THE CAJAL ADVANCED NEUROSCIENCE TRAINING PROGRAMME

Course Programme 2019

- Lectures by renowned scientists with methodological training sessions
- Interactive and engaging atmosphere
- Experiments within the frame of short scientific projects
- Two top European facilities in neuroscience

www.cajal-training.org
Course director:
• Martin Lauritzen (University of Copenhagen, Denmark)

Co-directors:
• Edith Hamel (Montreal Neurological Institute and Hospital, Canada)
• Jérôme Badaut (University of Bordeaux, France)

Venue:
Bordeaux Neurocampus, France

The Neurovascular unit (NVU) is a physiological entity that consists of fine-tuned interactions between cerebral blood vessels, pericytes, astrocytes, immune cells and neurons in order to maintain brain homeostasis. The NVU contributes to brain vessel properties such as blood-brain barrier (BBB) and cerebral blood flow regulation. Several brain disorders are associated with NVU dysfunction. There have been several recent advances in knowledge and in the technologies available to study the NVU. This advanced course will allow students to gain basic knowledge and hands-on experience with various techniques, such as in vivo/ex vivo high-resolution imaging, magnetic resonance imaging, brain vascular pathology rodent models and in vitro BBB models.
Biosensors and Actuators for Cellular and Systems Neuroscience
‘Integrating optogenetics, chemogenetics and optical readouts’
23 June - 13 July 2019

Course director:
• Ofer Yizhar (Weizmann Institute of Science, Israel)

Co-directors:
• Michael Lin (Stanford University, USA)
• Sandrine Pouvreau (University of Bordeaux, France)

Venue:
Bordeaux Neurocampus, France

Optical techniques have become indispensable for biological research in recent decades. Systems neuroscience has seen some of the most exciting developments in this regard, following the development of genetically-encoded biosensors and actuators that allow multi-modal interrogation of neural circuit function. This course will provide participants with an in-depth understanding of the principles behind the design and application of these tools, and enable hands-on experience with optogenetic and chemogenetic actuators and with genetically encoded reporters of calcium, voltage and metabolism. Experimental work will span a wide range of systems and experimental preparations, utilizing standard microscopy methods as well as advanced hardware for parallel excitation and imaging of neuronal circuits.
Course directors:
• Michael Hausser (University College London, UK)
• Menno P. Witter (Norwegian University of Science and Technology, Norway)

Co-director:
• Leopoldo Petreanu (Champalimaud Research, Portugal)

Venue:
Champalimaud Centre for the Unknown, Portugal

Understanding how activity in neural circuits drives behaviour is a fundamental problem in neuroscience. Making this link requires detailed information about the cell types and their connectivity, as well as the spatiotemporal patterns of activity in neural circuits in the intact brain during behaviour. This course will highlight the new anatomical, optical, genetic, electrophysiological, and pharmacogenetic approaches that are available for addressing these challenges. The faculty will discuss tool development through to their implementation in diverse model systems. Students will learn the potential and limitations of these techniques, allowing them to both design and interpret experiments correctly.
Course directors:
• Brent Doiron (University of Pittsburgh, USA)
• Maria Geffen (University of Pennsylvania, USA)
• Jakob Macke (Technical University of Munich, Germany)
• Joe Paton (Champalimaud Research, Portugal)


Venue:
Champalimaud Centre for the Unknown, Portugal

Computational Neuroscience is a rapidly evolving field whose methods and techniques are critical for understanding and modelling the brain, and also for designing and interpreting experiments. Mathematical modeling is an essential tool to cut through the vast complexity of neurobiological systems and their many interacting elements. The course teaches the central ideas, methods, and practices of modern computational neuroscience through a combination of lectures and hands-on project work. This course is designed for graduate students and postdoctoral fellows from a variety of disciplines, including neuroscience, physics, electrical engineering, computer science, mathematics and psychology.

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This is an intensive three-week course that will carry participants through the theory and practice of advanced methods for investigating brain structure-function relationships at the organ level. The course will balance lectures from world-acknowledged neuroimaging experts to experimental demonstrations and hands-on laboratory work in small groups. Participants will be introduced to a wide spectrum of techniques, from microscopic post-mortem brain cyto- and myelo-architectony to macroscopic in vivo 3D-imaging using magnetic resonance, functional ultrasound, near-infrared spectroscopy, electromagnetic waves, and gamma-ray emission tomography. Issues associated with whole brain neuroimaging multimodality and data-sharing will also be addressed. During the course, each participant will be given the opportunity to acquire and analyse whole-brain neuroimaging data in both preclinical and clinical environments.
Synaptic contacts are critical for information transfer in the brain. They are specialized sites, often far from the neuronal cell body, and operate in part as independent units. Synaptic dysfunction is strongly associated with diseases of the brain and this is thought to be an early feature of neurodegenerative diseases such as Parkinson’s and Alzheimer’s disease. The study of the molecular mechanisms of synaptic function and plasticity are the key to understanding how the brain works and what goes wrong in disease. Many of these processes are evolutionarily very well conserved and researchers study synaptic processes in a variety of species and in human neuron models. The advanced course will allow students to integrate the basic techniques in molecular and cellular neurobiology with advanced state-of-the art molecular, imaging and functional methodologies, through direct hands-on experiments using a variety of models.
What they say about the CAJAL Programme

““The Cajal programme provides exceptional training in superb scientific environments under the guidance of internationally renowned experts. FENS is dedicated to supporting this pan-European initiative to secure the future excellence of neuroscience research.”

Carmen Sandi, FENS President and Chair of the CAJAL Steering Committee 2019

“IBRO is dedicated to advancing neuroscience through the teaching, training and mentoring of young scientists in centres of research excellence. The CAJAL programme is our regional commitment to building European brain research and elevating its visibility and impact.”

Keiji Tanaka, IBRO Secretary-General

“When I was asked to become a CAJAL course director, I accepted without any hesitation because I knew from my own experience that this kind of intensive courses really help students in many ways; and the experience really exceeded my expectations.”

Eloisa Herrera, Developmental Neurobiology and Pathologies 2018 course director

“In only three weeks, I explored new topics, developed a deeper understanding of the field, and learned new techniques and analysis approaches. Whether you are a first-year PhD student or an experienced post-doc, I can definitely recommend the CAJAL courses as an incredible opportunity for scientific growth and for establishing an international network of highly specialised researchers.”

Cristiana Vagnoni, Interacting with Neural Circuits 2017 course participant

For more information contact: cajal@fens.org

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The CAJAL Advanced Neuroscience Training Programme represents commitment by the five partner institutions FENS, IBRO, the Gatsby Charitable Foundation, University of Bordeaux and the Champalimaud Foundation to establish a dedicated neuroscience training facility in Europe.