9TH BORDEAUX NEUROCAMPUS CONFERENCE

September 26th - 28th, 2023
Bordeaux, France

NeuroCompare

Comparative Neuronal Circuits for Adaptive Behavior

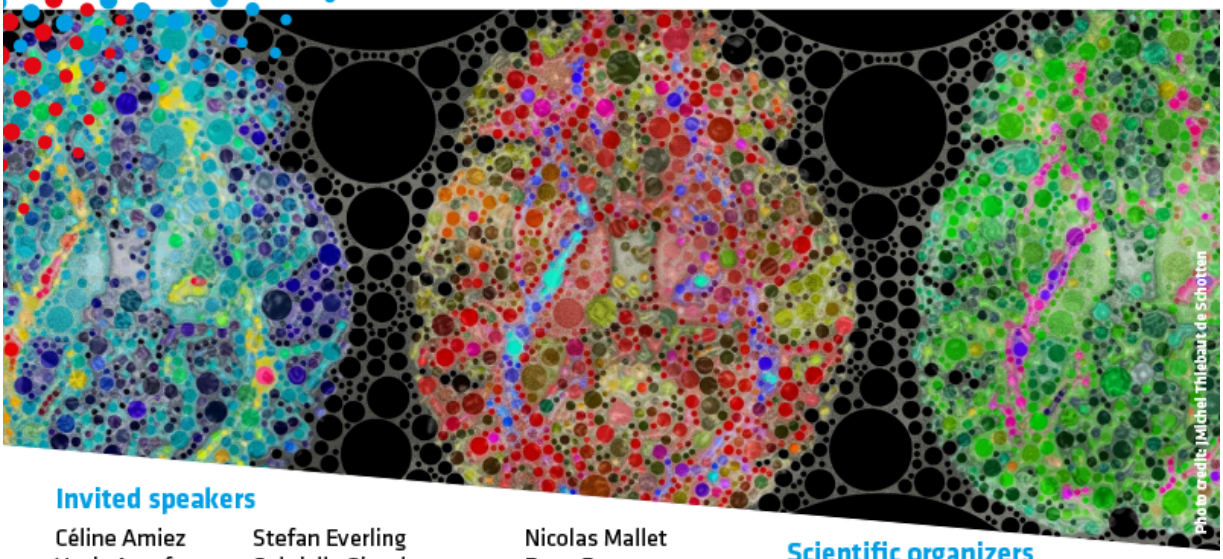


Photo credit: Michel Thiebaut de Schotten

Invited speakers

Céline Amiez
Yaniv Assaf
Helen Barbas
Emiliano Bruner
Yoram Burak
Marie Carlen
Long Ding
Julie Duqué
Stefan Everling
Gabrielle Girardeau
Karine Guillem
Suzanne Haber
Michael Halassa
Genevra Hart
Federica Lareno Faccini
Clément Léna
Nicolas Mallet
Rony Paz
Seongmin Park
Mathias Pessiglione
Naoya Takahashi
Nachum Ulanovsky
Mark Walton

Scientific organizers

Anna Beyeler (Neurocentre Magendie)
Etienne Coutureau (INCIA)
Frédéric Gambino (IINS)
Arthur Leblois (IMN)
Michel Thiebaut de Schotten (IMN)

brainconf.u-bordeaux.fr

Abstract book

Contents

About the conference

Current research highlights the role of cortical networks in supporting higher order cognitive functions such as decision making or working memory, and their functioning is systematically impaired in various psychiatric conditions including schizophrenia, depression and drug addiction.
This global research effort has demonstrated a large degree of functional parcellation within and between cortical networks, which shows high homology from primate (including human) to rodent brains. The "Comparative Neuronal Circuits for adaptive behaviour" conference will gather worldwide experts in Bordeaux Neurocampus to develop ideas and applications beyond the state of the art of current research on cortical circuits by including rodents, bat, monkeys and humans in our conceptual framework. We will discuss two complementary dimensions: (1) the anatomy and connectivity of cortical circuits, and (2) the function of those circuits in adaptive behaviour.

Scientific Organizers

Anna Beyeler (Neurocentre Magendie)

Etienne Coutureau (INCIA)

Frédéric Gambino (IINS)

Arthur Leblois (IMN)

Michel Thiebaut de Schotten (IMN)

About Bordeaux Neurocampus international conferences

The Bordeaux Neurocampus Conferences are a series of 3-day neuroscience meetings that take place every year in autumn at the university of Bordeaux, France, since 2014.
The purpose of the conferences is to present and discuss recent findings in a topic field in Neuroscience, bringing together leading international experts and young researchers.

Supports

This project has received financial support from the French government
within the framework of the France 2030 programme IdEx université de Bordeaux

Meet them during the meeting

Institutional partners

Programme

Tuesday 26th September

From 8:15 Registration + Welcoming coffee
8:45 Welcoming speech

Plenary lecture

Chair:
Anna Beyeler

9:00 - 10:00 **Marie Carlén**
Functional maps for the mouse prefrontal cortex

10:00 - 10:30 Coffee break

Session 1: Cortico-Thalamic circuits for adaptive behaviour

Chair:
Frédéric Gambino

10:30 - 11:00 **Helen Barbas**
Circuits for content, context, and affect synthesis through thalamus

11:00 - 11:30 **Michael Halassa**
Thalamocortical interactions in cognitive control and flexibility

11:30 - 12:00 **Naoya Takahashi**
Thalamocortical pathway for goal-directed action initiation

12:00 - 12:30 **Clément Léna**
Revisiting the roles of the cerebellum: lessons from motor and emotional systems

12:30 - 12:35 **Industrial talk: Femtonics**

12:35 - 14:00 Lunch time, industrial booths and posters (from 1pm)

Session 2: Cortical circuits for adaptive behaviour

Chair:
Shauna Parkes

14:00 - 14:30 **Céline Amiez**
Sulcal variability identifies differential evolution of frontal cortical regions in primates

14:30 - 15:00 **Karine Guillem**
Aberrant neuronal and gamma activities in the ventromedial prefrontal cortex in nicotine withdrawal-induced attentional deficits

15:00 - 15:30 **Stefan Everling**
Vocalization-related activity in the anterior cingulate cortex

15:30 - 16:00 **Julie Duqué**
Corticospinal correlates of processes underlying Action preparation

16:00 -16:30 Coffee break

Plenary lecture

Chair:
Michel Thiebaut de Schotten

16:30 - 17:30 **Yaniv Assaf**
Evolution of the connectome across the animal kingdom

18:00 Wine and cheese, industrial booths and posters

Wednesday 27th September

From 8:30 Welcoming coffee

Session 3: Cortico-Limbic circuits for adaptive behaviour

Chair:
Arthur Leblois

09:00 - 09:30 **Mark Walton**
Adaptive behaviour, state inference and mesolimbic dopamine

09:30 - 10:00 **Anna Beyeler**
Neural coding of anxiety and emotional valence in circuits of the insular cortex

10:00 - 10:30 **Rony Paz**
Neural representations of valence in the primate brain

10 :30 - 11:00 **Gabrielle Girardeau**
Neural mechanisms for memory and emotional processing during sleep

11:00 - 11:30 Coffee break

Plenary lecture

Chair:
Etienne Coutureau

11:30 - 12:30 **Emiliano Bruner**
Prehistory and neuroscience

12:30 - 14:00 Lunch break, industrial booths and posters (from 1pm)

Session 4: Cortico-Basal Ganglia circuits for adaptive behaviour

Chair:
Catherine Le Moine

14:00 – 14:30 **Long Ding**
Basal ganglia contributions to perceptual decision making in monkeys

14:30 – 15:00 **Genevra Hart**
Dorsomedial striatal dopamine release signals the goal-directed action-outcome relationship

15:00 – 15:30 **Nicolas Mallet**
Pallidostriatal projections from Arkypallidal neurons in basal ganglia circuits: 'Unraveling a novel feedback loop in the loop'

15:30 – 16:00 **Mathias Pessiglione**
A functional partition of the medial prefrontal cortex for the guidance of adaptive behavior

16:00 - 16:30 Coffee break

From 19:45 **Gala dinner** at Luchey-Halde

Thursday 28th September

From 8:30 Welcoming coffee

Session 5: Cortico-Hippocampal circuits for adaptive behaviour

Chair:
Lisa Roux

9:00 - 9:30 **Federica Lareno Faccini**
Hippocampo-cortical dynamics underlying memory f*ormation and consolidation*

9:30 - 10:00 **Seongmin Park**
Structural abstraction and behavioral flexibility

10:00 - 10:30 **Nachum Ulanovsky**
Neural codes for natural behaviors in flying bats

10:30 - 11:00 **Yoram Burak**
Coordination between attractor networks in the hippocampus and the entorhinal cortex

11:00 – 11:30 Coffee break

Session6: Advanced trends in comparative anatomy of cortical circuits

Chair:
Emmanuel Procyk

11:30 - 12:00 **Michel Thiebaut de Schotten**
Non-human primate neuroimaging: the next frontier

12:00 - 12:30 **Suzanne Haber**
Circuits underlying behavioral flexibility, psychiatric disease and neuromodulation: From primate anatomy to human neuroimaging

12:30 – 13:00 Final discussion (Round table)

From 13:00 Lunch (lunch boxes)

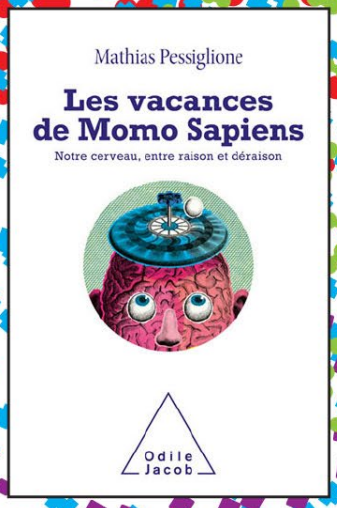
Conference

for a wide audience **(in french)**

NOTRE CERVEAU, ENTRE RAISON ET DÉRAISON

RENCONTRE AVEC

Mathias Pessiglione
Directeur de recherche, Inserm
Institut du cerveau, Paris
Auteur de
Les Vacances de Momo Sapiens
(Editions Odile Jacob)



animée par
Michel Thiebault de Schotten
Directeur de recherche, CNRS
Institut des Maladies Neurodégénératives,
Université de Bordeaux

LUNDI 25 SEPTEMBRE 2023
18:00
Station Ausone / Librairie Mollat
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33000 Bordeaux

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BORDEAUX neurocampus / université de BORDEAUX

Speakers

Click on the name to get to the details!

Céline Amiez (SBRI, Bron / CNRS, France)
Yaniv Assaf (Tel Aviv University, Israel)
Helen Barbas (Boston University, USA)
Anna Beyeler (Bordeaux Neurocampus / Inserm, France)
Emiliano Bruner (CNIEH, Burgos and CIEN, Madrid, Spain)
Yoram Burak (Hebrew University of Jerusalem, Israel)
Marie Carlen (Karolinska Institutet, Sweden)
Long Ding (University of Pennsylvania, USA)
Julie Duqué (UCL, Belgium)
Stefan Everling (Western University, Canada)
Gabrielle Girardeau (Institut du Fer à Moulin, Sorbonne Université / Inserm, France)
Karine Guillem (Bordeaux Neurocampus / CNRS, France)
Suzanne Haber (University of Rochester and Harvard University, USA)
Michael Halassa (MIT, USA)
Genevra Hart (UNSW, Australia)
Federica Lareno Faccini (CIRB, Collège de France / CNRS, France)
Clément Léna (IBENS, Paris / CNRS, France)
Nicolas Mallet (Bordeaux Neurocampus / CNRS, France)
Rony Paz (Weizmann Institute, Israel)
Seongmin Park (Institute of Cognitive Science Marc Jeannerod, Lyon / CNRS, France)
Mathias Pessiglione (Paris Brain Institute / Inserm, France)
Naoya Takahashi (Bordeaux Neurocampus / CNRS, France)
Michel Thiebaut de Schotten (Bordeaux Neurocampus / CNRS, France)
Nachum Ulanovsky (Weizmann Institute, Israel)
Mark Walton (University of Oxford, UK)

Céline AMIEZ

Stem Cell and Brain Research Institute, INSERM U1208, Bron
https://sbri.fr/public-profile/23/single-member

Sulcal variability identifies differential evolution of frontal cortical regions in primates

Abstract

Although the relative expansion of the frontal cortex in primate evolution is generally accepted, the nature of its scaling and inter-species anatomo-functional comparisons of the frontal areas remain controversial. Indeed, a large literature has emphasized the link between the extent of gyrification, the rapid expansion of the cerebral cortex, and the complexity of the computational processing performed in a given brain. Although important, these discussions of cortical gyrification have not considered another major dimension of sulcal pattern organization, i.e. its variability. I present here results showing how the medial and the lateral frontal cortical sulcal organization has evolved through the primate order. By performing within- and across-species comparison of sulcal morphological variability based on neuroimaging anatomical scans, I provide evidences that both regions are comparable anatomically and functionally from Old World monkeys to Hominoidea, at the sole exception of the ventrolateral prefrontal cortex. In this latter region, although chimpanzees display the precursor of the human ascending sulcus rostrally limiting Broca's area (Area 44), this precursor does not join the insula as in human. This lack of opercularization prevents the formation of the frontal operculum, and consequently prevents the formation of the sulci featuring the pars triangularis and therefore the formation of a full Broca's complex. These discoveries, together with recent paleontological studies suggesting that the frontal operculum appears only in Neanderthals concomitantly with modern language abilities suggests that the frontal operculum might be key to support language functions.

Biosketch

After a PhD in Bron (France) during which I performed electrophysiological recordings and pharmacological perturbations in prefrontal areas in behaving macaques, I spent 7.5 years in Michael Petrides' lab at McGill University (Canada) where I performed many functional magnetic resonance imaging studies in humans. In 2010, I joined the team "Neurobiology of executive functions" within the laboratory Stem Cell and Brain Research institute/INSERM U1208 (Bron, France). I was recruited by the CNRS in 2013 as a Research Associate (CR1) and then as a Research Director (DR2) in 2021. My research aims at identifying the organization of networks involved in high cognitive functions, and more particularly in cognitive adaptation and cognitive control of speech, and whether and how these networks evolved in the primate order. My research is organized into 2 major axes : 1) the study of the organization and the mode of functioning of these networks in humans and macaques, i.e. the model closest to the human brain allowing invasive studies, and 2) the study of the evolution of these networks in primates, from old-world monkeys (macaque, baboon), to apes (chimpanzee), and humans.

Yaniv ASSAF

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Evolution of the connectome across the animal kingdom

Abstract

The connectome, the wiring diagram of the brain is one of the greatest promises of today's neuroscience. Over 100 years ago, Ramon y Cajal hypothesized that neurons and their connections must be designed according to the "laws of conservation for time, space and material". Indeed, recent studies of the human connectome suggest that it is a dynamic component of the brain that takes an active role in neuroplasticity and adaptation to environment. In addition, with a unique database of MRI brain scans of more than 200 species across the aninal kingdom (mainly from the mammalian and avian classes), we revealed that the callosal inter-hemispheric connections are highly important for network balancing and regulation through evolution. This universal conservation law was able to explain also inter-subject connectivity variability within species on the HCP connectome database. In the lecture, I will describe the rules of inter-hemispheric connections in brain plasticity and evolution and the universal connectivity conservation.

Biosketch

Professor Yaniv Assaf is a neuroscientist and a biophysicist that has received his graduate degreesin chemistry from The Tel Aviv University, followed by a joint postdoctoral fellowship at Tel Aviv Sourasky Medical Center and the National Institutes of Health (NIH). During his postdoc, Assaf investigated the different aspects of neuronal white matter mapping with MRI, including the implementation of white matter mapping techniques for assessment of tissue damage in multiple sclerosis, stroke, and dementia (Alzheimer's disease). In addition, Professor Assaf has developed novel analysis tools that enhance the accuracy and sensitivity of MRI-based white matter mapping techniques, such as the CHARMED model.
Over the last two decades, Professor Assaf has focused on developing MRI techniques and analysis frameworks that enable indirect measurement of brain structures on the micron scale. The main hypothesis behind Assaf's research is that the morphology and function of the brain are linked. Professor Assaf's research is conducted with the aim of enhancing the information extracted from MRI beyond the resolution limitation of the millimeter scale. Under this assumption, Assaf's research group has focused on extracting micron-scale structures of both white and gray matter in animal brains as well as the human brain. One such research topic involves the characterization of microstructural changes that occur following cognitive training and brain plasticity.

Helen Barbas

Neural Systems Laboratory, Boston University, Boston, MA
Website : https://www.bu.edu/neural/

Circuits for content, contexte, and affect synthesis through thalamus

Abstract

The general principle of systematic variation of the cortical laminar architecture has provided the basis to formulate the relational Structural Model, with rules that organize and predict connections. Within this context, pathways from cortical and subcortical structures through the amygdala, hippocampus and thalamus give the prefrontal cortex a panoramic view of the sensory environment and the internal milieu of motives and drives. Specific areas of the prefrontal cortex also innervate widely the inhibitory Thalamic Reticular Nucleus that gates thalamo-cortical communication, providing the basis for selective recruitment of pathways through thalamus and cortex for goal-directed behavior and action. The patterns of connections of the prefrontal cortex with excitatory and inhibitory systems in cortical and subcortical structures have distinct implications for executive control, memory, and vulnerability to psychiatric and neurological diseases predicted by their impact on circuit mechanisms and through modeling.

Biosketch

Helen Barbas is Professor at Boston University and School of Medicine. She studied neuroscience at McGill University (PhD) and Harvard Medical School (postdoctoral). She established the Neural Systems Laboratory at Boston University, funded by grants from the National Institutes of Health (NIMH and NINDS), the National Science Foundation and Autism Speaks. Her research focuses on the organization of the cerebral cortex, and specifically on the pattern and synaptology of prefrontal pathways with excitatory and inhibitory systems, as well as influences from the amygdala and hippocampus through the thalamus for the synthesis of signals associated with cognition, memory and emotions. Her work has led to establishment of the predictive Structural Model, which links the laminar structure of the cortex to connections, development, the stability/plasticity continuum within the cortical mantle, and preferential vulnerability of some areas to neurodegenerative and psychiatric diseases

Anna BELEYER

Neurocentre Magendie, Inserm / University of Bordeaux, France
@anna_beyeler

Neural coding of anxiety and emotional valence in circuits of the insular cortex

Abstract

The response of the insular cortex (IC) and amygdala to stimuli of positive and negative valence were found to be altered in patients with anxiety disorders. However, the coding properties of neurons controlling anxiety and valence in this brain region remained unknown. To assess anxiety- and valence-related behaviors we used established behavioral assays including the elevated plus maze (EPM), the open field test (OFT), sucrose and quinine consumption, mild footshock as well as tail suspension. We combined photometry recordings, pharmacology and optogenetics in mice, as well as viral tracing and ex vivo electrophysiology, to dissect the role of four insular neural populations. We focused our analysis on three aspects of neural diversity: [1] topographical diversity by comparing the anterior and posterior insular cortex (aIC and pIC), [2] diversity based molecular markers (glutamate, GABA as well as serotonin and dopamine receptors) and [3] diversity based on the projection target, focusing on insula neurons targeting the basolateral amygdala (BLA).
First, we uncover that glutamatergic projection neurons in aIC are more active in anxiogenic spaces, while the pIC did not show changes in activity. Interestingly, in a pathological model of anxiety, induced by a high fat diet, we revealed an upregulation of the aIC, suggesting that alteration of the coding properties of projection neurons of the aIC contribute to the pathophysiology of anxiety disorders. We then characterized the monosynaptic aIC to BLA connection, and employed projection-specific optogenetics, to reveal anxiogenic properties of aIC-BLA neurons in anxiety-related behaviors. Then, using projection specific photometry recordings, we identified that aIC-BLA neurons are more active in anxiogenic spaces, and in response to aversive stimuli.
Together, our findings show that negative valence, as well as anxiety-related information and behaviors are encoded by aIC glutamatergic neurons and more specifically within aIC-BLA glutamatergic circuit.

Biosketch

Anna Beyeler received her undergraduate degree in Biochemistry from the University of Bordeaux in 2006. Her expertise in electrophysiology roots in her doctoral training in the same university, after what she joined the Picower Institute for Learning and Memory (MIT) as post-doctoral fellow. There, she identified circuit and synaptic mechanisms of emotions in the amygdala, underlying memory formation and retrieval of positive and negative associations. After five years abroad, she started her lab in the Neurocentre Magendie within the vibrant Neuroscientific community of Bordeaux. Since then, her team is studying the contribution of circuits of the insular cortex to emotional valence and anxiety, as well as the alteration of those circuits in pre-clinical models of psychiatric disorders. They use a wide panel of techniques including fiber photometry recordings, in vivo and ex vivo electrophysiology, opto- and chemo-genetics, along with cutting-edge whole-brain circuit mapping. In 2020, Dr. Beyeler has been tenured as a principal investigator by the French Institute of Health (INSERM). She received the Avenir fund of INSERM, and numerous grants including from ANR, FRM or the 'Cercle FSER'. She is also an associate member of the American College of Neuropsychopharmacology (ACNP), a member of the FENS-Kavli Network, and an ambassador of the ALBA network for diversity in Neuroscience.

Emiliano BRUNER

Centro Nacional de Investigación sobre la Evolución Humana, Burgos (Spain)
Centro de Investigación en Enfermedades Neurológicas, Madrid (Spain)
Website : www.paleoneurology.wordpress.com

Prehistory and Neuroscience

Abstract

Evolutionary anthropology must rely on both paleontological and neontological evidence as to provide a reliable comparative framework to test hypotheses and theories. This requirement is even more stringent when dealing with brain and cognitive evolution, because of the noticeable difficulties when investigating anatomical and behavioural aspects in extinct species. Paleoneurology is the study of brain anatomy in fossil taxa. It largely deals with the functional and structural relationships between skull and brain in ontogeny and phylogeny, relying on digital anatomy, computed morphometrics and numerical modelling to perform intra- and inter-specific morphological comparisons. Neuroarchaeology, instead, investigates brain functions associated with behaviours inferred from the archaeological record. Finally, cognitive archaeology concerns the study of those same behaviours according to current psychological models. Namely, these three fields deal with brain anatomy, brain functions, and the cognitive process, respectively. A proper integration between these three perspectives is necessary to provide a consistent comparative background when making inference on brain evolution in fossil hominids.

Biosketch

Emiliano Bruner is PhD in Animal Biology for the University La Sapienza, Rome (Italy). Since 2007, he is Research Group Leader in Hominid Paleoneurobiology at the National Research Center for Human Evolution, Burgos (Spain). He has published more than 150 scientific papers, and his main research areas deal with human evolution, brain evolution, paleoneurology, comparative neuroanatomy, and cognitive archaeology. He employs a wide array of methods and techniques that includes geometric morphometrics, multivariate statistics, digital imaging, network analysis, electrodermal analysis, psychometrics and eye-tracking. His research is particularly focused on the evolution of the parietal lobes, and on the evolution of visuospatial integration, body perception, and attention. He is involved in science dissemination, writing for several Spanish magazines and blogs.

Yoram BURAK

Hebrew University of Jerusalem, Israel
Racah Institute of Physics and Edmond and Lily Safra Center for Brain Sciences, Israel
https://buraklab.me

Coordination between attractor networks in the hippocampus and the entorhinal cortex

Biosketch

Yoram Burak is the William N. Skirball Chair in Neurophysics, and an Associate Professor at the Racah Institute of Physics and the Safra Center for Brain Sciences, at the Hebrew University of Jerusalem. He received his Ph.D. in theoretical physics from Tel-Aviv University, supervised by Prof. David Andelman. Before joining the Hebrew University in 2012, Yoram Burak was a postdoctoral research associate at the Kavli Institute for Theoretical Physics at UCSB, and a Swartz Postdoctoral Fellow in Theoretical Neuroscience at the Center for Brain Science at Harvard University. His research aims to identify how neural circuits in the brain implement computational functions.

Marie CARLÉN

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Functional maps for the mouse prefrontal cortex

Abstract

The prefrontal cortex (PFC) covers the front part of the frontal lobe of the cerebral cortex and is considered to enable cognition. The structure and function of the PFC across species remain unresolved. Taking advantage of the technological toolbox available to studies in rodents, our studies aim to outline the mouse PFC through integration of structural, molecular, and functional characteristics. The connectivity outlines the mouse PFC as a module with dense intraconnectivity, questioning independent processing in discrete prefrontal subregions. In line with this, higher cognitive functions are considered to be integrative rather than localized. Non-localized functions of the PFC can only be revealed by studies focusing on the PFC as a whole.

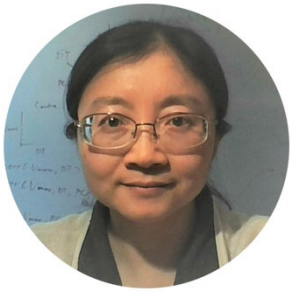
The past decade has seen an avalanche of studies presenting large-scale data on structural and molecular features of the brain, knowledge that has propelled our understanding of the circuit wiring and tissue composition across the brain. In parallel, high-density probes for single neuron electrophysiology have opened for massive and concurrent sampling of neuronal activities across large brain territories. I will in my talk introduce the concept of functional maps of brain regions and present our work towards annotation of the mouse PFC based on generation of activity maps. I will include analyses of possible hierarchy within the PFC, local vs non-local functions, and also, as far as possible, comparisons to other brain regions, and species.

Biosketch

Dr. Marie Carlén is a Professor and group leader at the Department of Neuroscience at Karolinska Institutet, Stockholm, Sweden.Marie received her Ph.D. in medicine from Karolinska Institutet in 2005. Her doctoral studies were conducted in the laboratory of Professor Jonas Frisén and focused on stem cells and neurogenesis in the adult brain and spinal cord. Marie went to Massachusetts Institute for Technology, Boston, for postdoc studies in the laboratory of Professor Li-Huei Tsai at the Picower Institute for Learning and Memory. During her postdoc, Marie investigated how the activity of inhibitory interneurons expressing parvalbumin (PV) relates to cortical oscillatory activities and cognitive functions.
In 2010 Marie was recruited to the Department of Neuroscience to Karolinska Institutet, and her laboratory is investigating the structure and function of the prefrontal cortex. The studies are primarily conducted in mice and the current work uses high-density electrophysiology and imaging to decipher how the neurons and networks in the prefrontal cortex enables cognition.

Long DING

University of Pennsylvania
Website : https://www.med.upenn.edu/dinglab/



Basal ganglia contributions to perceptual decision making in monkeys

Abstract

Decision making often requires processing uncertainty related to reward expectation and/or sensory input. The basal ganglia are well-known to be involved in reward modulated behaviors, including value-based decisions that take into account reward uncertainty. The basal ganglia are also involved in perceptual decisions based on uncertain sensory evidence, but their exact roles are less understood. We are interested in basal ganglia contributions to complex decisions that require appropriate balancing of reward and sensory information. In my talk, I will summarize our recent work examining the computational roles of the caudate nucleus in monkeys performing an asymmetric-reward random-dot visual motion direction discrimination task. I will also share more preliminary results of single-neuron activity patterns in the subthalamic nucleus for perceptual decisions. These results suggest that the basal ganglia contribute to multiple computational components in the decision process.

Biosketch

Long Ding received her BS in Telecommunications from Xidian University in Xi'an, China. Inspired by lectures on classic studies of the pupil reflex and ion channels, where engineering and mathematical concepts led to insightful inferences about how the brain works, she switched fields and went on to obtain a Ph.D. in Neuroscience from the University of Pennsylvania. She has been fascinated by the basal ganglia and looked at their functions through many lenses, including characteristics of resting tremor in Parkinson's Disease patients, dopaminergic actions that may support vocal learning in songbirds, reward modulated saccade behaviors in monkeys, and neural computations supporting decision making in monkeys. She joined the faculty at the University of Pennsylvania in 2012 and is now a Research Associate Professor in the Department of Neuroscience. Her current research focuses on the computational roles of individual basal ganglia nuclei in decision processes that incorporate noisy visual information and reward contexts in monkeys.

Julie DUQUÉ

Université catholique de Louvain (UCLouvain)
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@DuqueLab

Neural regulation of speed-accuracy tradeoff during human behavior

Abstract

Humans and other animals make a wide range of decisions throughout their daily lives. In some cases, decisions are slow and uncertain, as opposed to other situations in which they are fast. Models introduced decades ago have been highly effective at explaining this basic observation by viewing decision making as a process of noisy accumulation of evidence: during deliberation, sensory evidence is accumulated until some threshold, at which point the decision is made and the action is initiated. In the context of motor behavior, such accumulation directly converts into a rise in motor neural activity, from a starting point to a consistent decision threshold. In these models, the time taken to select a motor act is thus a direct function of the speed at which motor activity grows (depending on evidence) and of the amount of activity rise required to reach the decision threshold. Yet, decisions can be made even when evidence is low or absent; as it is often better to take a guess than to wait forever. Relatedly, a new type of model has emerged whereby activity rises not only due to evidence accumulation, but also to a key evidence-independent, time-related urgency to respond. Such signal would push motor activity closer to threshold as time passes, even in the absence of any further evidence. In my talk, I will describe some of our work in humans that aimed at better understanding the neural correlates of this key urgency signal. My presentation will be divided into two parts. In the first section, I will focus on the impact of urgency on motor neural activity, studied using transcranial magnetic stimulation (TMS) over primary motor cortex (M1) during decision making in an index finger variant of the Tokens task, originally developed for studies of urgency in non-human primates. By taking advantage of the high spatial resolution of motor-evoked potentials (MEPs) to TMS over M1, we were able to show that urgency materializes into two main adjustments of motor neural activity. On one side, we found that decision urgency induces a suppression of neural activity in fingers surrounding the prime mover (i.e., the MEP rise in responding index comes with a drop in thumb/pinky MEPs), an effect reminiscent of greater surround inhibition. On the other side, concurrent to this local effect on finger MEPs, we found larger MEPs in leg muscles, an effect suggestive of a broad upregulation of motor activity by urgency. These two markers possibly reflect distinct influences that finally determine the overall level of urgency. Then, in the second part of my talk, I will turn to the source(s) of urgency, focusing on the potential role of the arousal system that we recently started to investigate following a causal approach. Critically, the current literature on arousal in humans is dominated by correlative studies considering changes in pupil size to index arousal as a function of specific behaviors. In this work, pupil size has been reported to increase in urgent settings associated with faster decisions. But whether arousal is augmented because of the increased cognitive demand related to such behavioral context, or whether it is at the origin of such speeded-up decisions remains unanswered. Interestingly, it is possible to causally address the role of arousal in humans by means of transcutaneous Vagus Nerve Stimulation (tVNS), which employs electrical stimulation targeting the auricular branch of the vagus nerve to modulate the locus coeruleus noradrenergic system, one major source of arousal in the brain. By applying tVNS during a random dot motion

discrimination task, we collected new data that are inconsistent with the view that arousal may be involved in generating urgency.

Biosketch

J. Duque completed her PhD in Neuroscience in 2006 at the UCLouvain (Belgium) under the supervision of Prof. E. Olivier. Her PhD training also included a fellowship (2002-2003) at the National Institute of Neurological Disorders and Stroke (NIH, Bethesda, USA) with Prof. L.G. Cohen (PhD co-supervisor). At that time, she characterized interactions occurring between motor areas of both hemispheres using transcranial magnetic stimulation (TMS) in healthy subjects and in stroke patients. After her PhD, she joined the lab of Prof. R.B. Ivry (UC Berkeley, USA) as a BAEF and Fulbright postdoctoral scholar, with the goal to further her understanding of the contribution of cognitive processes to the control of voluntary movements (2006-2008). She then continued this research line at the UCLouvain on a FNRS postdoctoral position and worked for a year (2008-2009) with Prof. M. Rushworth (University of Oxford, UK). J. Duque is now associate professor at the UCLouvain where she established her lab in 2010 (Cognition and Actions Lab - https://www.coactionslab.com/) in the Institute of Neurosciences (IoNS), exploring a range of questions pertaining to the cognitive neuroscience of human motor behavior, using a variety of techniques including TMS, electroencephalography (EEG) and magnetic resonance imaging (MRI) in neurologically healthy and impaired individuals.

Stefan EVERLING

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Vocalization-related activity in the anterior cingulate cortex

Abstract

The prefrontal cortex (PFC) is central to high-order cognitive functions, with dysfunctions in these regions associated with various neuropsychiatric disorders. While research in the PFC has focused on visual cognition, it is in fact audition that exhibits a significantly more extensive representation within the PFC. The strongest interconnections with auditory cortices are not with lateral PFC but with medial PFC. Surprisingly, little is known about the activity of mPFC neurons in response to auditory stimuli. To bridge this gap, we use the common marmoset, a highly vocal New World primate, as an additional nonhuman primate model. With its well-characterized auditory cortex, lissencephalic structure suitable for electrode implants, and amenability to ultra-high field preclinical fMRI, the marmoset provides an excellent model for studying the mPFC-auditory network. Our recent studies employing whole-brain ultra-high field fMRI at 9.4T, supported by high-density Neuropixels recordings, have revealed strong activations for conspecific vocalizations area 32. In this talk, I will elaborate on the methodologies we have employed, our findings, and the implications for our understanding of vocal processing in primates. The findings lay the groundwork for future invasive manipulative studies, promising to fill longstanding gaps in understanding of the neural basis of auditory attention and vocal communication in primates.

Biosketch

Stefan Everling, Ph.D., serves as a professor of physiology and pharmacology at the University of Western Ontario. Born in 1968, he pursued his studies in Biology and Psychology at the University of Bremen, where he also earned his Dr.rer.nat. After completing postdoctoral training under Dr. Douglas Munoz at Queen's University, Kingston, Canada, and a position at the MRC Cognition and Brain Sciences Unit in Cambridge, Dr. Everling joined the University of Western Ontario as an Assistant Professor, eventually rising to the rank of Full Professor
Dr. Everling's research investigates the neural basis of attention, cognitive control, and decision-making processes. Employing electrophysiological recordings and functional magnetic resonance imaging in nonhuman primates, his laboratory investigates both local and lagre-scale neural circuits that support these functions. In 2016, the team broadened their scope, incorporating marmosets alongside macaque monkeys in their studies.

Gabrielle GIRARDEAU

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Neural mechanisms for memory and emotional processing during sleep

Abstract

The hippocampus and the amygdala are two structures required for emotional memory. While the hippocampus encodes the contextual part of the memory, the amygdala processes its emotional valence. During Non-REM sleep, the hippocampus displays high frequency oscillations called “ripples”. Our early work shows that the suppression of ripples during sleep impairs performance on a spatial task, underlying their crucial role in memory consolidation. We more recently showed that the joint amygdala-hippocampus activity linked to aversive learning is reinstated during the following Non-REM sleep epochs, specifically during ripples. This mechanism potentially sustains the consolidation of aversive associative memories during Non REM sleep. On the other hand, REM sleep is associated with regular 8 Hz theta oscillations, and is believed to play a role in the regulation of emotional reactivity and the consolidation of emotional memories. In particular, the activity of the amygdala during REM sleep is important for emotional regulation, but the underlying physiology is relatively unknown. Unraveling the fine neuronal dynamics related to REM sleep, Non-REM sleep and the transitions between states in the amygdala will further our understanding of the implication of these sleep stages and related brain patterns in emotional processing.

Biosketch

Dr. Gabrielle Girardeau leads the "Sleep and Emotional Memory" team at the Institut Fer-à-Moulin in Paris, France. She obtained her PhD at the Collège de France/Université Pierre et Marie Curie (now Sorbonne University) in Paris, where she contributed to the identification of a key hippocampus-dependent mechanism of memory consolidation during slow wave sleep. She did her post-doctoral work in Dr. Buzsaki's lab at NYU Langone Medical Center at New york University (New York City, USA), where she studied hippocampus-amygdala coordination in the context of aversive memory consolidation. In 2018, she was recruited as a full researcher at Inserm (Institut national de la santé et de la recherche médicale), and in 2019, she created her research team in Paris at the Institut Fer à Moulin. The team uses large-scale electrophysiological recordings and optogenetics in freely behaving rodents to understand the neurophysiological processes involved in normal and pathological emotional processing during sleep.

Karine GUILLEM

Institut de Neurosciences Cognitives et Intégratives d'Aquitaine (INCIA),
CNRS / University of Bordeaux

Aberrant neuronal and gamma activities in the ventromedial prefrontal cortex in nicotine withdrawal-induced attentional deficits

Abstract

Nicotine addiction is characterized by an increase consummation of the drug despite negative consequences, an increased motivation/craving for the drug but also by the appearance of cognitive impairments during withdrawal, in particular attentional deficits. These attentional impairments persist even long after drug use cessation and might contribute to the motivation to smoke in order to relieve/compensate for those deficits. The prefrontal cortex (PFC) plays a critical role in attentional processes in humans and animals. Neuroimaging studies have reported that cigarette smokers have reduced PFC function and impaired attention, suggesting that dysfunction in the PFC may underlie these attentional deficits. I will present recent data showing that nicotine intake escalation in rat increases attention while withdrawal from nicotine escalation induces attentional deficits that are long lasting and persist few days after nicotine cessation. At the neuronal level, nicotine escalation and withdrawal also induced long-lasting changes in the ventromedial PFC (vmPFC) neuronal activity and gamma band oscillations. Finally, using a newly developed approach that selectively targets vmPFC interneurons, I will show that chemogenetic manipulation of vmPFC alters attention, highlighting the key role of these interneurons in attention and in the neuronal changes induced by nicotine escalation.

Biosketch

I have been conducting behavioral experimental research in rodents, mainly on drug addiction, for 20 years. After a PhD obtained in 2005 in Bordeaux on the role of the co-factors present in tobacco smoke on the addictive properties of nicotine, I moved to the laboratory of Dr Laura Peoples in Philadelphia where I study the neurophysiological processes underlying drug addiction using in vivo electrophysiological recordings in behaving animals. Then I joined the laboratory of Pr. Huibert Mansvelder in Amsterdam studying the role of the nicotinic receptor subunits in attention processus using viral-based approaches. Since 2011, I am a tenured Research Associate at CNRS working in the team of Dr. Serge Ahmed "Choice, Addiction and Neurodysfunction" at the Institut de Neurosciences Cognitives et Intégratives d'Aquitaine (INCIA).
I have a recognized expertise in the neurophysiology of drug addiction using in vivo electrophysiological recordings in behaving animals during drug-taking and drug-seeking behaviors. Recently, I have extended my expertise to the neuronal processes underlying attention and decision-making within the prefrontal and orbitofrontal cortex using optogenetic and chemogenetic stimulation methods.

Suzanne HABER

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Circuits underlying behavioral flexibility, psychiatric disease and neuromodulation: From primate anatomy to human neuroimaging.

Abstract

The cortico-cortical and basal ganglia networks are central to incentive-based learning and behavioral flexibility. There is growing consensus that obsessive-compulsive disorder (OCD), major depressive disorder, and addiction are manifestations of dysfunction of these networks. This talk will first review the cortical and basal ganglia connections most associated with psychiatric illnesses. Deep brain stimulation (DBS), an effective therapeutic approach for several treatment resistant disorders, targets key circuits within these networks. Common cortico-subcortical targets are the anterior limb of the internal capsule, the ventral striatum, and the subthalamic nucleus. The second part of the talk, will follow cortical pathways through the white matter to the DBS targets. Here, using animal tracing experiments, the precise trajectory and location of fibers from different cortical regions through each target will be outlined. Combining the anatomy with diffusion magnetic resonance imaging animals, I will demonstrate how accurate diffusion MRI reflects the anatomic organization. Finally, using this analysis as a guide, connections through each target will be identified using diffusion MRI in humans illustrating the likely circuits captured at different surgical targets. These sites will be compared with respect to the cortical functional areas mostly likely effected by DBS.

Biosketch

Dr. Suzanne N. Haber, Ph.D. Professor, Department of Pharmacology and Physiology, University of Rochester School of Medicine and Visiting Professor, Department of Psychiatry, Harvard medical School. Suzanne N. Haber is The Dean's Professor in the Department of Pharmacology and Physiology, with secondary appointments in the Departments of Brain and Cognitive Sciences, Neuroscience, and Psychiatry at the University of Rochester and Visiting Scientist at McLean Hospital. She received her B.A. in Psychology from Kent State University, and Ph.D. in Neuroscience from Stanford University. Her postdoctoral research was in neuroanatomy at the University of Minnesota (Dr. Robert Elde) and at MIT (Dr. Walle Nauta). Dr. Haber's research interests focus on the neural networks that underlie incentive-based learning and decision-making with a focus on circuit dysfunction in mental health illnesses. Anatomic connectivity studies, carried out in nonhuman primates, are linked to diffusion and resting state functional MRI to better understand how these imaging modalities reflect the anatomic connections. This work paves the way for identifying circuit abnormalities that may underlie psychiatric illnesses. They also help develop and guide invasive therapeutic targets and understand how target locations might impact different circuits. Dr. Haber has received several awards including a NIMH Merit Award, Distinguished Investigator Award (NARSAD), and the Gold Medal Award from the Society of Biological Psychiatry. She is presently principal investigator of several grants from the NIMH, including a multi-institutional Conte Center: "Neurocircuitry of OCD: Effects of Modulation". She serves on several, foundation boards including, Brain and Behavior Research Foundation, and the Foundation for OCD Research.

Michael HALASSA

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Thalamocortical interactions in cognitive control and flexibility

Abstract

The brain exhibits a remarkable ability to generate a wide range of contextually appropriate behaviors. Theoretically, this ability comes at the cost of requiring many interactions with the environment, but how the brain manages to trade off flexibility and efficiency is unclear. In collaboration with several colleagues which I will mention during my talk, we propose that thalamocortical interactions provide a solution; feedforward thalamic networks are easily trained and configured, while recurrent cortical ones implement complex computations. Specifically, the frontal cortex supports strategic planning, but requires thalamic control for efficient learning and switching. Consistent with this hypothesis, thalamic readout of abstract task variables, such as context and uncertainty, have been reported experimentally, and have been shown to be computationally advantageous in models. This framework explains how thalamocortical network architectures balance cognitive flexibility with efficiency, and highlights a key contemporary research horizon integrating computation, cognition, and systems neuroscience. I will present data across animals and models in support of this framework.

Biosketch

Michael Halassa is Associate Professor and Director of Translational Research, Tufts University, and School of Medicine Director, Neuroscience Center, University of Helsinki

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Dorsomedial striatal dopamine release signals the goaldirected action-outcome relationship

Abstract

The acquisition and performance of goal-directed actions has long been argued to depend on the integration of glutamatergic inputs to the posterior dorsomedial striatum (pDMS) under the modulatory influence of dopamine. Nevertheless, relatively little is known about the dynamics of striatal dopamine during goal-directed actions. To investigate this, we chronically recorded dopamine release in the pDMS as rats acquired two actions for distinct outcomes as these actionoutcome associations were incremented, as well as when they were subsequently degraded or reversed. We found that bilateral dopamine release scaled with the action values, updated by a reward prediction error following exposure to the outcome. However, goal-directed actions also generated a lateralized dopamine signal, that reflected the strength of the action-outcome association independently of changes in movement. Our results establish, therefore, that striatal dopamine signaling during goal-directed actions reflects both bilateral moment-to-moment changes in action value and the long-term action-outcome association, the latter encoded in the degree of lateralized release during the action.

Biosketch

Genevra Hart is a lecturer in the Decision Neuroscience Laboratory at the University of New South Wales (Sydney, Australia). She obtained her PhD from the University of New South Wales in 2012. Her research investigates the neural bases of goal-directed actions, including cortico-striatal (Hart et al., *Journal of Neuroscience,* 2016, 2018; Hart et al., *Current Biology* 2018) and striato-nigral (Peak et al., *eLIFE,* 2020) projection pathways controlling the acquisition and performance of goal-directed actions. Her most recent work investigates the striatal signalling mechanisms underlying goal-directed actions, using fiber photometry.

Federica LARENO FACCINI

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Hippocampo-cortical dynamics underlying memory forma tion and consolidation

Abstract

The two-stage model of memory trace formation posits that the hippocampus is responsible for the quick but volatile encoding of a memory trace. During subsequent sleep, such newly encoded memory traces are transferred to the neocortex for long-term storage. This mechanistic model was initially formulated by Buzsaki in 1989 and proposed a role for ripples (high frequency oscillations taking place in the hippocampus, during sleep and quiet wakefulness) in the consolidation phase. Further support to this model was given by the discovery of replays, the neuronal content of ripples, where sequences of place cells (space modulated cells) activated during exploration are reactivated in the same order but compressed in time.
For two decades, direct causal evidence to confirm such a model was lacking. Our lab has helped to demonstrate the key role hippocampal activity plays in both encoding and consolidation of spatial and episodic memory. One main question regarded the mechanism underlying the encoding of the sequences of place cells during exploration. By dynamically modulating the ability of the rat to walk, while being moved on a model train, we were able to show that the fine tuning of the sequences at the theta, 7-12Hz, timescale (theta sequences), and not at the behavioural timescale, was needed for the generation of replays. We also showed the role of ripples in the consolidation of memory traces, by disrupting their natural occurrence during sleep after a spatial memory task. This was obtained by a closed-loop electrical stimulation of online detected ripples. The team investigated also the hippocampal-prefrontal pathway and its role in consolidation of spatial and episodic memory. We enhanced the synchrony of ripples (hippocampal activity) and delta waves and spindles (neocortical and thalamo-cortical activity, respectively) during sleep after a behavioural task, designed to promote encoding but not consolidation. Behavioural performance was increased in subsequent trials and the prefrontal local network underwent functional reorganisation. This demonstrated the importance of the hippocampo-prefrontal pathway in memory consolidation. Lastly, we have investigated the nature of delta waves (down state of cortical slow oscillations). They have been historically considered as periods of general silence of the neocortical network. But upon close inspection, a small number of residual spikes was detected and we demonstrated that these neurons were part of neuronal assemblies functionally linked with hippocampal neurons reactivated during replays. We thus hypothesised that delta waves are needed to increase the signal-to-noise ratio of specific neuronal assemblies and facilitate consolidation of newly acquired memory traces.
In conclusion, we have shown how the hippocampus plays a crucial role in the encoding of memory traces by means of theta sequences and in their consolidation through replays and the hippocampo-cortical connections that induce plastic reorganisation of the neocortical network.

Biosketch

Federica Lareno Faccini studied neuroscience at the Università degli studi di Trieste, Italy where she investigated the interactions between neurons and carbon-based nanomaterialsin vitro, in the group

of Laura Ballerini at SISSA.
She completed her PhD at the Institut des Neurosciences Cellulaires et Intégratives (INCI) in Strasbourg, under the supervision of Philippe Isope. During this period, she studied the role of the cerebello-prefrontal network in implicit time perception in mice. She aided in the establishment of a new experimental axis in the laboratory, for extracellular recordings and optogenetic stimulation in behaving mice.
She joined the team of Michaël Zugaro at the Collège de France in 2022 as a postdoctoral researcher, where she is specializing in data analysis of hippocampal electrophysiological signals.
Her current research is focused on the neural mechanisms under lying the formation and consolidation of episodic and spatial memory in rats.

Clément LÉNA

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Revisiting the roles of the cerebellum: lessons from motor and emotional systems

Biosketch

Clément Léna studied physics and biology at the Ecole Normale Supérieure in Paris. During his PhD he studied the physiology of nicotinic acetylcholine receptors at the Pasteur Institute. After receiving training on in vivo multielectrode recordings at MIT in the laboratory of Matt Wilson, he obtained an INSERM position in Paris. His research aims at revealing the multiple functions and mechanisms of the cerebello-cerebral circuits. He has notably pioneered the use of multitrodes in the cerebellum in vivo to characterize ultra-fast cerebellar oscillations, provided the first functional demonstration of closed loops between the cerebellum and the cortex, and unraveled the role of the cerebellum in regulating cortical oscillations and synchronizations.

Nicolas MALLET

Institut des Maladies Neurodégénératives, CNRS / University of Bordeaux, France

Pallidostriatal projections from Arkypallidal neurons in basal ganglia circuits: 'Unraveling a novel feedback loop in the loop'

Abstract

Basal-ganglia (BG) circuits form complex loops interacting with cortex, thalamus, and brainstem centers to perform action selection and movement control. In the last two decades, the role played by the external globus pallidus (GPe) in these subcortical circuits has changed drastically. Conventional ideas have viewed the GPe as a simple relay nucleus composed of only one population of cells that always project downstream to the subthalamic nucleus as part of the traditional indirect pathway. However, this vision has been challenged by our past findings describing a novel population of GPe neurons, the so-called Arkypallidal neurons, that exclusively project back to the striatum, particularly its dorsal motor region. In this presentation, I will discuss the anatomo-functional organization of Arkypallidal neurons, including their unique molecular properties and what is known about their specific input/output synaptic organization. I will also elaborate on their contribution to the function and dysfunction of motor control, in particular in the context of the hyperkinetic movements associated to levodopa-induced dyskinesia. Finally, I will delve into speculations regarding their mechanistic contribution to striatal action execution or inhibition.

Biosketch

My research is focused on the cortico-basal ganglia-thalamo-cortical loop and how these loops control movement execution. I have always studied these brain regions from a circuit perspective, looking at their activities both in normal conditions and in experimental models of Parkinsonism. My area of expertise lies in the field of the *in vivo* electrophysiological activity of these neuronal networks and their underlying connectivity (i.e. functional or anatomical). My interest has been to understand the neural mechanisms that generate normal motor programs in basal ganglia circuits and how these events are altered in movement disorders such as Parkinson's disease. To tackle these questions, I use innovative and multidisciplinary strategies that rely on the combined use of experimental methods—such as: *in vivo* single or multi-site (128 channels) electrophysiological recordings, juxtacellular labeling, *in vivo* fiber photometry imaging, and optogenetic manipulations—applied to behaving rodents (i.e. rats or mice often executing a fine motor task).

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Neural representations of valence in the primate brain

Abstract

The primate amygdala is a neural hub that processes computations for learning and memory, especially when it involves emotional cues, rewards, and punishments. Failures of such computations lead to maladaptive behaviors and psychopathologies. However, the core principles of amygdala function continue to elude the field, and we do not fully understand the mechanisms governing adaptive processing of valence and its reversal. We developed a new framework using brain-computer-interface (BCI) and a closed-loop approach that allows us to guide changes in neural activity and test the hypothesis that coding properties of amygdala neurons are dynamic. I will describe new results that show that we can reverse the valence of single amygdala neurons (from appetitive to aversive and vice versa), how such modulation is supported by recruitmenet of network activity, how inputs from the prefrontal-cortex and the substantia-innominate contribute to this plasticity, and finally, how it leads to behavioral changes in response to learned stimuli. The BCI approach allows a more direct (rather than correlative) role for the amygdala in the process of valence-based learning and identifies the constraints that limit network adaptivity.

Biosketch

Prof. completed a B.Sc. in Mathematics and Philosophy, a Ph.D. in computational neuroscience from the Hebrew University, and postdoctoral studies at Rutgers University. He joined the Weizmann Institute in 2008. His Lab investigate the neural codes that underlie phenomena such as reinforcement learning, generalization of learning, emotional modulation of memories, extinction and maintenance of memories, primitives of computation, social cognition, and derives animal and human models for pathologies that arise from abnormalities in the neural code (e.g. post-traumatic-stress-disorder (PTSD), Mood and Anxiety disorders, Autism and more). He is currently the Dean of the Faculty of Biology, and the Director of the *Director of the Drescher Center for Research on Mental and Emotional Health.*

Seongmin PARK

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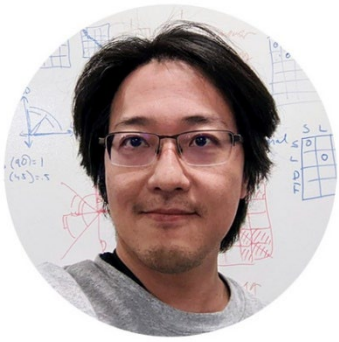

Structural abstraction and behavioral flexibility

Abstract

Generalizing past experiences to new situations is a hallmark of human intelligence, but it remains a challenge for many AI systems. One proposed mechanism for achieving this behavioral flexibility is through the construction of an internal model called "cognitive map"—a structural knowledge representation that indicates the relationships between discrete entities learned from different events. However, we have yet to fully understand how the brain constructs low-dimensional representations from everyday experiences and leverages its cognitive map to promote generalization and flexible decision-making. In this talk, I will present research shedding light on these questions from human neuroimaging and neural network modeling. My findings suggest that the brain organizes relationships between discrete entities into a graphical structure embedded in Euclidean space. Moreover, I will demonstrate how the geometry of the cognitive map interacts with changing task goals to facilitate flexible decision-making. Finally, I will provide evidence that the brain generalizes previously learned abstract knowledge structures to solve novel problems, akin to finding unexplored shortcuts during spatial navigation. By incorporating insights into the neural representation of cognitive maps into computational frameworks like reinforcement learning, my work indicates we can develop a deeper understanding of complex human cognition not fully accounted for by standard models. Uncovering the mechanisms underlying the brain's remarkable behavioral flexibility has implications for advancing both cognitive science and artificial intelligence.

Biosketch

Generalizing past experiences to new situations is a hallmark of human intelligence, but it remains a challenge for many AI systems. One proposed mechanism for achieving this behavioral flexibility is through the construction of an internal model called "cognitive map"—a structural knowledge representation that indicates the relationships between discrete entities learned from different events. However, we have yet to fully understand how the brain constructs low-dimensional representations from everyday experiences and leverages its cognitive map to promote generalization and flexible decision-making. In this talk, I will present research shedding light on these questions from human neuroimaging and neural network modeling. My findings suggest that the brain organizes relationships between discrete entities into a graphical structure embedded in Euclidean space. Moreover, I will demonstrate how the geometry of the cognitive map interacts with changing task goals to facilitate flexible decision-making. Finally, I will provide evidence that the brain generalizes previously learned abstract knowledge structures to solve novel problems, akin to finding unexplored shortcuts during spatial navigation. By incorporating insights into the neural representation of cognitive maps into computational frameworks like reinforcement learning, my work indicates we can develop a deeper understanding of complex human cognition not fully accounted for by standard models. Uncovering the mechanisms underlying the brain's remarkable behavioral flexibility has implications for advancing both cognitive science and artificial intelligence.

Mathias PESSIGLIONE

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A functional partition of the medial prefrontal cortex for the guidance of adaptive behavior

Abstract

Deciding for a course of action involves 1) at a first level, an estimation of option values, which determine confidence in the intended choice and 2) at a second level, an estimation of how much effort must be invested in deliberation, to reach sufficient confidence. In a series of fMRI studies using different tasks, we have located value, confidence and effort representations along a dorso-ventral gradient in the medial prefrontal cortex. Focusing on the ventromedial prefrontal cortex, we have demonstrated key properties of neural value signals: they can be decoded in pre-stimulus activity, for various categories of items, even during a distractive task. These properties were observed in both human and non-human primates, using either hemodynamic or electrophysiological signals. Taken together, they might explain several irrational choice behaviors, such as why the valuation of options can be biased by irrelevant contextual features.

Biosketch

Mathias Pessiglione is Research Director at Inserm and Team Leader at ICM. He was trained as both a biologist (Ecole Normale Supérieure, Lyon) and a psychologist (Université René Descartes, Paris). His main question is ‘how the brain motivates the behavior, in both normal and pathological conditions’. To address this question, he combines functional neuroimaging, computational modeling and clinical research in human volunteers.

Naoya TAKAHASHI

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Thalamocortical pathway for goal-directed action initiation

Biosketch

Naoya Takahashi is a CNRS researcher and head of the "Neural Basis of Perception" team at the Institute for Interdisciplinary Neuroscience (IINS) within the Bordeaux Neurocampus. After completing his PhD at the University of Tokyo, he pursued his postdoctoral career at the laboratory of Prof. Matthew Larkum at the Humboldt University of Berlin, where he published a series of studies on the active role of cortical neuron dendrites in somatosensory processing.
Since 2020, N Takahashi has been leading his team at the IINS, where they use an array of advanced tools and methods in neurophysiology and behavioral neuroscience to investigate the cellular and circuit mechanisms that underlie tactile perception in mice.

Michel THIEBAUT DE SCHOTTEN

Institut des Maladies Neurodégénératives, CNRS / Université de Bordeaux

Non-human primate neuroimaging: the next frontier

Abstract

The past decade has seen tremendous progress in magnetic resonance imaging applied to several species. We can now compare anatomical features across species and, by doing so, infer evolutionary principles. This endeavor is within everybody's reach thanks to open data initiatives but requires sophisticated analyses plus good theoretical knowledge. This lecture will be dedicated to the description of some of the leading evolutionary theories and aims to boost curiosity and motivate the neuroimaging community to develop tools and run analyses to build the first brain evolutionary tree.

Biosketch

Michel Thiebaut de Schotten work, which includes >100 peer review articles, spans the whole gamut from novel neuroimaging methodologies to experimental work to theory. Critically, he dedicates significant effort toward the clinical translation of his work through an open model approach that makes his tools freely accessible to the community. His PhD in Paris, la Salpêtrière, published in Science (2005) showed the first demonstration in humans that hemispatial neglect could be reversibly produced by disconnecting the white matter. Today, operating rooms worldwide use his assessment to prevent spatial attention deficits after surgery. During his postdoc at King's College London, he mapped white matter anatomy in the healthy human living brain through a series of influential studies, which led to the publication of the Atlas of the Human Brain Connections. As a tenured researcher at the Paris Brain Institute, he developed the BCBtoolkit software suite, a set of programs for computing disconnections made freely available to the scientific and clinical communities. Recently, in Bordeaux as the head of the neuroimaging department, he has explored the role of white matter connections in defining functional areas. Most recently, he published his first Atlas of the function of white matter as well as a new software the "functionnectome" that unravels the contribution of white matter circuits to function. His latest theoretical point of view on the functioning of the brain is extensively illustrated in his review published in Science last year and entitled "the emergent properties of the connected brain".

Nachum ULANOVSKY

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Neural codes for natural behaviors in flying bats

Abstract

This talk will focus on the importance of using natural behaviors in neuroscience research - the "Natural Neuroscience" approach. I will illustrate this point by describing studies of neural codes for spatial behaviors and social behaviors, in flying bats - using wireless neurophysiology methods that we developed - and will highlight new neuronal representations that we discovered in animals navigating through 3D spaces, or in very large-scale environments. In particular, I will discuss three recent studies : (1) A multi-scale neural code for very large environments, which we discovered in the hippocampus of bats flying in a 200-meter long tunnel. This new type of neural code is fundamentally different from spatial codes reported in small environments - and we show theoretically that it is superior for representing very large spaces. (2) Rapid modulation of position x distance coding in the hippocampus during collision-avoidance behavior between two bats flying in the long tunnel. This result provides a dramatic illustration of the extreme dynamism of the neural code. (3) I will also describe new results on the social representation of the other individuals in the hippocampus, in a highly social multi-animal setting - which revealed complex neuronal coding of social variables. The lecture will propose that neuroscience experiments - in bats, rodents, monkeys or humans - should be conducted under evermore naturalistics conditions.

Biosketch

Nachum Ulanovsky is a Professor of Neuroscience and Head of the Center for Learning, Memory & Cognition at the Weizmann Institute of Science. He is an elected International Honorary Member of the American Academy of Arts and Sciences. Nachum studies the neural basis of spatial cognition and social cognition in the mammalian hippocampal formation - usingbats as a novel animal model that he pioneered. His group developed wireless-electrophysiology devices, which enabled the discovery of 3D place-cells, 3D head-direction cells and 3D grid cells in flying bats; as well as the discovery of goal-vector cells - which encode navigational goals; and social place-cells - which represent other individuals, in a social context. Nachum performs experiments in bats flying in very large environments, hundreds of meters in size, during navigation and social interactions. He seeks to create a "Natural Neuroscience" approach for studying the neural basis of behavior - tapping into the animal's natural behaviors in complex, large-scale, naturalistic settings.

Mark WALTON

Department of Experimental Psychology, University of Oxford, U.K.
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Adaptive behaviour, state inference and mesolimbic dopamine

Abstract

Adaptive behaviour requires learning which actions lead to desired outcomes and updating these preferences when the world changes.Reinforcement learning (RL) has provided an influential account of how this works in the brain, with reward prediction errors (RPEs) updating estimates of the values of states and/or actions, in turn driving choices. However, it is increasing clear that an ability to infer statistical relationships and hidden states of the world also plays an important role in shaping adaptive behaviour.Intriguingly, brain recordings have shown that not only prefrontal cortex but also the dopamine system can reflect knowledge of such hidden states. However, this raises several conundrums: first, if state inference, not RL mediates flexible reward-guided behaviour, why does dopamine look and act like an RPE?Conversely, if value updates driven by dopaminergic RPEs are central to flexible, how does this generate the signatures of hidden state inference seen in the data? Here, I will present data from highly-trained mice performing a structured two-step decision task that belief updates shape dopamine responses but are not caused by them. These data can be reconciled by a neural network model in which cortex infers hidden states by predicting observations and basal ganglia uses RL mediated by dopaminergic RPEs to learn appropriate actions.

Biosketch

Mark Walton is a Professor of Behavioural Neuroscience at the University of Oxford. Research in his group is focused on understanding the neural mechanisms shaping motivation and adaptive reward seeking, with a particular interest into how neurotransmitters such as dopamine regulate these processes in rodents on a moment-by-moment timescale. To do this, they use in vivo techniques to enable fine-scale measurement and manipulation of neurochemistry and neural circuits integrated during rich behavioural tasks that can tease apart animals' behavioural strategies and motivations.

Posters

P1 - All-optical interrogation of emotional memory circuits during REM sleep

Mattia Aime [1,2], Niccolo Calcini [1,2], Micaela Borsa [1,2], Tiago Campelo [1,2], Thomas Rustherolz [1,2], Antoine Adamantidis [1,2].
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REM sleep is associated with the consolidation of emotional memories encoded by neuronal circuits from the limbic system and prefrontal cortex in mammals. Yet, the underlying neuronal circuits and synaptic mechanisms remain unclear. Here, we found that REM sleep is associated with a somatodendritic decoupling in pyramidal neurons of the prefrontal cortex, using simultaneous 2-photon calcium imaging and electrophysiological recordings in sleeping mice. This decoupling reflects a shift of inhibitory balance between PV neurons-mediated somatic inhibition and VIP-mediated dendritic disinhibition, mostly driven by neurons from the central medial thalamus. We further showed that REM-specific optogenetic suppression of dendritic activity led to a loss of danger versus safety discrimination during associative learning and a lack of synaptic plasticity, whereas optogenetic release of somatic inhibition resulted in enhanced discrimination and synaptic potentiation. Additionally, we found that long-range projections from the basolateral amygdala instruct the prefrontal neurons about the emotional valence of the conditioned cues (safety versus danger), during REM sleep. REM-locked optical perturbation of amygdala projections resulted in impaired discriminative performances. Collectively, our results demonstrated that somatodendritic decoupling during REM sleep promotes opposite synaptic plasticity mechanisms that optimize emotional response to future behavioral stressors. Furthermore, long-range projections from the basolateral amygdala are necessary to transfer the emotional content to the prefrontal circuits during REM-dependent memory consolidation.

P2 - Emerging rhythms in a model of the monkey corticobaso-thalamo-cortical loop

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The cortico-baso-thalamo-cortical loop, involved in action selection and learning mechanisms, is also fostering the emergence and preservation of brain rhythms, involving the gamma and beta oscillations. Bursts of beta activity (13-35 Hz) have been associated to several cognitive processes such as decision making and working memory processes. In Parkinson's disease, aberrant beta band oscillations can be widely observed in the cortex and basal ganglia. However, even in the healthy case, the origins of beta activity and the mechanisms allowing its maintenance remain poorly understood.
To shed light on the rhythmic dynamics of these brain modules, and more specifically the plausible beta generation sources in rhesus macaques, we built a computational spiking model of the loop between the cortex, basal ganglia and thalamus.
We perform spectral analysis of the LFP simulated by the model and identify specific beta and gamma activity. We use several connection deactivation paradigms to investigate the potential sources of these rhythms, highlighting for example the role of the STN-Gpe loop in the emergence of beta power.

P3 - 3dBrainMiner, a tool to generate brain graphs from MR-images

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The rise of brain imaging methods generates a considerable mass of morphological and functional data. However, their exploration and comparison over time for an individual (development and aging), between individuals (variability within the species), and even more so between different species, have been only shortly studied One strategy to facilitate this exploration is to first model this data with graphs. These brains can then be analysed using classical graph theory methods (e.g., graph mining and graph-matching) or more recent approaches of artificial intelligence (deep neural networks on graphs, geometric deep learning, etc.).
The most common way to model a brain as a graph consists in representing brain structures as nodes and anatomical and/or functional connections between structures as edges. This representation, therefore, requires a good knowledge of the species under consideration, which is rarely available across the entire animal kingdom. In this context, we propose to create a new tool that allows specialists to easily transform/model 3D brain MRI images into graphs. This tool lets also specialists defining and automatically computing other nodes and edges attributes to better represent brain morphology. This tool named 3dBrainMiner can extract geometric and signal information from MR-images and the associated segmentations. To generate representations in the form of graphs, 3dBrainMiner takes the MR-image, the corresponding segmentation, the segmentation label list, and the connectivity matrix, if available. If the connectivity matrix is not provided, 3dBrainMiner constructs edges in the graph by connecting two structures if they are sufficiently close to each other. Based on literature data, we know that the size of certain structures varies due to living conditions, pathologies, etc. Furthermore, observations of brains from different animal species show that structures can have different shapes (e.g. the caudate nucleus in sea lions etc.). In this context, we have chosen to introduce new descriptors without functional biases. For the nodes, 3dBrainMiner calculates shape descriptors (volume, surface, sphericity), the position of the center of gravity of each structure, and extracts information on grey-level intensities (mean, variance, radial profile). All this information is included in the graph representation with help of node attributes. Concerning edge attributes, the tool calculates distances (minimum, maximum, mean) and contact surfaces between connected nodes. Using this tool, we have constructed brain graphs for quails, lambs, and humans and have started analysing them. In particular, for the quail model, we have initiated work on lineage classification using graph neural networks. 3DBrainMiner integrates a computer user interface that displays the 3D MRI image and the resulting graph, at the same time.
3DBrainMiner source code is available in open access at URL.

P4 - Effects of adolescent obesity on episodic memory performances in an fMRI task

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Cognitive dysfunctions and brain modifications have been reported in adolescents with obesity (Maayan et al, 2011; Pearce et al, 2019). However, it remains unclear if episodic memory is affected in obese adolescents and related to particular brain functional changes. Here we evaluated the impact of obesity during this critical period of development on episodic memory and its associated brain activation.

We developed an event-related functional magnetic resonance imaging (fMRI) task to test episodic memory in 11 obese male adolescents and 15 male healthy adolescents (mean body mass index: 33.65 $\pm$ 5.45 kg/m² and 18.10 $\pm$ 3.37 kg/m² respectively) aged 9 to 17 years old, presenting no other diagnosed comorbidity. At the beginning of the fMRI task, during the encoding phase, subjects were shown a series of 48 different trials comprising a background image of an every-day life situation (airport's halls, bridges…), followed by a combined image of a portrait from the Karolinska Directed Emotional Faces database superposed onto the situation background. No explicit encoding guidelines were given. After ten minutes, subjects had to retrieve, amongst 3 faces, the one that was presented previously over an already shown background for the 48 trials. Facial recognition memory performance was calculated from the last phase of the task during which response rates and times were recorded. Functional neuroimaging analyses were performed on the encoding phase.

Although both groups had similar response rates, obesity in male adolescents was associated to significantly reduced facial recognition performances in comparison to their age-matched controls (Student One-tailed t-test, $p=0.039$). Additionally, obese subjects were significantly faster to answer than their peers whether the faces were accurately or falsely retrieved (Two-way ANOVA, Group effect, $p<0.001$). Whole-brain fMRI statistical analyses revealed similar activated encoding networks in successful or failed trials ($Z > 2.3$; cluster corrected $p< 0.05$) in both groups. Further analyses only on the successfully encoded trials revealed a hypoactivation of the right hippocampus and parahippocampal gyrus in the adolescents with obesity in comparison to the control group ($Z > 2.3$; cluster corrected $p< 0.05$). Confirmatory Region-Of-Interest analyses in the right hippocampus corroborated the significant difference in levels of activation between groups (Student t-test, $p=0.025$).

Our study indicates that lower episodic memory performances are concomitant with lower hippocampal activation in obese adolescents, confirming that episodic memory is affected in obese adolescents and suggesting its neural bases.

References: Maayan et al, 2011 doi:10.1038/oby.2011.15 Pearce et al, 2019 doi:10.1016/j.dcn.2019.100727

P5 - Physiological characterization of piriform cortex modulation by respiratory signal

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While respiration is crucial for survival by its peripheral action, it also shares strong functional links with the brain. On the one hand, respiratory patterns are modulated by sensory stimuli, attention, emotions, and can be affected in the case of cognitive disorders. On the other hand, respiration shapes brain function, influencing perception, emotions and cognition. Despite the importance of this intricate brain-body relationship, monitoring respiration in freely moving animals has remained challenging: acquisitions in awake moving subjects usually lack the precision reached in head-fixed protocols and have rarely been combined with neuronal recordings. Thanks to the precision of the respiratory signal obtained in mice with portable intra-nasal pressure sensors, we found that during wake, the duration of inhalation/exhalation was relatively invariant. Our results show that respiration is in fact made of a combination of elementary oscillatory units (made of exhalation/inhalation epochs) interspersed among respiratory pauses, the durations of which dictate the ongoing respiratory rate.
Spurred by this observation, we asked whether the olfactory piriform cortex could be modulated by respiration using combined silicon probe recordings and nasal pressure monitoring. We examined the activity of large ensembles of piriform neurons and found that putative excitatory and inhibitory units are differently responsive to either oscillatory (inhalation/exhalation) or linear (pauses) components of respiration. Moreover, we found that when nasal pressure fluctuations are treated as an oscillatory signal, a large fraction of piriform cortex neurons are entrained by the oscillation. Interestingly, their phase preference depends on the respiration rate and internal brain state. Next, we explored whether gamma rhythm, the most prominent oscillation in the piriform cortex during wake, could similarly be modulated by respiration. Consistent with previous results, we observed two independent non-harmonical gamma bands centered around 40 Hz and 60 Hz. During wake state, their prominence was differentially modulated by the phase and frequency of the respiratory oscillation pattern. Together, these results highlight several physiological features of the piriform cortex, enriching our global understanding of its internal network dynamics during naturalistic behaviors.

P6 - Dopaminergic regulation and electrophysiological signature of anterior insular cortex neurons in anxiety-related behavior

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Anxiety is an adaptive response which can become pathological. Although anxiety disorders represent the most prevalent psychiatric conditions, the underlying neurobiology remains largely unknown. Numerous studies in humans and in preclinical models revealed the implication of different neuromodulators including serotonin, norepinephrine, but also dopamine (DA)1.

In parallel, imaging studies identified that the insular cortex (or insula) and the amygdala, are both overactivated in patients with anxiety disorders. Moreover, preclinical studies confirmed the implication of the amygdala in anxiety-like behaviors, and our lab revealed that neurons of the anterior insula (aIC) are activated in anxiogenic environments and have anxiogenic properties2. Interestingly, activation of type 1 DA receptors (D1) within the amygdala has an anxiogenic effect in rodents. Although the D1 is also expressed in the insula, its role in the control of anxiety remains unknown. The goal of this preclinical study is to define the impact of DA release and D1 receptors in the aIC, on anxiety. Thus, we tested the hypothesis that DA release in the aIC promotes anxietylike behaviors in mice, at three levels of analysis.
We mapped the origin of DA to the insula and our results suggest that the insula receives DA from both the ventral tegmental area and the substantia nigra pars compacta. We also identified that D1+ neurons are denser in the anterior compared to the posterior insula (aIC vs. pIC). Finally, we evidenced that D1+ insula projections mainly target amygdala nuclei and the contralateral insula.
Using fiber-photometry recordings, we uncovered an increase in DA release when mice are located in anxiogenic spaces, and that this DA release targets D1+ neurons. Using a pharmacological approach, we also demonstrated that D1 receptors of the aIC have anxiogenic properties.
We performed single-unit recordings of aIC neurons during anxiety assays to identify how DA modulates coding properties of aIC neurons and applied computational techniques (CEBRA3) to uncover neural population dynamics during anxiety-related behaviors.
Altogether, our work provides an electrophysiological and anatomical characterization of insula neurons as a starting point to identify the potential role of dopaminergic modulation of the insula in anxiety.

P7 - Thalamocortical bases of voluntary actions

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Anxiety is an adaptive response which can become pathological. Although anxiety disorders represent the most prevalent psychiatric conditions, the underlying neurobiology remains largely unknown. Numerous studies in humans and in preclinical models revealed the implication of different neuromodulators including serotonin, norepinephrine, but also dopamine (DA)1.
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Altogether, our work provides an electrophysiological and anatomical characterization of insula neurons as a starting point to identify the potential role of dopaminergic modulation of the insula in anxiety.

P8 - Daam1 as a molecular modulator of mnemonic discrimination and pattern completion in mice

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The correct retrieval of memories requires two cognitive processes. Pattern separation (PS) is a process that enables similar experiences to be encoded separately. It prevents memories from overlapping and is critical for mnemonic discrimination (Yassa and Stark 2011). Conversely, pattern completion (PC) is a generalization process that allows the global memory to be retrieved from partial information (Rolls, 2013). Mechanistically, the neuronal circuit formed by the dentate gyrus (DG) and the CA3 hippocampal areas is critical for PS and PC modulation.
Using a conditional knockout (cKO), our team previously showed that the core Planar Cell Polarity (PCP) protein Vangl2 participates in these processes (Robert et al., 2020). We notably showed that when *Vangl2* is deleted specifically in granule cells of the DG, PC process is altered while PS process is improved. To bypass the need for *Vangl2* deletion and control the spatiotemporal disruption of PCP signaling, we developed a molecular construct that we could inject in various regions of the brain, at various developmental and adult stages. An AAV coding for the truncated version of Daam1 protein was injected in the DG of adult animals and we verified by immunochemistry and biochemistry analysis its correct expression. The mice were then subjected to PS- and PC-dependent protocols to assess the efficiency of the construct on learning and memory. We used innovative and non-aversive touchscreen-based approaches to assess mnemonic discrimination. Our preliminary results show improved discrimination abilities in the mouse model for PCP disruption, similar to what was observed in absence of *Vangl2*. These results were validated in an 8-arm radial maze. The mice also showed an impairment of PC in the water maze paradigm for PC. These results support our team's previous report and validate the molecular construct of the truncated version of Daam1 as an alternative to *Vangl2* deletion to modulate mnemonic discrimination and PC in mice.

P9 - Recovery of gap-crossing skills after partial sensory deprivation requires whisker-related primary somatosensory cortex

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The contributions of the whisker-related primary somatosensory cortex (wS1) to perceptual decisions remain a subject of ongoing debate. Previous works related wS1 to stimulus detection and discrimination, as well as to the coordination of whisker movements during active touch and

associative learning. Intriguingly, rodents can fully recover performance after acute and permanent wS1 inactivation in simple stimulus detection tasks. A hypothesis suggests that wS1 is engaged in general operations related to the whisker system, but its contribution to behavior becomes increasingly critical as cognitive load and perceptual demands rise in the task. In this context, the gap-crossing task emerged as a model to study wS1 functions as it requires mice to actively use their whiskers to locate a target platform after a gap and execute an appropriate action to cross the gap in order to get a reward. Previous studies involving wS1 ablation in the gap-crossing task yielded mixed evidence. In these studies, lesions were often made by complete removal of the cortical tissue which compromised *en passant* cortico-cortical projections shown to be important for perception, movement and decision-making. Furthermore, prior studies often employed partially sensory deprived animals to facilitate experimental control over both stimuli and cortical lesions, which may obscure the influence of cortical remapping on skills recovery. In our study, we induced wS1 lesions using ibotenic acid before and after task learning and examined lesion effects in mice after partial sensory deprivation. Also, we combined high-speed video recordings and advanced machine vision algorithms to track mouse body posture during gap-crossing behavior. Expert mice with intact whiskers showed minimal performance deficits after wS1 lesions, fully recovering task skills after one session. Similarly, wS1 lesions did not impair task learning in mice with intact whiskers. Interestingly, both groups showed marked impairment in recovering learned task skills when subjected to partial sensory deprivation. Our findings emphasize the importance of considering cortical remapping and precise lesion targeting in studies of wS1 function. While wS1 may not be essential for full whisker mice, its role becomes critical during recovery from sensory deprivation, shedding light on the complex interplay between sensory processing, motor skills, and cortical plasticity in a challenging behavioral task.

P10 - Relative Reward Value Guides Rat Decision-Making

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The distinction between relative and absolute value encoding in decision-making offers a more nuanced insight into the fundamental mechanisms that underpin choice behaviour, challenging traditional models of reinforcement learning. Rather than basing decisions on specific reward contingencies (absolute value), compelling evidence indicates that humans often learn option values in reference to the currently available alternatives (relative value), which can lead to suboptimal decisions. Yet, the extent to which this relative value learning has been conserved across other mammalian species remains unclear. To address this, we designed a touchscreen task that is structurally analogous to those used in human studies. Rats underwent a two-phase training and testing regimen to discern whether choices made at test are based on the learning contexts' absolute reward probabilities or on the relative differences between the available options. In Phase 1, rats were trained in dual choice contexts: a high value context (AB) with reward contingencies A=100% and B=50%, and a low value context (CD) with C=50% and D=0%. Here, the absolute value of 50% reward probability was common to both options B and C in the separate learning contexts, whereas their relative ranking within each context differed. Across the training sessions, rats exhibited a significant preference for the high value options A in the AB context and C in the CD context. In Phase 2, all combinations of stimuli from both contexts were presented. The results revealed that rats preferred A

in AB and AD choices, C in CD and BC choices, and B in BD choices, but showed no significant preference in AC choices. This preference for C in BC (a choice between two options of equal absolute value but opposing relative value) and the absence of preference for A in AC choices (a choice between two options of differing absolute value but equivalent relative value) support the hypothesis that rats select options based on the relative reward probability acquired within the phase 1 learning context in which the contingencies were acquired, rather than the absolute reward probabilities. We then questioned if the strength of the relative value effect we observed was driven by unique qualities of deterministic values; i.e., A (100%) and B (0%). In a subsequent experiment using non-deterministic values for A (87.5%) and D (12.5%), the same relative value preferences were replicated, indicating that deterministic values are not necessary for generating relative value-based preferences in rats.

P11 - Spatiotemporal organisation of cholinergic input in the somatosensory cortex

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Brain states exert a powerful influence over the perception of sensory stimuli, dynamically modulating sensitivity to detect stimuli. Neuromodulatory systems play a crucial role in regulating brain states. Previous studies have demonstrated that cholinergic inputs originating from the basal forebrain (BF) modulate cortical activity, thus influencing the detection of visual stimuli in mice. Neuromodulation has traditionally been associated with brain states, and thought to have a widespread and uniform impact throughout the brain. However, recent anatomical evidence points toward BF cholinergic neurones offering targeted innervation within specific sensory cortex regions, potentially enabling localised modulation. As of yet, there is limited evidence regarding the exact dynamics of cortical cholinergic modulation and their relevance in sensory perception. Here, we aim to characterise the spatiotemporal organisation of cholinergic activity in the somatosensory cortex (S1) of mice engaged in tactile detection.
By employing a whisker-based tactile detection task, we first tested the role of S1 cholinergic activity on the mouse's sensitivity to detect tactile stimuli. We locally injected acetylcholine (ACh) receptor antagonists in S1 in mice engaged in the task. The local injection of a muscarinic ACh receptor antagonist significantly increased the mouse's perceptual threshold, while a nicotinic ACh receptor antagonist injection had no effect on behaviour. These results suggest that local cholinergic activity can influence tactile detection through modulating S1 activity via muscarinic receptors.
Next, to elucidate the spatiotemporal dynamics of cholinergic modulation in S1, we performed *in vivo* wide-field imaging using a genetically-encoded ACh sensor. Imaging was performed through a chronic glass window implanted over S1 while mice were performing the task. Preliminary experiments have revealed dynamic fluctuations in cholinergic activity across S1 subregions and the surrounding cortical areas. The ongoing analyses focus on discerning differences in these spatiotemporal patterns between the trials where the mouse successfully detected the stimulus and those where it failed to detect.

P12 - Exploration vs exploitation: a thalamocortical circuit to support voluntary actions

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How we make decisions and act in an uncertain environment is a crucial but still unclear question in the field of systems and cognitive neurosciences. It is believed that adjusting behavior in a changing environmental context requires an appropriate balance between exploitation (i.e., using the knowledge already available to secure a gain) and exploration (i.e., exploring the environment to identify more favorable options). However, the neural circuit supporting the mechanisms behind this exploitation/exploration trade-off remains unclear. Recent research reveals that the rodent secondary motor cortex (M2) may constitute a critical node within cortical-subcortical circuits supporting the flexible control of voluntary actions. M2 receives two essential synaptic projections from the mediodorsal (MD) and the ventro-anterior/ventrolateral (VAVL) thalamic nuclei, regions with demonstrated roles in flexible behaviors, which could imply dissociable but complementary roles. We combine axonal and somatic two-photon calcium imaging in vivo, circuit mapping, goaldirected behaviors, and optogenetic/lesions in mice to identify the function of the M2 circuits for deciding when to explore or when to exploit the environment, mostly by illuminating the relevance of the functional organization of the M2-MD/VAVL thalamocortical circuits.

We found that the firing rate of M2 neurons is gradually modified over long-time scales during learning as head-fixed mice perform a two-armed bandit task, in a way that quantitatively reflects choice-related signals. Accordingly, the performance of these animals is specifically impaired when the M2 is lesioned. Interestingly, both MD and VAVL thalamic regions project to the M2 but presumably in a non-overlapping manner. To address potential specific functions, we monitored over weeks the activity of both thalamic regions' axons in the M2, during the entire course of learning and after change in reward contingencies. We observed specific clusters of axons that show time-locked activity during key periods of the task, which could mean that they transmit choice-specific integrated information relevant for the exploitation/exploration trade-off.

Together, our results provide mechanistic hypotheses on how integration of different thalamocortical streams - with possibly distinctive contribution to the computational flexibility of M2 circuits - may shape the exploitation/exploration balance.

P13 - Implication of polyunsaturated fatty acid (pufa) biostatus in dopamine transmission-related reward Processing deficits

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Reward-processing impairments are a characteristic symptom found across various psychiatric diseases such as schizophrenia, major depression or bipolar disorder. This may suggest a common underlying pathophysiological mechanism. Many clinical studies have described a decrease in n-3 Polyunsaturated Fatty acids (PUFAs) in subsets of patients suffering from these psychiatric disorders. Interestingly, preclinical findings from others and our lab suggest that dopamine transmission, known to be involved in these processes, is particularly sensitive to developmental PUFA biostatus.
We show that a decrease in n-3 PUFA in mice leads to a motivational deficit that can be reversed when PUFA biostatus is restored only in dopamine (DA) neurons through a transgenic mouse model (iFAT1) indicating that n-3 PUFA deficiency in DA neurons is sufficient to induce motivational impairments. Motivational deficits are classically related to meso-limbic dopamine (DA) transmission and a dysfunction of the Nucleus Accumbens (NAcc). Interestingly, micro dialysis data from our lab suggests an alteration of DA transmission in n-3 PUFA deficient mice particularly in the prefrontal cortex (PFC). We combined genetically encoded biosensor d-light coupled to fibre photometry during amphetamine exposure to validate these findings. In deed PFC DA transmission is blunted in n-3 PUFA deficient animals compared to controls. We therefore hypothesize that developmental n-3 PUFA deficiency could lead to impaired motivation at adulthood through a direct effect on cortical dopamine transmission in the meso-cortical pathway. To further elucidate the implication of the cortico-meso-limbic system and DA dynamics in the PFC/NAcc during reward-processing in n-3 PUFA deficient mice, we also used the biosensor d-light coupled to fibre photometry in an operant task. Furthermore, anatomical and biochemical analyses helped to assess how the integrity of DA transmission is altered in both of these regions.
These findings further suggest that dopamine transmission is particularly vulnerable to PUFA biostatus and support an implication of lipid metabolism in the aetiology of specific psychiatric symptoms such as deficits in reward processing.

P15 - Sexual dimorphism of insular cortex function in persistent alcohol drinking despite aversion in mice

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One major hallmark of alcohol use disorder (AUD) is the persistent alcohol drinking despite negative consequences. Among the indicators of AUD vulnerability, binge drinking is a strong risk factor. Although the lifetime prevalence of binge and AUD has been historically higher in men than women, this gap dramatically narrowed in the last decade. Additionally, sex differences in AUD and binge drinking has been shown in clinical and preclinical studies, respectively.

The insular cortex (IC) plays an important role in AUD, and the anterior (aIC) and posterior (pIC) divisions have sexually dimorphic functions. However, the contributions of the aIC and pIC sections in alcohol binge drinking and alcohol persistent drinking despite aversion, as well as the sexual dimorphism of these contributions, remain to be uncovered.
First, by combining the drinking in the dark model with chemogenetics, we studied the causal role of aIC and pIC excitatory neurons in binge and persistent ethanol drinking in male and female mice. Second, using calcium fiber photometry, we investigated pIC neuronal activity in both sexes during both binge and persistent ethanol drinking.
We identified a higher binge and persistent ethanol consumption in females compared to males. Chemogenetic inhibition of aIC glutamatergic neurons reduced the intake of bitter solutions independently of the solvent (ethanol or water), in both sexes. In contrast, inhibition of pIC glutamatergic neurons exclusively reduced persistent ethanol drinking in female mice. Finally, using fiber photometry recordings, we uncovered that pIC glutamatergic neurons activity was selectivity increased in female mice during ethanol persistent drinking.
These findings suggest a sex-dependent function of the pIC in persistent ethanol drinking, providing a starting point in our understanding of the insular cortex function in the neurobiology of AUDs in both sexes.

P16 - The Neuromodulatory role of Orbitofrontal Noradrenaline in the control of action-outcome updating

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Behavioral flexibility is a fundamental neurocognitive process referring to an organism's ability to adapt to environmental changes. Past research across different species has demonstrated that the Orbitofrontal Cortex (OFC) plays a key role in behavioral flexibility given that its alteration results in a wide range of behavioral impairments, from value updating to economic decision-making and reversal learning (RL) (1).
Recent research from our team has highlighted the importance of noradrenergic (NE) input from the Locus Coeruleus (LC) to the OFC in controlling reversal learning when the subjects must encode a new relationship between an action and a specific outcome (2). In the current study, we further investigated the role of LC (NE)-OFC system in behavioral flexibility using a probabilistic RL task allowing us to study the online updating of action value.
In this task, rats must identify the most valuable option among 2 possible choices, with one lever being associated with an 80% chance of reward delivery while the other option delivers the reward only on 20% of the presses. Within a session, the contingencies are shuffled multiple times based on the rats' performances to prompt the animals to switch from one lever to the other, therefore online updating the contingencies continually.
Using this task, we found that chemogenetic silencing of the OFC CaMKII neurons ii) of LC-OFC NE inputs impaired the rats' ability to adjust their behavior at reversal following reward omission trials. Interestingly, fiber photometry recordings suggest that reward omissions violating prior expectations might enhance NE release within the OFC, an indication that this specific pathway might be central in regulating behavioral flexibility.

Taken together, our finding demonstrate a specific role of NE terminal in the OFC for controlling the online updating of the relationship between an action and its outcome.

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P17 - Sex-dependent impact of high-fat versus very high-fat diet during adolescence on action control

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Obesity is now one of the most important health issues in modern society. Obesity incidence is especially growing fast in children and teens who develop related disorders early in life. It is mainly driven by maladaptive dietary habits with overconsumption of highly palatable and energy-rich foods, suggesting that these types of foods can highjack the homeostatic regulation of feeding. Despite numerous studies, the long-term impact of such diets on the control of food-seeking and related behaviours remains understudied. Adolescence appears to be a crucial vulnerability window as several brain regions involved in these processes are still under development. We previously showed that chronic consumption of obesogenic diet from adolescence promotes nonflexible habitual control of food-seeking in males. However, it remains unknown if i) these effects are dependent of the food nutrient content, ii) if similar effects are observed in females and iii) if such dietary habits induce long-lasting alterations at adulthood.
Male and female adolescent C57Bl/6J mice were given 5 weeks (post-natal day 28-63) of free and continuous access to a combination of control chow pellets and high-fat (HFD; 45%) or very high-fat pellets (vHFD; 60%). Control animals were only given standard diet (SD, chow; 9%). At adulthood, all mice were switched to SD and trained to perform an action (lever press) to obtain food pellet. We then tested if animals were able to 1) correctly adapt their actions according to changes in the value of the food (outcome devaluation), 2) learn and use new action-outcome relationships (reversal learning), and 3) flexibly change their action when it is not required anymore to obtain the food (contingency degradation). Our results suggest complex fat content- and sex-dependent differences in processes underlying control of food-seeking, highlighting the importance of diet composition and to study potential sex-differences to understand long-lasting impact of dietary habits on behaviour and brain functions.

P18 - Prefrontal noradrenaline and flexible behavior: the surprise matters

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The capacity to flexibly modify our actions in order to seek goals relies upon specific brain regions and neurochemicals. In our most recent work [1], we showed that noradrenergic (NE) inputs from the locus coeruleus (LC) to the ventral and lateral parts of the orbitofrontal cortex (vlOFC), but not to the medial prefrontal cortex (mPFC), are required for updating action-outcome associations following reversal.

The aim of the current work was to investigate NE dynamics during instrumental reversal learning. To do so, rats were trained on a two-lever task, with one lever active and rewarded, the other inactive and unrewarded. Then, the outcomes of the two levers were switched.

At first, using fiber photometry and the NE-specific sensor $GRAB_{NE}$, we monitored NE activity in the vlOFC and in the mPFC at the time of the switch (i.e. day 1 of reversal learning). We observed an increase in vlOFC-NE activity following unexpected reward deliveries (positive surprises), a response that was particularly strong during the very first event and that *positively* correlated with the rats' performance of the following day. On the other hand, we observed a decrease in mPFC-NE activity, a response that was also particularly strong during the first event, but that *negatively* correlated with the rats' performance. Moreover, a significant and progressive increase in mPFC-NE activity was observed following inactive lever presses (negative surprises).

As a second step, we decided to chemogenetically silence LC:vlOFC NE projections on day 1 of reversal learning to test if inhibiting the NE response during the switch affected the pace of the behavioral adaptation. We found that, on day 2, while control rats already displayed a preference for the newly active lever and a similar latency to press the two levers, rats whose LC:vlOFC projections were silenced showed no preference and a much higher latency to approach the newly active lever.

Overall, our results add to the growing evidence of a modular LC architecture by showing divergent NE dynamics in close prefrontal subregions. Moreover, they provide initial evidence that NE signals both positive and negative prediction errors prior to behavioral adaptations and argue the existence of a causal relationship between vlOFC-NE and flexible behavior.

[1] J.-C. Cerpa*, A. Piccin* et al. (2023) Inhibition of noradrenergic signalling in rodent orbitofrontal cortex impairs the updating of goal-directed actions. eLife 12:e81623. *Co-first authors.

P19 - Risky decision making: behavioral implementation and potential neural substrates

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Motivated decision-making behaviors are part of everyday life in both human and animals. Faced with a choice where one of the two options provides the most interesting outcome but in an uncertain way, one need to evaluate the risk in order to make an optimal decision. However, in the environment the likelihood of an event occurring is changing, and a choice that was previously advantageous can become disadvantageous depending on the risk. Being flexible is therefore essential to adapt choices. The mediodorsal nucleus of the thalamus (MD) is a key structure for cognitive flexibility and goal-

directed behavior, and shares reciprocal connections with the orbitofrontal cortex, involved in risky decision process.
Our objective was to implement a "probabilistic discounting task" based on St Onge & Floresco (2009) to study the neural bases of risky decision making. In an operant cage, male rats had to choose between a "safe" lever, always delivering a small reward (1 pellet), and a "risky" lever that delivers a larger reward (4 pellets) but with various probabilities. After exploring several experimental conditions, we developed a version of the task in which the risky probability varied within a session (advantageous: 6/10 or disadvantageous: 1/10) in an ascending or descending manner between-subject. Our data indicated that rats performed 80% of risky choices for the advantageous probability. Conversely, when the probability became disadvantageous, rats switched toward safe choices making only 23% of risky choices. This applied in both ascending and descending situations, showing their capacity to adjust their choice according to the current level of risk to maximize rewards.
To investigate the role of the MD, we performed post-training NMDA lesions. Our preliminary data show that lesioned rats tend to make more risky choices at the disadvantageous probability than controls, but this effect is transient (first four days of test).
Further experiments are needed to confirm these data and provide a better understanding of the neural network underlying risky decision making in adaptive and maladaptive conditions as found in several neuropsychiatric disorders.

P20 - The role of olfaction in alloparental behaviors and its modulation by oxytocin

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Alloparental behaviors consist in a set of various actions to insure the survival of the pups, like nesting, retrieval, grooming, feeding... Naive virgin mice can already display maternal behaviors when pups are presented to them for the first time and they can get better quickly. This process, by which long or repeated exposition to pups triggers maternal behaviors in naive virgin mice has been called “sensitization” (Okabe et al, 2017). However, the neurobiological substrates of this phenomenon are still unclear.
Interestingly, the neuropeptide oxytocin (OXT) is known to play a role in maternal and alloparental behaviors by its central action (Ferguson et al, 2000). For instance, it was shown previously that oxytocin in the left auditory cortex promotes the onset of maternal behaviors such as pup retrieval (Marlin et al, 2015). In rats, blockade of oxytocin in the olfactory bulbs leads to reduced maternal behaviors (Yu et al, 1996). Moreover, the expression of the oxytocin receptor (OXTR) is higher in the olfactory bulbs and olfactory cortex (also called piriform cortex (PCtx)) of mothers, compared to naive females and males (Mitre et al, 2016), suggesting further an important role of olfaction during motherhood. These results open the possibility that in female mice, oxytocin modulates the onset of alloparental behaviors by its action at the level of olfactory areas (olfactory bulbs / piriform cortex).
The objective of this project is to assess the role of olfaction in the establishment of alloparental behaviors, especially nesting and retrieval, in female mice and understand how it could be modulated by oxytocin. We made the hypothesis that pups’ odor is essential to activate brain areas involved in the onset of alloparental behaviors, for which the link with olfaction has not been much investigated yet. Our first results suggest that pups' vocalizations may not be the main cue that triggers retrieval in

dams. Interestingly, in virgin mice, olfaction is involved in the pups' care strategy, as mice that are presented with a pup, whose odor was covered and modified, started to nest later and tended to retrieve the pup close to the cotton before building the nest. Moreover, olfaction and nesting seem even more closely linked, as systemic injection of an oxytocin receptor antagonist (OTA) increased sniffing in naive mice which seemed to favor nesting over retrieval.

P21 - Sensory hyposensitivity and neocortical alterations in the Fmr1$^{-/y}$ mouse model of autism during a perceptual decision-making task

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Altered sensory experience is one of the core features of autism spectrum disorder (ASD), a neurodevelopmental disorder characterized by alterations in social communication and repetitive behaviors. Sensory alterations affect approximately 90% of autistic individuals, exert a strong negative influence on day-to-day life and contribute to the development of other core symptoms and medical conditions that co-occur with autism. Touch is particularly crucial during development, with a strong role in defining the self, exploring the environment, and building the foundations of social interactions. Tactile alterations in autistic individuals include differences in stimulus perception (perceptual sensitivity), reactions to perceive stimuli (affective reactivity to sensory input), and sensory-related neural excitability. Better understanding and synthetizing these features is crucial in characterizing altered tactile experience in autism and can provide insight into the development of other core features.
In this study, we aimed to characterize tactile alterations in Fmr1$^{-/y}$ mice, a genetic mouse model of autism. To study perception at the behavioral and neuronal level, we developed a novel perceptual decision-making task based on vibrotactile stimuli that can be can be combined with measurements of neuronal activity and translated in human studies. Our findings show slower acquisition of the task for Fmr1$^{-/y}$ mice and recapitulate the alterations observed in autistic individuals, with higher detection thresholds leading to perceptual hyposensitivity of vibrotactile stimuli of differing intensities in the flutter range. Notably, increased inter-individual variability in the detection thresholds was observed in the responses of Fmr1$^{-/y}$ mice, as was previously reported in autistic individuals. Parallel *in vivo* calcium imaging recordings of neuronal activity of excitatory and inhibitory neurons in the somatosensory cortex revealed that different patterns of activity in the Fmr1$^{-/y}$ mice underlie perceptual alterations. Aiming to examine changes in affective reactivity to sensory input, a parallel approach was adopted, also showing hypo-reactivity in Fmr1$^{-/y}$ mice. These results help us expand our knowledge of tactile alterations in autism and contribute in our goal to develop objective biomarkers that can be used to test mechanism-based treatments in preclinical models and can also be translated in human studies.

P22 - Subcortical correlates of the social tolerance scale in the macaca genus

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Relying on years of ethological studies of the Macaca genus, 23 species have been ordered on a 4grade social tolerance scale. This scale is based on 18 covariant behavioural traits such as counteraggression and reconciliation rates of each species that are ordered from low (Grade 1, such as M. mulatta) to high social tolerance (Grade 4, such as M. tonkeana). To date, the neuroanatomical correlates of interspecific variability in macaques' social behaviours are unknown. To explore the existence of such a link, we have established a unique collection of 36 post-mortem samples from 12 species of macaques that have been scanned in Strasbourg (7T MRI) or gathered from existing databases (PRIMate Data Exchange, Japan Monkey Centre, 9.4T MRI, Oxford University). We studied the subcortical anatomy (SARM atlas) of these samples in light of recent knowledge about primates' social brain. Previous studies in M. mulatta have shown that the volume of subcortical regions (e.g. amygdala, striatum, or raphe nucleus) can correlates with social variables (e.g. individual's hierarchical rank or group size). We thus hypothesize that volumetric variations of subcortical regions belonging to the social brain, should reflect the level of tolerance of the species studied. Some volumes variations of ROIs such as the amygdala, a region that has a prevalent impact in the subcortical social brain expression and perception of emotions were consistent with the social grade, with Grade 4 having bigger nuclei than Grade 1 species. These results represent the first insights about the cross-species neuroanatomical correlates of social behaviours variations in primates and pave the way for further investigations related to the evolution of primates' social brain.

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P23 - Role of hippocampal CA2 beyond social memory : exploring a potential role of CA2 in reward encoding and goal-oriented remapping in the hippocampus.

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Hippocampal place cells fire at discrete locations as subjects traverse space, thereby providing an explicit neural code for current location during locomotion. However, this cognitive spatial map is not a homogeneous representation of the physical environment. Interestingly, place fields tend to accumulate next to salient cues such as a reward zone, an escape platform or odor cues. Moreover, several studies demonstrated that place cells shift their place fields towards reward locations during learning, a phenomenon called goal-oriented remapping. The mechanisms underlying the establishment of this biased mapping are very little understood.
Recently, the CA2 region of the Hippocampus was demonstrated as being physiologically and morphologically different from the regions CA1 and CA3. In the last decade, CA2 was shown to play a key-role in social memory. While other, even more recent works suggest a more general role of CA2 in hippocampus-dependent memory processing beyond social memory. Notably ,encoding position during immobility, generating ripple oscillations and novelty sensitivity.
Interestingly, the previously observed, specific increase in activity of a subpopulation of CA2 cells during immobility was concomitant to reward consumption, suggesting that this subpopulation might be involved in reward encoding. We hypothesize that CA2's possible sensitivity to reward and novelty signals might be leading to the directed remapping of CA1 population code towards goal locations. Therefore, my PhD project is focused on revealing the role of CA2 in reward encoding and goal directed remapping in CA1, using in vivo high-density electrophysiologic recordings during a spatial-navigation task in a circular maze and optogenetic technics to specifically identify CA2 pyramidal neurons.

P24 - Contribution of insular cortex to value- versus cue-guided choice

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Every day we make choices between different actions. But what guides these choices? While we typically select actions based on our current needs or desires, choice can also be influenced by environmental cues. Cues signalling food, for example, can guide us towards a food source and can also induce cravings even when we're not hungry. Here, we use two carefully designed behavioural paradigms (instrumental outcome devaluation and Pavlovian-to-instrumental transfer) to dissect choice situations that are driven by the value of outcomes versus situations where choice is instead guided by predictive cues. Using a chemogenetic approach, we show that IC is required for both value- and cue-guided choice. We then use an innovative trans-synaptic anterograde viral approach to

investigate if value- and cue-guided choices are supported by distinct IC pathways. Specifically, we inhibited either nucleus accumbens or mediodorsal thalamic cells receiving IC input during the choice period. Our results show that a cortico-striatal pathway (IC to nucleus accumbens) is required for both value- and cue-guided choice, whereas a cortico-thalamic pathway (IC to mediodorsal thalamus) is necessary only for cue-guided choice.

Practical Information

Conference venue

The conference will take place at
Centre Broca Nouvelle-Aquitaine
Bordeaux Neurocampus
Campus Carreire
Bordeaux

The Centre Broca is located on the Bordeaux University campus ; it has a direct access from the airport and from Bordeaux city center by the tramway in less than 20 minutes.

How to get there?

Location on Google map:
https://goo.gl/maps/p4JE9mnJVMQ9hzz5A

By tram : Tram stop "Saint Augustin".
Take the tramway line A.
From the city center of Bordeaux > Direction: “Pin Galant”, “Hailland Rostand" or “Airport”.
From the airport: any direction.

The Centre Broca is an 8 min walk from the tramway station. Take the white path that goes under the huge chimney and walk until the end. The location will be indicated.

Access details:
https://www.bordeaux-neurocampus.fr/qui-sommes-nous/contacter-neurocampus

GPS:
44.810012 / -0.59645

By taxi
Give the address “38 rue Albert Marquet” or “14 rue Eugène Jacquet”

By car: Enter on the campus at “125 rue Bethman” then park your car at the **P1**

Closest Campus entrances:
Close to 38 rue Albert Marquet or 14 rue Eugène Jacquet

Transportation in the city

You can use the app “TBM”

You can buy a ticket at the tram stops or use the app **“TBM”** on your phone:
https://www.infotbm.com/en/fares/tbm-m-ticket-your-tickets-your-smartphone.html

To use your “tickarte”, just validate each time you get into the tram or bus.

Posters

List of posters:
https://brainconf.u-bordeaux.fr/en/Program/List-of-posters/r1775.html

You will be presenting a poster?
Please note that maximum size is: 1.20m long x 1.60 high (vertical)

Wifi

Access through **Eduroam** will be possible.

Wifi connection will be available at the BROCA Centre

Coffee and lunch

A welcome coffee will be served every morning before the talks.

Coffee, tea and refreshments will be available during morning and afternoon breaks.

Lunches will be taken at the conference venue.

Gala dinner

Wednesday, September 27th
Shuttle at 6:30pm from Hotel Normandie*
Visit from 7pm*
Dinner at 7:45pm
** On registration on Day 1*

Only for registered participants

Château Luchey-Halde is located in the heart of Bordeaux, in the prestigious Pessac-Léognan appellation, and benefits from an exceptional terroir.

It is constituted of several ridges which contain gravel, pebbles and fine soil deposited by the Garonne River and its tributaries between the end of the Tertiary and the beginning of the Quatenary periods. It is a poor but well-drained soil perfectly adapted to winegrowing in the oceanic climate of Bordeaux.

www.luchey-halde.com

How to get there?

- Shuttle for Hotel Normandie : more details on Tuesday

- By tram : line A – Stop: "Fontaine d'Arlac" stop (10 min by walking)

- By taxi : adresse is "17 avenue du Maréchal Joffre – Mérignac»

Phone numbers :
Chateau: +33 (0)5 56 45 97 19
Arnaud / Marine: +33 (0)6 03 81 61 36

No dress code
More details will be given during the conference

Organization

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Any question before the event?

You can send an email to brainconf@u-bordeaux.fr
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Staff during the event

Marine Boussicault
Nolwenn Cloarec
Claire Delattre
Arnaud Rodriguez
… and all the volunteers!

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