

### Program ABC Summer School

**B**IN

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# in Consciousness and Perception



amsterdam brain & cognition







Human Brain Project



# **Getting started**

Our brains are constituted by billions of interconnected neurons which mediate complex cognitive processes such as perception, memory, decision-making and ultimately also consciousness.

The way in which these mental operations are implemented –or rather, emerge from –the electrical activity of the neural networks in our brain is regarded as one of the greatest mysteries of our time. To match such an intimidating task, modern neuroscientists employ the latest experimental techniques to study human and non-human brains in combination with cutting edge computational methods, from Al and advanced data analysis techniques

to detailed computational models of brain dynamics and cognitive functions. Current computational neuroscience techniques are being used to dissect the mechanisms used by our brains to, for example, perceive objects through a combination of senses, navigate through our environment, make decisions in context-dependent situations, and experience the world through the glass of our self-aware perspective.

## Program

MON. <b>20</b> JUNE	09:00 - 09:30	<b>Cyriel Pennartz</b> Introduction to the Summer School Room: REC M1.03
	09:30 - 12:00	Matthew Larkum Room: REC M1.03
	12:00 - 13:00	Lunch break
	13:00 - 17:00	Workshop session #1 Rooms: REC C3.07, REC CK.08, REC C2.07, REC JKB.05, REC C3.04, REC E0.08, REC C2.04, REC CK.06.
TUES. <b>21</b>	09:30 - 12:00	<b>Jorge Mejias</b> Large-scale brain models for perception and memory
		Room: REC M1.03
	12:00 - 13:00	Room: REC M1.03 Lunch break
	12:00 - 13:00 13:00 - 16:00	Room: REC M1.03  Lunch break  EBRAINS Demo/Workshop Brain Simulation Platform Room: REC M1.01.

ED. <b>2</b>	09:30-12:00	<b>Lucia Melloni</b> Room: REC A1.03
NE	12:00-13:00	Lunch break
	13:00-16:00	<b>Demo/Workshop: The Virtual Brain</b> Room: REC A1.03
	16:00-17:00	Workshop session #3 Rooms: REC C3.07, REC CK.08, REC C2.07, REC JKB.05, REC GS.07, REC GS.04, REC JKI.26, REC CI.07
JR. <b>3</b>	09:30 - 12:00	<b>Christopher Summerfield</b> Neural networks as theories of biological representation learning Room: REC M1.03
	12:00 - 13:00	Lunch break

00	Workshop session #4					
	Rooms: REC JKB.05, REC CK.08, REC GS.07,					
	REC GS.04, REC C3.04, REC C2.07, REC C3.07,					
	REC CK.06. REC CK.06, REC CK.04, REC GS.07,					
	REC GS.04					

### FRI. **24** JUNE

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#### Predictive coding models and their relevance for cognition and consciousness Room: REC M1.01

09:30 - 10:30 Cyriel Pennartz

11:00-12:00

13:00 - 17:0

#### Sander Bohte

Learning in spiking neural networks Room: REC M1.01

			WED.	09:30 - 12:00	Walter Senn
	12:00-13:00	Lunch break	29		Creative dreams and navigating through error
	13.00-17.00	Workshop session #5	.111NE		landscapes
	13:00-17:00	Poome DEC C307 DEC CK08 DEC C 207	OONE		Room: REC MI.03
		REC C3.04		12:00 - 13:00	Lunch break
				13:00 - 17:00	Workshop session #8
					(incl. delivering final poster to printshop)
					Rooms: REC C3.07, REC CK.08, REC C2.07,
MON.	09:30 – 12:00	Algin Destexhe			REC JKB.05, REC GS.07, REC GS.04, REC JK1.26,
27		Room: REC AL02			
JUNE	12:00 - 13:00	Lunch break			
			THUR.	09:30 - 12:00	Iris Groen
	13:00 - 17:00	Workshop session #6	20		Inhibition and plasticity of sensory representation
		Rooms: REC C3.07, REC CK.08, REC C2.07,	30		Room: REC M1.01
		REC JKB.05, REC C3.04, REC E0.08,	JUNE		
		REC C2.04, REC CK.06.		12:00 - 13:00	Lunch break
				13:00 - 17:00	Workshop session #7
					(incl. preparing oral presentations of posters)
TUE.	09:30 - 12:00	David Cox			Rooms: REC B2.01, REC B2.10, REC B2.11,
28		Room: REC M1.03			REC A2.04, REC A2.05, REC C3.04, REC C3.07,
					REC C2.04.
JUNE	12:00 - 13:00	Lunch break		17:00 - 19:00	Dinner break
	13:00 - 17:00	Workshop session #7			
		Rooms: REC JKB.05, REC CK.08,		19:00 - 20:00	Wolf Singer
		REC CK.04, REC C2.07, REC C3.07,			Frijda Lecture
		REC CK.06, REC GS.07, REC GS.04			Location: De Balie, Kleine Gartmanplantsoen 10,
					1017 RR Amsterdam.

# **ABC Symposium**

How does consciousness arise in our brains? Understanding the mechanisms which allow for the chatting between millions of neurons to give rise to our conscious perception of the world is a daunting scientific task.

A panel of internationally renowned experts will speak on this topic and discuss fundamental questions in the field together with Honorary Frijda Chair Wolf Singer. Topics will include: What are the fundamental ingredients and brain mechanisms of conscious perception? How do we measure consciousness in people who are awake, sleeping, or even in coma? And could machines, or artificial neural networks, develop some form of consciousness?

The ABC Symposium is a part of the 2022 ABC Summer School which is a 12-day full-time program, for selected

students. The students will be given the opportunity to dive into topics given from the hand of world-renowned experts from the fields of neuroscience. psychology and Al. Lectures from local, national and international experts. The programme will be complemented by hands-on workshops and tutorials. where students will learn to apply some of the contents covered in the lectures aided by experienced tutors. The ABC Symposium is a wrap up on 'Computations in Consciousness and Perception' with distinguished lecturers and the participation of students, lecturers and tutors.

FRI. Wolf Singer, Jorge Mejias 09:30 - 09:45 01 Introduction to the symposium JULI Athena Demertzi 09:45 - 10:25 **Coffee break** 10:25 - 10:50 **Claire Sergent** 10:50 - 11:30 Lunch break & poster session 11:30 - 13:15 Marcello Massimini 13:15 - 13:55 **Cyriel Pennartz** 13:55 - 14:35 **Coffee break** 14:35 - 15:00 Dr. Simon van Gaal 15:00 - 15:40 **Gustavo Deco** 15:40 - 16:20 Coffee break 16:20 - 16:45 Wolf Singer & Jorge Mejias 16:45 - 17:30

17:30 – 17:45 Announcement of poster awards

Location: De Balie, Kleine-Gartmanplantsoen 10, 1017 RR Amsterdam



### Alain Destexhe

University of Amsterdam, the Netherlands

Alain Destexhe is Director of Research at CNRS, Adjunct Director of NeuroSpin and Director of the European Institute for Theoretical Neurosciences in Paris, France. His research activity in computational neuroscience is at the interface between physics (dynamic systems) and neuroscience (electrophysiology). Current research projects include the study of stochastic activity of the cerebral cortex, the study of collective dynamics of neural networks and field potentials, and the design of methods at the interface with electrophysiology.

### **Christopher Summerfield**

University of Oxford, United Kingdom

Christopher Summerfield is Professor of Cognitive Neuroscience at the University of Oxford, UK. His work is concerned with understanding how humans learn and make decisions, by studying learning in adults using computer-based tasks. He is interested in how humans acquire new concepts or patterns in data, and how they use this information to make decisions in novel settings. For this, his team uses a combination of computational models, including deep neural networks, and noninvasive brain recording methods such as fMRI and EEG.



### Athena Demertzi University of Liege, Belgium

Athena Demertzi is a tenured researcher (FNRS Research Associate) at the University of Liege in Belgium. She directs the Physiology of Cognition Lab, where her team conducts research in cognitive and clinical neuroscience, including the study of brainbody interactions as a proxy to human sentience in health and disease by means of high- and lowtech methodologies. She performs behavioral and neuroimaging studies in physiological, and pathological conditions, uses artificial intelligence to determine neuromarkers of conscious states, and contributes to individualized patient care.





### Claire Sergent University of Paris, France

Claire Sergent is Team Leader at NeuroSpin and Professor at the Center of Integrative Neuroscience and Cognition of the University of Paris, France. Her central topic of research is the understanding of the psychological and neural mechanisms of conscious access, notably in vision and audition, in healthy human adults and in patients with disorders of consciousness. She uses experimental psychology, human electrophysiology and functional MRI as her main investigation tools.



#### **Cyriel Pennartz** University of Amsterdam, the Netherlands.

Cyriel Pennartz is Professor of Cognitive and Systems Neuroscience at the Swammerdam Institute for Life Sciences and the University of Amsterdam, the Netherlands. His research is focused on memory, motivation, circadian rhythms, perception and consciousness. His group uses a multidisciplinary combination of techniques to understand the relationships between distributed neural activity and cognition, including in vivo electrophysiology and optical imaging, animal behavior and computational modelling.

#### Gustavo Deco Pompeu Fabra University, Spain

Gustavo Deco is an ICREA Research Professor at the Pompeu Fabra University in Barcelona, Spain. He directs the Center for Brain and Cognition and the Computational Neuroscience Group. His research includes the study of the dynamics of neural circuits by means of theoretical and computational models, and in particular the analysis and modeling of wholebrain dynamics during resting-state activity.



#### **David Cox** Harvard University, United States of America

David Cox is the John L. Loeb Associate Professor of the Natural Sciences and of Engineering and Applied Sciences at Harvard University in the US. His lab seeks to understand the computational underpinnings of object recognition through a concerted effort on the study of biological visual perception and artificial models of vision. He is also passionate about the development of novel neurotechnologies to improve vision and brain research.





#### Iris Groen University of Amsterdam, the Netherlands.

Iris Groen is a MacGillavry Fellow and Assistant Professor at the Institute for Informatics of the University of Amsterdam, the Netherlands. She performs interdisciplinary research at the interface of computer vision and cognitive neuroscience, aimed at understanding naturalistic perception in the human brain. To this end she uses computational models of vision to predict human perception and brain activity measured with human brain imaging techniques such as fMRI, EEG and ECoG.



#### Jorge Mejias University of Amsterdam, the Netherlands.

Jorge Mejias is Assistant Professor of computational neuroscience at the University of Amsterdam in the Netherlands. He also serves as external faculty at the Carlos I Institute of Theoretical Physics in Spain and the European Institute for Theoretical Neuroscience in Paris, France.His team at Amsterdam conducts theoretical and computational research on the mechanistical principles of perception and memory, with a particular focus on modeling brain networks as a multiscale systems.

### Marcello Massimini University of Milan, Italy

Marcello Massimini is Professor of the Department of Biomedical and Clinical Sciences at the University of Milan in Italy. The research of his team is devoted to understanding changes in thalamocortical networks when consciousness fades and recovers, such as when we sleep and reawaken. To this aim, he has carried out research ranging from intracellular recordings of cortical neurons in vivo to the recording and analysis of high-density EEG, and including the development of novel techiques (TMS/hd-EEG), leading to fundamental insights on the role of brain lesions in brain communication.



## Lucia Melloni

#### Max Planck Institute, Germany

Lucia Melloni is Professor and Group Leader at the Max Planck Institute for Empirical Aesthetics at Frankfurt am Main, Germany. Her lab is broadly interested in understanding the neural underpinnings of how we see (perception), how and why we experience what we see (consciousness) and how those experiences get imprinted in our brain (learning and memory) – as well as the interplay between these processes. She uses multiple methods to get at those questions, ranging from electrophysiological and neuroimaging methods over behavioral techniques to online surveys.





#### Matthew Larkum Humboldt University of Berlin, Germany

Matthew Larkum is Professor of Neuroscience at the Humboldt University in Berlin, Germany. He also heads a neuroscience laboratory as part of the NeuroCure Cluster of Excellence on the Charité University campus in Berlin. His work focuses on the processing of feedforward and feedback information in the cortex, and particularly, on the contribution of active dendritic properties to the computational power of neocortical pyramidal neurons. His current focus is on examining the hypothesis that both the cellular properties and architecture of the cortex are tightly coupled, suggesting a powerful operating principle of cortex.



### Sander Bohte

Center for Mathematics and Informatics, the Netherlands

Sander Bohte is Senior Researcher at the Machine Learning Group of the Center for Mathematics and Informatics, and Professor at the Swammerdam Institute for Life Sciences of the University of Amsterdam and at the Faculty of Science and Engineering of the University of Groningen, the Netherlands. Prof. Bohte's team is interested in the study of bio-inspired neural network models with a particular focus on the temporal dimension of neural computations, including learning in networks of spiking neurons, cognitive functions such as decision making, and deep reinforcement learning methods.

#### Walter Senn University of Bern, Switzerland

Walter Senn is Professor for Computational Neuroscience at the Department of Physiology, University of Bern. He studied Mathematics, Physics and Russian at the University of Bern, with a Master in Mathematics and a PhD with specialty in differential geometry and calculus of variation (1993). During his PhD he further studied dynamical systems at Lomonossov University in Moscow, and he got a degree as a high school teacher from University of Zurich.

Before joining the Department of Physiology (1999), he was at the Department of Computer Science and Applied Mathematics at University of Bern. During his postdoc time he was at the Hebrew University, Jerusalem (Prof. I. Segev), and the Center for Neural Sciences, New York University (Prof. J. Rinzel). Using mathematical models of synapses, neurons and networks, he investigates how cognitive phenomena such as perception, learning and memory can emerge from neuronal structure.



#### Simon van Gaal University of Amsterdam, the Netherlands

Simon van Gaal is an Associate Professor at the Brain and Cognition Department and head of the Conscious Brain Lab at the University of Amsterdam, the Netherlands. His lab studies the neural correlates of consciousness and the role of consciousness in cognitive control and decision-making using various neuroimaging techniques (e.g., EEG, functional and structural MRI, MEG). His goal is to eventually contribute to a better understanding of the neural mechanisms and potential function of consciousness.





#### Wolf Singer Max Planck Institute, Germany

Wolf Singer is Emeritus Professor of Neuroscience at the Max Planck Institute for Brain Research and the Ernst-Strungmann Institute for Neuroscience in Frankfurt am Main, Germany. His research aim is to elucidate the neuronal processes of higher cognitive performance, such as in the case of visual perception, in memory, or in other ways of cognition. Prof. Singer is internationally known for his research and reflections on the physiological basis of attention and identification procedures, and is widely recognized and a leader in the field of cognitive neuroscience.

#### Organised by

The Institute for Interdisciplinary Studies The Amsterdam Brain and Cognition Center The University of Amsterdam

#### Coordinated by

Jorge Mejias, Cyriel Pennartz

#### **Contact** Email: summerschool-iis@uva.nl

For more information check out our website: www.abcsymposium.nl

