizes heartbeat signals to facilitate auditory regularity encoding in a variety of altered consciousness states. In healthy volunteers during wakefulness and overnight sleep and in patients on the first day of coma after cardiac arrest, we administered three auditory sequences with different embedded regularities. In the synchronous sequence, sound onsets were temporally locked to the ongoing heartbeat; in the isochronous sequence, sound-to-sound intervals were fixed; and in the control sequence, there was no specific regularity. A baseline condition without auditory stimulation served as an additional control. I will present evidence of the neural and cardiac correlates of cardio-audio regularity encoding in the synchronous condition, absent in the control conditions. Our results suggest that humans utilize the temporal cue provided by the ongoing cardiac rhythm to help them identify patterns in their sensory environment across consciousness states, with both local and global changes in neural and peripheral signals. Our findings point to a novel computationally efficient mechanism by which the human brain utilizes continuously monitored cardiac signals to sample its environment.