Champalimaud Research

Annual Report 2019

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The Champalimaud Centre for the Unknown integrates research and clinical operations, under Champalimaud Research and the Champalimaud Clinical Centre (respectively), with the objective of developing cutting edge research side by side with excellent patient care.

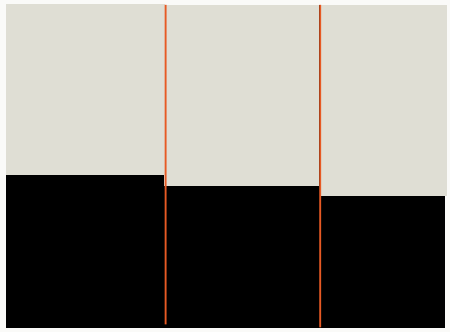
The goal of Champalimaud Research (CR) is to perform world-leading fundamental and translational research. Current research work is focused on the fields of neuroscience, physiology and cancer.

As of 2019, CR hosts three programmes that explore the core research areas of the Foundation:

- ▲ Champalimaud Neuroscience Programme
- ● Champalimaud Physiology and Cancer Programme
- ⬣ Champalimaud Experimental Clinical Research Programme

A Research Direction Team was appointed to coordinate this endeavour. It is comprised of three scientific directors representing the three programmes: Joe Paton, Henrique Veiga-Fernandes and Celso Matos. Together, the team will carry out the scientific aim of the Champalimaud Foundation: to explore new avenues of investigation, while reinforcing the links between research and clinical activities.

10



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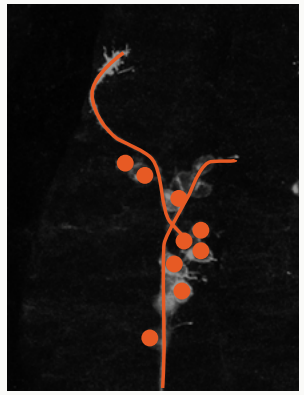

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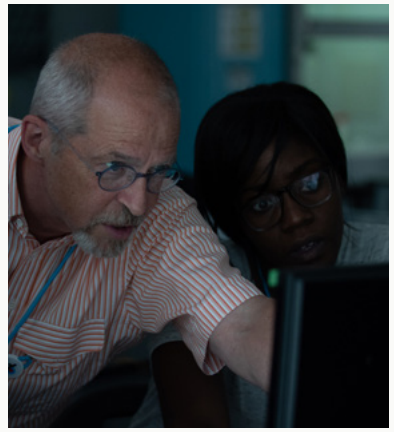

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Content

The Foundation

Through scientific breakthroughs and clinical developments, the Champalimaud Foundation is there to help those who need it most.

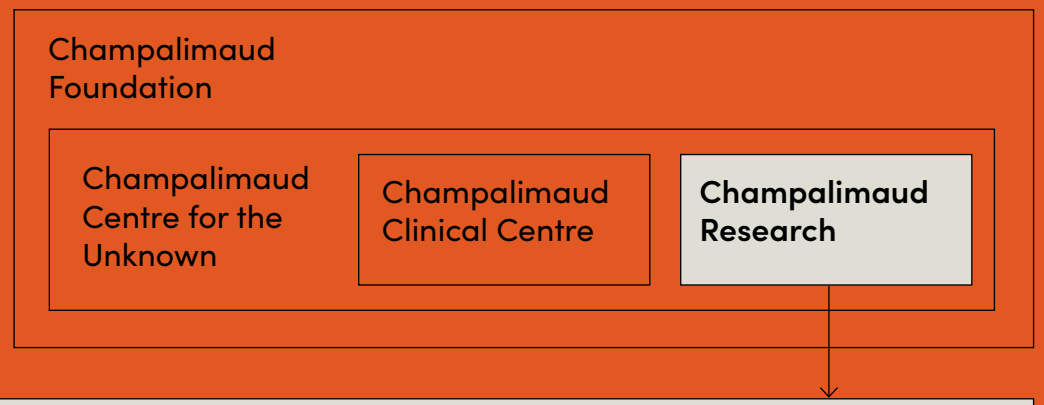
Leonor Beleza, President
João Silveira Botelho, Vice-president (right)
António Horta-Osório, Non executive director (left)

The Champalimaud Foundation exists as the legacy of Portuguese entrepreneur and industrialist, the late António de Sommer Champalimaud. It was formally created in 2005 under the full title: Anna de Sommer Champalimaud and Dr. Carlos Montez Champalimaud Foundation. Thus, honouring the benefactor's parents, with Leonor Beleza as President, as set out in the will of António Champalimaud. The Foundation gives full backing to its researchers who work on the frontline of science and biomedicine. Its scientists and doctors use their creativity, experience and talents to find new and innovative ways to approach the many questions of modern neuroscience and oncology.

In September 2018, during the António Champalimaud Vision Award ceremony, the Champalimaud Foundation announced the creation of the first pancreas cancer research and treatment centre in the world.

Mauricio Botton Carasso and his wife, Charlotte Botton, decided to work with the Champalimaud Foundation, contributing 50 million euros to build an innovative facility where scientists, doctors and physician-scientists can work together to advance knowledge, take control and fight the hitherto irreducible character of a disease that has defied science for decades.

Structure



Champalimaud Research

Direction Team

Celso Matos, Henrique Veiga-Fernandes, Joe Paton

Research Groups

Experimental Clinical Research ⬣

Mireia Castillo
Durval Costa
Rita Fior
Cristina João
Markus Maeurer
Albino Oliveira-Maia
Nickolas Papanikolaou
Noam Shemesh

Physiology & Cancer ●

Bruno Costa-Silva
Adriana Sánchez Dánes
Eduardo Moreno
Christa Rhiner
Henrique Veiga-Fernandes

Neuroscience ▲

Megan Carey
Eugenia Chiappe
Rui Costa
Gonzalo de Polavieja
Susana Lima
Christian Machens
Zachary Mainen
Marta Moita
Michael Orger
Joe Paton
Leopoldo Petreanu
Alfonso Renart
Carlos Ribeiro
Maria Luisa Vasconcelos

CR SAB *

Regular members
J. Anthony Movshon
Martin Raff

2019 members
Gilles Laurent
Michael Shadlen
Rainer Friedrich
Thomas Clandinin
Yang Dan

Support Units

Direction Support
Events
Human Resources & Fellows
Support Office
Lab Administration
Pre-award
Post-award

Scientific & Technological Platforms

Fish
Flow Cytometry
Fly
Glasswash & Media Preparation
Histopathology
Microscopy
Molecular & Transgenic Tools
Rodent
Scientific Hardware
Scientific Software

Science Communication

Institutional communication
Outreach

Education

Direction
Coordination
Teaching Lab
Education & Courses

Graduate Programme SAB *

Carlos Belmonte
Gilles Laurent
Alessandro Treves

* The Scientific Advisory Board consist of external scientists who provide helpful guidance to CR Programmes and Research Groups.

Growth and diversity

The CR grew by nearly 100 new members since last year! This increase was the result of the association of clinical research groups, previously solely affiliated with the Champalimaud Clinical Centre, to CR.

By maintaining their links with the clinic, while establishing new ones with the fundamental research department, the new Experimental and Clinical Research Programme is well poised to persue its goals in the field of translational research.

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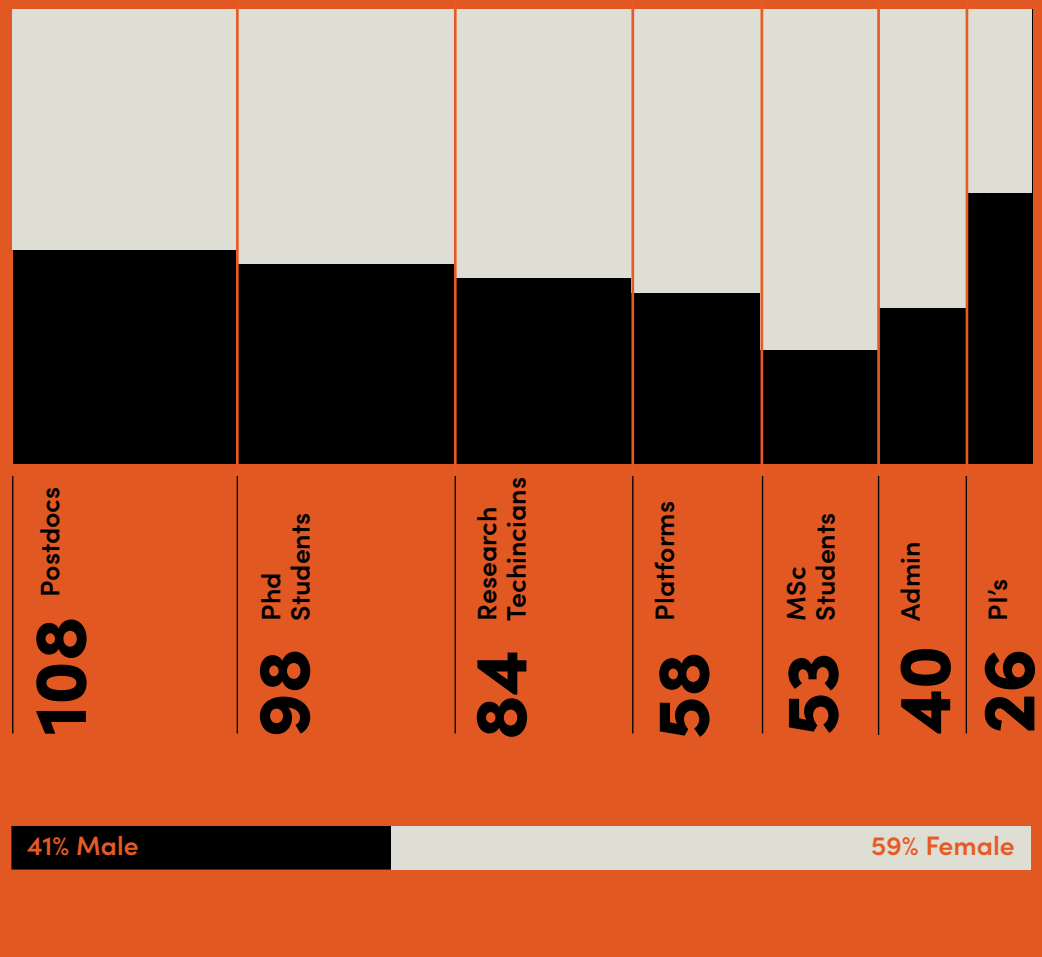
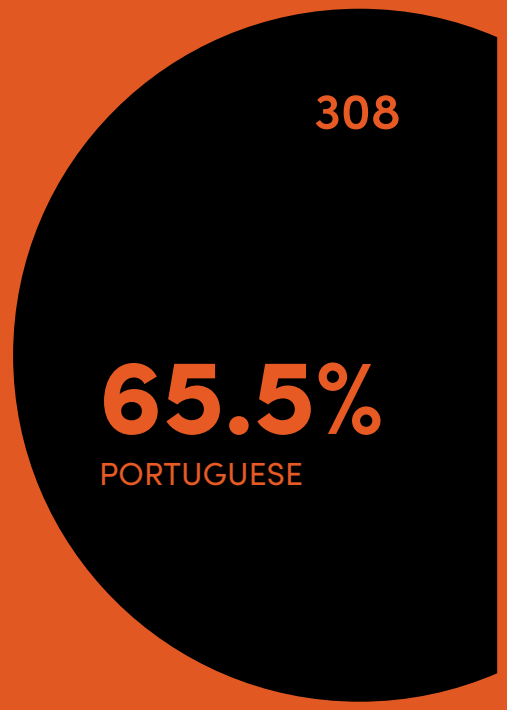
CR MEMBERS





34.5%
NON PORTUGUESE

35

NATIONALITIES

Angola
Argentina
Australia
Austria
Belgium
Brazil
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Cape Verde
Chile
Colombia
Croatia
Ecuador
Finland
France
Germany
Greece
India
Israel
Italy
Jamaica
Japan
Lesotho
Mauritius
Norway
Philippines
Poland
Portugal
Romania
Spain
Switzerland
The Netherlands
Turkey
United Kingdom
United States of America
Venezuela

CR Community

Alentejo, 2019

Exploring new avenues of investigation, while reinforcing the links between research and clinical activities.

Research Groups

▲	●	⬢
Neuroscience	Physiology & Cancer	Experimental & Clinical Research

Megan Carey

Neural Circuits & Behaviour

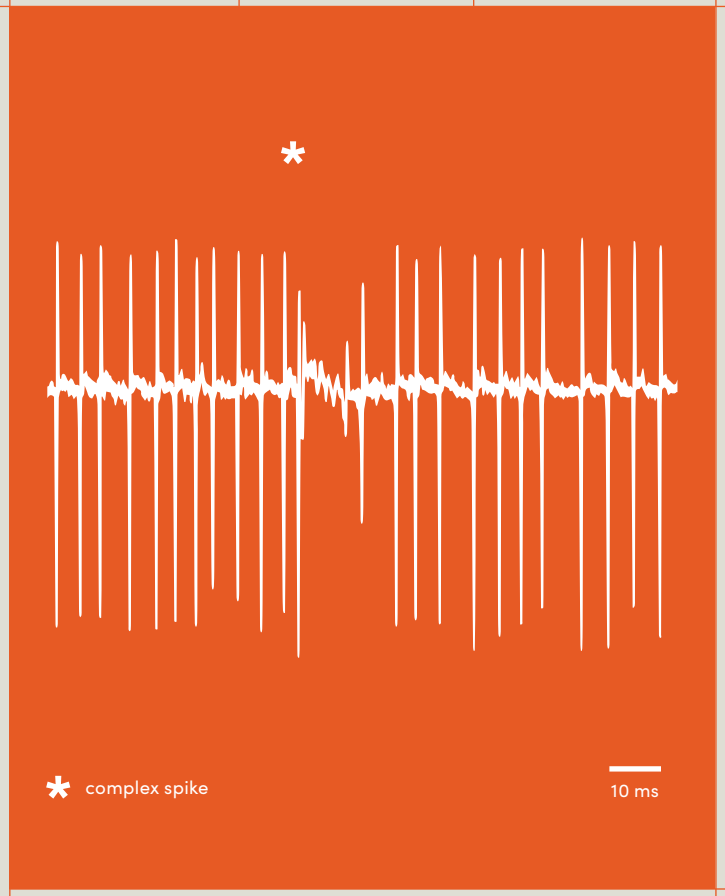
Models	Brain Regions	Research Methods
Rodent	Cerebellum	Quantitative behavioural analysis; Optogenetics Chemogenetics; Electrophysiology

Postdoctoral Researchers
Ana Machado
Catarina Albergaria
Dana Darmohray
Hugo Marques
Jorge Ramirez

PhD Students
Ana Gonçalves
Diogo Duarte
Jovin Jacobs
Tatiana Silva
Rita Félix (Co-Sup with Michael Orger)

MSc Student
Leonard Dupont

Research Technicians
Catarina Almeida
Marta Maciel
Virginia Casasnovas



A cell-attached *in vivo* electrophysiological recording from a mouse cerebellar Purkinje cell reveals two kinds of action potentials: frequent simple spikes, and the occasional 'complex spike' (marked with an *) that gives rise to large increases in postsynaptic calcium.

Credit: Jorge Ramirez, Carey lab

careylab.org

How the brain generates and controls coordinated movement

The Neural Circuits and Behaviour lab studies the cerebellum, a brain area that is critical for coordinated motor control and motor learning. The well-described cerebellar circuit is conserved across species, which enables the researchers to study it in mice, a powerful animal model that offers an array of genetic tools for measuring and manipulating activity in specific populations of neurons. In some cases, these manipulations mirror neural conditions that exist in humans who suffer damage to the cerebellum through illness or injury.

In 2019, the lab published an innovative study, where they reported remarkable similarities between the way humans and mice learn to adapt their manner of walking. In addition, in that same study, the researchers identified a site in the brain that controls the two components crucial for mastering this task - space and time.

"Several exciting things happened in 2019. Among these, I would highlight a couple of events. The first is publishing a new research article in the journal Neuron, where we reported striking similarities between human and mouse locomotor learning and localised a brain area that controls the temporal and spatial components of walking.

Another highlight was Chairing the 2019 Gordon Research Conference on the Cerebellum, a top conference in our field, which took place in Switzerland in July.

Finally, my lab received a Consolidator Grant from the European Research Council (ERC). This generous grant will allow us to continue investigating how the activity of neurons throughout the brain produces learned and coordinated movements."

Spatial and temporal locomotor learning in mouse cerebellum.
Darmohray DM, Jacobs JR, Marques HG, Carey MR. Neuron. 102(1):217-231.e4. doi: 10.1016/j.neuron.2019.01.038

Eugenia Chiappe

Sensorimotor Integration

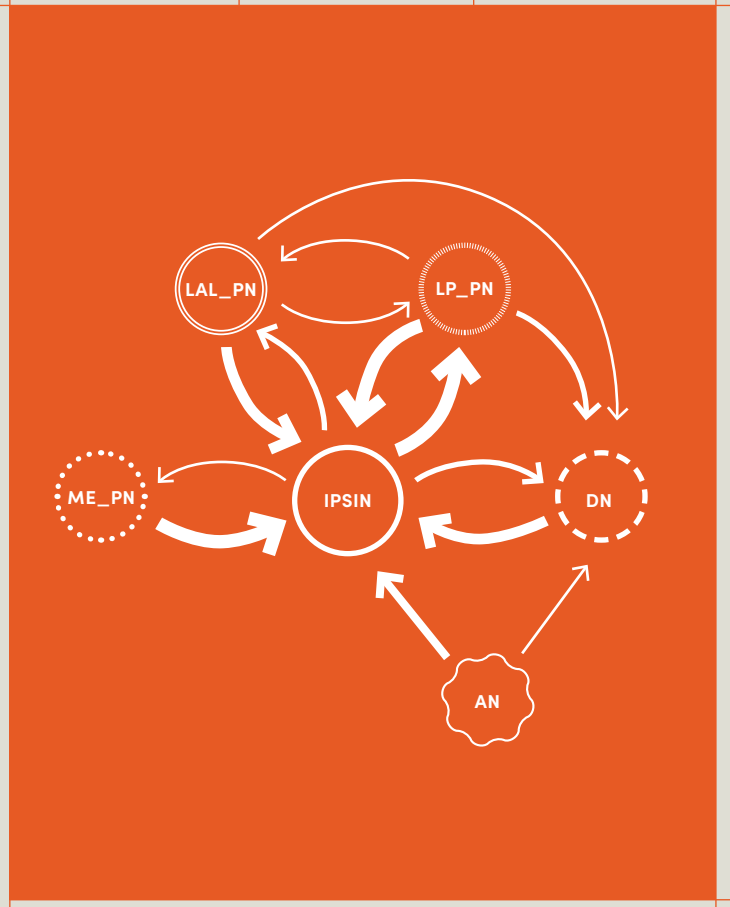
Models	Brain Region	Research Methods
Fruit fly	Sensory; Premotor and motor areas	Electrophysiology; Optical tools; Behaviour; Virtual reality; Whiteboard; Literature

Postdoctoral Researchers
João Marques
Paavo Huoviala
Terufumi Fujiwara

PhD Students
André Marques
Mert Erginkaya
Miguel Paço
Nuno Rito
Tomás Cruz

MSc Student
Mara Bruhns

Research Technicians
Margarida Brotas
Nélia Varela
Saliha Ece Sönmez
Sebastián Malagón Pérez
Wynne Stagnaro



Using data obtained from an Electron Microscope, we have identified and reconstructed a small network contributing to head-body coordination during locomotion. The network is highly recurrent, and contains critical interneurons (IPSIN) that connect to premotor (LAL_PN) and visual (Me_PN and LP_PN) areas of the fly brain, as well as to neck and ventral nerve cord circuits (the spinal cord of insects).

chiappelab.org

The computational principles that govern motor and sensory coordination for the control of goal oriented locomotion

The research strategy of the Sensorimotor Integration lab focuses on connecting neural activity dynamics to internal representations of the brain to the locomotive behaviour of the fruit fly, *Drosophila melanogaster*. The researchers employ multiple methods to record and reversibly perturb neural activity in behaving flies, to analyse the structure of interconnected neurons, to quantify different aspects of the fly's locomotive behaviour, and to model functional networks. This multidisciplinary approach, together with the ever-expanding genetic toolkit of the fruit fly, allows the team to find mechanistic explanations for how multi-sensory and sensorimotor integration processes in the brain are used to guide adaptive behaviour.

"In 2019, we published the results of an exciting new study in a preprint, where we identified that visual networks contribute to the stability of locomotion in a context-dependent manner. Specifically, in a context that is defined by the internal motor state and the goals of the fly. This work suggests models for how visual feedback is combined with internal signals to guide exploratory course control.

We also welcomed new researchers into the lab, three doctoral students - André Marques, Miguel Paço and Nuno Rito, and two postdocs - Paavo Huoviala and João Marques."

Motor context coordinates visually guided walking in drosophila. *Cruz, T, Fujiwara, T, Varela, N, Mohammad, F, Claridge-Chang, A, and Chiappe, ME. bioRxiv 572792. doi: https://doi.org/10.1101/572792*

Rui Costa

Neurobiology of Action

Models	Brain Regions	Research Methods
Rodent Human	Basal ganglia Orbitofrontal cortex	Optogenetics; Electrophysiology; Behaviour

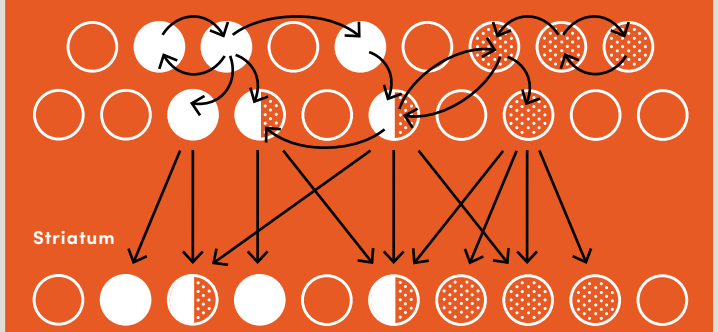
Postdoctoral Researchers
Ana Cruz
Andreas Klaus
Catarina Carvalho
Cristina Afonso
Cristina Álcacer
Daniela Pereira
Joaquim Alves da Silva
Nicolas Morgenstern
Rodrigo Oliveira
Vitor Paixão

PhD Students
Ivo Marcelo
Michael Pereira (Co-Sup with Christian Machens)
Marcelo Mendonça (Co-Sup with Steven Kushner, Erasmus MC)
Nuno Loureiro (Co-Sup with José del R. Millán, University of Texas)

MSc Students
Ana Isidro
Sara Abalde

Research Technicians
Sofia Marques
Maria Inês Almeida

Visiting Researchers
Jonathan Tang
Loredana Stoica



Data suggests that neurons in the striatum that are coactive during the same action, share inputs from the cortex.
Circles with white markings represent neurons related to two different actions (dotted and solid white, respectively).

This schematic was adapted from: Klaus et al., Annu Rev Neurosci. 2019.

costa-lab.org

How the brain generates and selects actions

The Neurobiology of Action lab studies how the basal ganglia is involved in motor planning and decision making. This brain area interacts with several cortical areas, being fundamental for movement control and learning. This essential role is reflected in how dysfunctions in these brain areas result in important neural disorders such as Parkinson's and Huntington's disease and obsessive-compulsive disorder. By using a cross-level approach, from molecules to neural circuits, work developed in the Neurobiology of Action lab has contributed to expanding the knowledge of this field, with groundbreaking findings challenging and updating the previously held perceptions regarding the role played by basal ganglia subcircuits in movement.

"Among this year's publications, I would like to highlight a research article published in the journal Molecular Psychiatry titled 'Differential effects of Foxp2 disruption in distinct motor circuits' and a perspective article published at the Annual Review of Neuroscience titled 'What, If, and When to Move: Basal Ganglia Circuits and Self-Paced Action Initiation'."

Differential effects of Foxp2 disruption in distinct motor circuits. *French CA, Vinueza Veloz MF, Zhou K, Peter S, Fisher SE, Costa RM, De Zeeuw CI. Mol Psychiatry. 2019 Mar;24(3):447-462. doi: 10.1038/s41380-018-0199-x.*

What, If, and When to Move: Basal Ganglia Circuits and Self-Paced Action Initiation. *Klaus A, Alves da Silva J, Costa RM. Annu Rev Neurosci. 2019 Jul 8;42:459-483. doi: 10.1146/annurev-neuro-072116-031033.*

Gonzalo de Polavieja

Collective behaviour

Models	Brain Regions	Research Methods
Zebrafish Human	Whole brain	Behaviour; Mathematical modelling; Machine learning

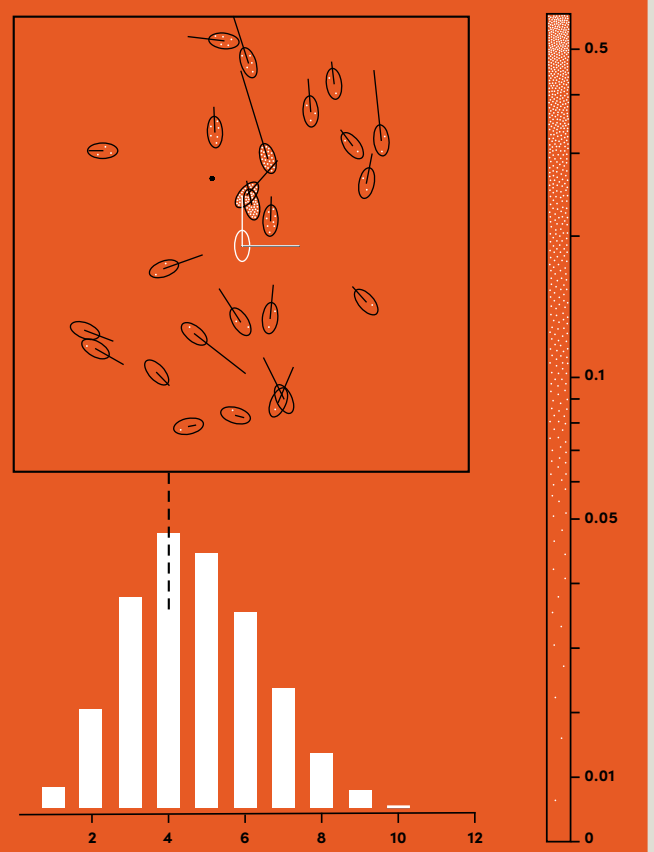
Research Scientist
Fernando Martin-Maroto

Postdoctoral Researchers
Francisco J. Heras
Georgios Korpas

PhD Students
Antonia Groneberg (Co-Sup with Michael Orger)
Francisco Romero
Marta Iglesias
Tiago Costa (Co-Sup with Alfonso Renart)
Victoria Brugada

MSc Students
Cátia Fortunato
Ines Wichert
Renata Cruz

Research Technician
Nuno Ferreira



Applying deep attention networks as a way to model fish collective behaviour, we found that each animal has a small number of relevant neighbours out of the total number of fish in the group. Also, this number changes in time depending on the behaviour of neighbours.

Taken from Heras et al. 2019.

polaviejalab.org

Collective behaviour and machine learning

At the Collective Behaviour lab, a multidisciplinary team that includes mathematicians, physicists and biologists implements a diverse set of computational and behavioural tools. The research focuses on two problems. The first one consists in understanding the rules of collective decision-making and motion. Both the data gathering process and modelling tools make heavy use of machine learning techniques that we adapt to study behaviour and brain activity. The second problem the lab studies is in finding mathematical approaches to learning from data and prior knowledge and that is transparent to mathematical analysis.

"In 2019, we published an AI-based tracking software called idtracker.ai, in which we adapted deep learning to better acquire behavioural data of multiple animals in groups. This software was used in another publication that came out that same year. In that study, we demonstrated that collective motion of individuals in a group can be modelled in a way that is very predictive and insightful."

idtracker.ai: tracking all individuals in small or large collectives of unmarked animals. *Romero-Ferrero F, Bergomi MG, Hinz RC, Heras FJH, de Polavieja GG. Nature Methods. 16(2):179-182. doi: 10.1038/ s41592-018-0295-5.*

Deep attention networks reveal the rules of collective motion in zebrafish. *Heras FJH, Romero-Ferrero F, Hinz RC, de Polavieja GG. PLoS Comput Biol. 15(9):e1007354. doi: 10.1371/ journal.pcbi.1007354.*

Susana Lima

Neuroethology

Models	Brain Regions	Research Methods
Rodent	Hypothalamus Ventral tegmental area	Electrophysiology; Optogenetics; Anatomy; Behaviour

Postdoctoral Researchers
Bertrand Lacoste (Co-Sup with Christian Machens)
Constanze Lenschow
Francisco Esteves
Jonathan Cook
Luís Moreira
Nicolas Gutierrez

PhD Students
Ana Rita Mendes
António Dias
Basma Husain
Baylor Brangers (Co-Sup with Zachary Mainen)
Silvana Araújo
Susana Valente

Research Technicians
Liliana Ferreira
Margarida Duarte

The ventromedial hypothalamus is a brain area important for integrating hormonal information and social cues. Using a viral-based strategy, we were able to identify direct inputs across the entire mouse-brain into a group of neurons that express progesterone receptors in this area. This illustration depicts positive staining (dots) in a small sample from a series of more than 100 slices, which spans the whole brain.

lima-lab.org

How the brain controls key processes in sexual behaviour

The Neuroethology lab focuses its efforts on understanding the mechanisms that ensure sexual behaviour is promoted when fertilization is most likely to occur and inhibited otherwise. For one, as the willingness of females to engage in sex is limited to periods of fertility, the team investigates how sex hormones modulate neural activity and behaviour throughout the female reproductive cycle. Second, the team also studies the mechanisms that ensure termination of sexual interaction in males: the post-ejaculatory refractory period.

To gain insight into how the brain controls these fundamental processes, the team works on several brain regions, but most of their efforts are centred on the medial hypothalamus, an area that is of particular importance for female sexual behaviour. In addition, in order to understand how the refractory period after ejaculation is established in the male, the lab is also investigating the spinal cord mechanisms that control ejaculation. Despite the importance of ejaculation for species maintenance and well-being, very little is known about how this process is controlled.

"During 2019 the lab was joined by a new postdoctoral fellow, Jonathan Cook. Jonathan completed his PhD at the Salk Institute under the guidance of Ed Callaway and Xin Jin where he investigated how action timing is implemented in the brain. During his stay at the Neuroetholgy lab he is going to investigate the role of the medial preoptic nucleus for the execution of sexual behaviour. For this, Jonathan will record the neuronal activity of hypothalamic neurons in behaving animals in order to understand how activity within this area can support the proper execution of this behaviour."

Christian Machens

Theoretical Neuroscience

Models	Brain Regions	Research Methods
Monkey Rodent Zebrafish	Frontal lobes Visual cortex Auditory cortex Striatum Hindbrain	Mathematical analysis; Numerical simulations

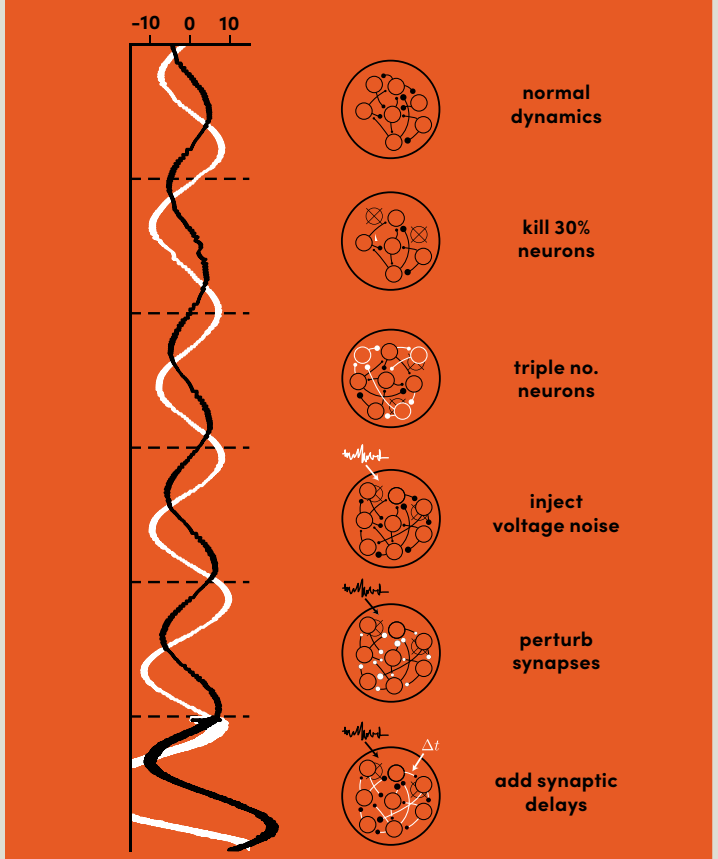
Postdoctoral Researchers
Adrien Jouary (Co-Sup with Michael Orger)
Sander Keemink
Bertrand Lacoste (Co-Sup with Susana Lima)
William Podlaski

PhD Students
Allan Mancoo
Gonçalo Guiomar (Co-Sup with Joe Paton)
Michael Pereira (Co-Sup with Rui Costa)
Oihane Horno (Co-Sup with Leopoldo Petreanu)
Nuno Calaim
Severin Berger

Research Technician
Joana Carmona

MSc Student
Amber Brands

Visiting Researcher
Mirjana Maras



Unlike man-made machines, biological systems such as the brain are robust to many perturbations and even their partial destruction. Shown here is a simulation of a neural network that maintains its functionality - generating an oscillation - despite the death of neurons, increased levels of voltage noise, perturbations of synaptic connections, etc.

machenslab.org

Formulating computational theories of brain function and animal behaviour

To develop models of information processing in the brain, the Theoretical Neuroscience lab uses mathematical analysis and numerical simulations. These tools allow the researchers to formulate their ideas and intuitions in a precise manner and thereby put them to test using real data. Specifically, the team focuses on several 'higher-order' regions such as the frontal cortices that are involved in turning sensory information into decisions.

The team is comparing experimental data across different species and brain areas in order to find common principles of how information is being represented in the brain. The team also engages in the development of new methods to summarise the activity of neural populations in useful ways and to compare population activity across areas. They work in close collaboration with several experimental labs, both within and outside of the Champalimaud Centre for the Unknown.

"In 2019, I had the privilege of co-organising the most important conference in the field of theoretical neuroscience - Cosyne, which was held in Lisbon for the first time this year.

The thesis work of João Semedo, a former doctoral student in the lab who graduated in 2018, was published in the journal *Neuron* in April. Several months later, Nuno Calaim, another doctoral student, defended his PhD thesis titled 'Robustness of spike coding networks'."

***Cortical areas interact through a communication subspace**. Semedo JD, Zandvakili A, Machens CK, Yu BM, Kohn A. Neuron. 102(1):249-259.e4. doi: 10.1016/j.neuron.2019.01.026.*

Zachary Mainen

Systems Neuroscience

Models	Brain Regions	Research Methods
Rat Mouse Human	Cortex Raphe nuclei	Optogenetics; Theory; Behaviour; Electrophysiology

Postdoctoral Researchers
Cindy Poo
Fanny Cazettes
Gautam Agarwal
Guido Meijer
Hanne Stensola
Julia Huntenburg
Mattia Bergomi
Romain Ligneul
Tor Stensola

PhD Students
Baylor Brangers (Co-Sup with Susana Lima)
Pietro Vertechi
Dario Sarra
Kcénia Bougrova
Madalena Fonseca (Co-Sup with Noam Shemesh)
Solène Sautory (Co-Sup with Leopoldo Petreanu)
Tiago Quendera (Co-Sup with Albino Oliveira-Maia)

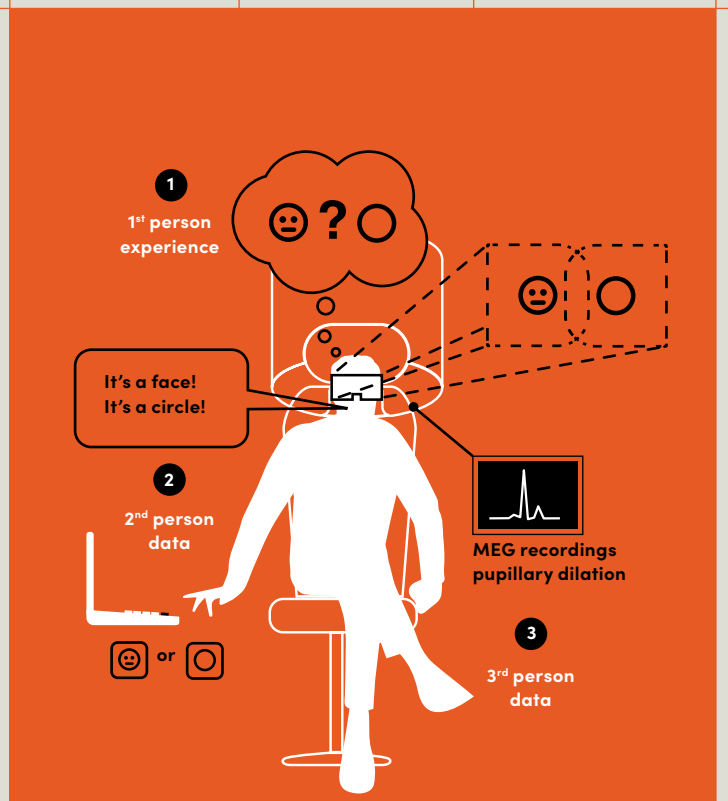
MSc Students
José Miguel Teixeira
João Morais

Senior Technicians
Olivier Winter
Niccolo Bonacchi

Research Technicians
Eleni Smaradgi
Inês Laranjeira
Lucas Soares
Megha Patwa
Beatriz Godinho
Margarida Duarte

Intern
Sofia Morou

Lab Manager
Catarina Pimentel



Experiments in cognitive science using human subjects rely on first-person experience, even if they try to reduce its inherent subjectivity by operationalising it with more objective third-person methods (EEG, pupil dilation, etc.). Still, experiments depend on the reports through which subjects, acting as sensors, intentionally communicate their experience to the experimenter. Rigato, Rennie and Mainen argue that the importance of these reports, which they name second-person methods, should be acknowledged.

mainenlab.org

How brains use perceptual information to create and act on models of the world, the role of confidence, uncertainty and neuromodulators in these processes

Until recently, most research on cognitive phenomena, such as perception and decision-making was done mainly in human and non-human primates. Together with a handful of colleagues, Mainen, head of the System Neuroscience lab, has helped to show that rodents, in fact, share many of primates' cognitive abilities. Indeed, in 2008, his lab was the first to discover neural activity that reflected decision confidence in any species, a feat that was done in rats.

Though research projects with human subjects have more recently started in the lab, this approach still dominates the Systems Neuroscience lab today, where rodents are the stars, allowing the use of advanced genetic and molecular tools not available in humans and non-human primates. Using these tools, the team is able to combine multiple techniques, which allow them to record and manipulate the neural circuits that control confidence and decision-making in relevant brain regions, such as the cortex and the midbrain. The team places a major focus on the midbrain serotonin system, which they believe to play a key role, along with other neuromodulators, in regulating learning and decision-making. Theory and modelling are also a vital component of the work done in the lab because of the inherent complexity involved.

The members of the Systems Neuroscience lab are a diverse group, with backgrounds ranging from biology to mathematics, engineering and even philosophy. Lab members also count on collaborations with many groups at the CR.

"In 2019, the Wellcome Trust awarded the International Brain Laboratory (IBL) 10 Million BP. These generous funds will support IBL in its effort to understand brainwide circuits for complex behaviour. The consortium counts with 21 labs around the world, including ours. We are looking forward to the next phase of this challenging and exciting endeavour."

Marta Moita

Behavioural Neuroscience

Models	Brain Regions	Research Methods
Rat Fruit fly	Amygdala Auditory thamalus Cortex	Development of behavioural tasks; Genetics; Optogenetics; Physiology to study neuronal circuits

Postdoctoral Researchers
Andreia Cruz
Anna Hobbiss (Co-Sup with Cesar Mendes, CEDOC)
Clara Ferreira
Natalia Barrios
Ricardo Neto Silva
Ricardo Zacarias

PhD Students
Matheus Farias
Mirjam Heinemans

Research Technicians
Catarina Mendes (MSc student)
Sofia Silva (MSc student and Fly platform tech)
Rui Gonçalves

Motion signal
(**speed** x θ)

In this experiment, the freezing response of a group of flies to a threatening stimulus (an expanding dark circle) was tested. The more threatening events happened, the longer the flies took to move again. This pattern suggests that the level of activity reflects the level of safety. Specifically, in groups, the movement of others can constitute a cue of safety leading to further activity. This schematic illustrates the experimental setup, and how the motion signal is calculated.

fchampalimaud.org/researchfc/groups/grupo-behavioral-neuroscience

Defensive and social behaviour

Once a threat is detected animals need to choose the appropriate action. While the action displayed by an animal depends on several factors, there is little understanding of how the choice between different defence strategies is made. For example, the existence of a refuge nearby may dictate the escape strategy deployed by the prey. Another factor that plays a crucial role in regulating defensive responses is the social environment. For instance, many times defensive behaviours are carried out at the level of the population, such as shoaling in fish. Once a defensive behaviour is selected a number of physiological changes implement its execution, from changes in muscle activity to changes in heart rate and mobilization of energy.

To address the question of the neural mechanisms of defence against an external threat, the Behavioural Neuroscience lab uses the fruit fly as a model system. It's amenable to the search for the neural mechanism of behaviour, and it allows the study of the behaviour of large groups of individuals. This is the ideal model system due to its large collection of powerful genetic tools, a rapidly increasing number of approaches to study neural circuits, and an expanding set of behavioural paradigms. Therefore, the team is developing assays to dissect the mechanisms of choice and implementation of defensive responses in *Drosophila*.

"In 2019 the results of one of the projects of the lab were published in a preprint. In this study, we investigated which factors influence the response of animals to social cues that communicate the existence of a threat, such as the freezing behaviour displayed by other individuals. We demonstrated that personal experience significantly influences the response displayed by an individual to social cues. We believe that this insight provides a framework to study how the neural circuits involved in the self-experience of defensive behaviours overlap with the ones involved in socially triggered defensive behaviours."

Freezing displayed by others is a learned cue of danger resulting from co-experiencing own-freezing and shock. *Andreia Cruz, Mirjam Heinemans, Cristina Marquez, Marta A. Moita*
doi: https://doi.org/10.1101/800714

Michael Orger

Vision to Action

Models	Brain Regions	Research Methods
Zebrafish	Whole brain	High-speed behaviour tracking; 2-photon calcium imaging; Light-sheet microscopy; Optogenetics

Postdoctoral Researchers
Adrien Jouary (Co-Sup with Christian Machens)
Raquel Jacinto
Sabine Renninger

PhD Students
Antonia Groneberg (Co-Sup with Gonzalo de Polavieja)
António Lucas Martins
Elena Hindinger
Jens Bierfeld
Joaquim Contradanças
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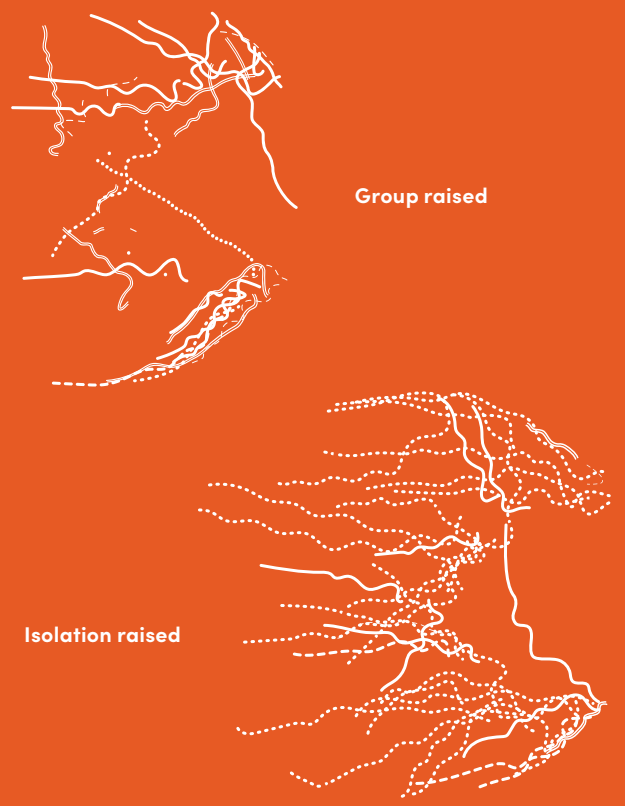
MSc Student
Pedro Tomás Silva

Senior Technicians
Aaron Ostrovsky
Edite Figueiras

Research Technicians
Adinda Wens
Alexandre Laborde
Bernardo Esteves
Rita Esteves
Sofia Freitas
Lucas Soares

Intern
Elisa Morbiato



Responses of zebrafish larvae to lateral line inputs depend on social experience. Each line shows the trajectory of a swim bout in response to a water vibration. Each line type (smooth, dotted, etc.) represents a different kinematic category.

fchampalimaud.org/researchfc/groups/grupo-vision-to-action

Determine the principles on which sensorimotor circuits are organised and reveal how activity dynamics unfold throughout the whole brain during behaviour

The Vision to Action lab uses a combination of advanced optical, genetic and behavioural methods in zebrafish. In recent years, zebrafish have emerged as an attractive model system, as they exhibit a robust set of instinctive visually guided behaviours, while their brain, which follows a typical vertebrate pattern, is sufficiently small and transparent so that researchers can non-invasively image the activity of each of its neurons. Specifically, the team visualises changes in levels of calcium ions, a marker of neural activity, while performing high-speed behavioural tracking to make a detailed, quantitative analysis of visually-evoked swimming and eye movements. In addition, the team develops genetic tools in order to probe and manipulate defined circuit elements with high specificity.

Recently, the team has developed a high-speed, real-time tracking system that has allowed them to systematically characterise the swimming behaviour of zebrafish larvae in response to a variety of different stimuli. Using a computational approach to behaviour classification, called unsupervised machine learning, they have identified a core set of swimming movements and demonstrated how they are used flexibly across different behaviours.

"Along with 12 other researchers across Europe, we secured funding for the Zebrafish Neuroscience International Training Hub (Zenith). The aim of ZENITH is to train a new generation of neuroscientists in cutting-edge approaches that bridge biology, physics and mathematics to uncover the mysteries of brain formation and function. The ZENITH PhD program will train 15 students, hosted by 13 laboratories, who will undertake collaborative projects that address major questions in neuroscience."

Joe Paton

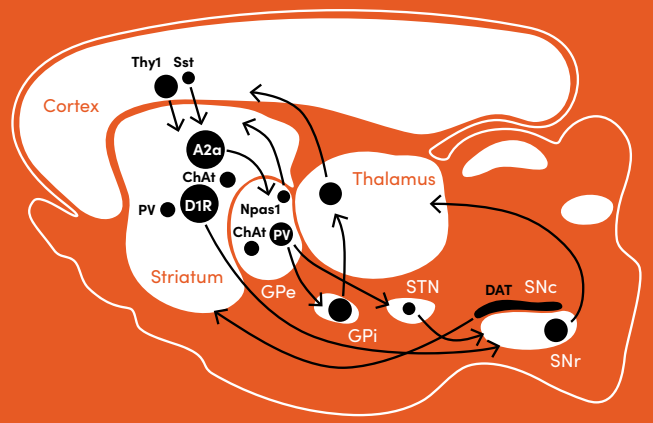
Learning

Models	Brain Regions	Research Methods
Rodent	Basal ganglia Thalamus Frontal areas of the cerebral cortex	Behaviour; Neurophysiology; Calcium imaging; Optogenetics; Mathematical modelling

Postdoctoral Researchers
Bassam Atallah
Cristina Domnisoru
Georg Raiser
Tiago Monteiro

PhD Students
Bruno Cruz
Gonçalo Guiomar (Co-Sup with Christian Machens)
Margarida Sousa
Mauricio Toro
Filipe Rodrigues
Renato Sousa (Co-Sup with Rui Oliveira, ISPA & CR)

Research Technicians
Ben Zarov
Daniela Domingues
Margarida Pexirra



Schematic showing a sample of genetically modified mouse lines that label specific cell types within cortico-basal ganglia circuitry. The lab uses these mice to monitor and manipulate targeted neurons to understand how the circuit operates in the control of behaviour.

patonlab.org

Learning, decision-making and cognition

The Learning lab studies how information about dynamic, internal variables can be encoded across networks of neurons and how that information is transformed by the circuitry of the basal ganglia into adaptive behaviour. One of the lab's contributions to the field was the discovery that information about elapsed time can be encoded in a wave-like activity pattern that travels across populations of neurons within a brain region called the striatum. An additional discovery made by the lab showed that subjective time perception can be directly controlled by manipulating the activity of dopamine neurons within a brain structure called the substantia nigra in mice. The loss of these neurons is the major contributing factor to symptoms of Parkinson's disease, a condition which is known to be associated with impaired timing capabilities in patients.

Other projects in the lab target genetically and anatomically targeted cell types across the basal ganglia, thalamus and frontal areas of the cortex. These frontal areas specifically are optimal sites for studying timing behaviour as they are thought to be involved in the association of experienced positive outcomes with the choices and actions that have led to them, or in other words, creating a mental connection between causes and positive effects. A deeper understanding of these areas could have far reaching implications for grasping how people function in both healthy and pathological conditions such as addiction or Parkinson's disease.

"In 2019 we completed a study where we detailed how the two main projection cell types in the striatum contribute to distinct aspects of motor control and action selection. Specifically, using a combination of calcium imaging and opotgenetic manipulations during a carefully designed behavioural task, we found that indirect pathway projection neurons are activated by and necessary for the proactive suppression of specific actions. These neurons are preferentially lost in the early stages of Huntington's disease, wherein patients exhibit uncontrolled movements called chorea. In contrast, we found that direct pathway neurons were not activated by action suppression and inhibiting them had no effect on action suppression or selection, but rather disrupted the vigor with which actions were produced. Another major neurological disorder of the basal ganglia, Parkinson's disease, is associated with a slowing of movement called bradykinesia. Thus, our work maps distinct symptoms of neurological disorders onto specific cell types within the basal ganglia.

This study was recently published as a preprint in bioRxiv, and is currently under revision in a peer-reviewed journal."

Dorsolateral striatal circuits support broadly opponent aspects of action suppression and production. *Bruno F. Cruz, Sofia Soares, Joseph J. Paton. bioRxiv. doi: https://doi.org/10.1101/2020.06.30.180539.*

Leopoldo Petreanu

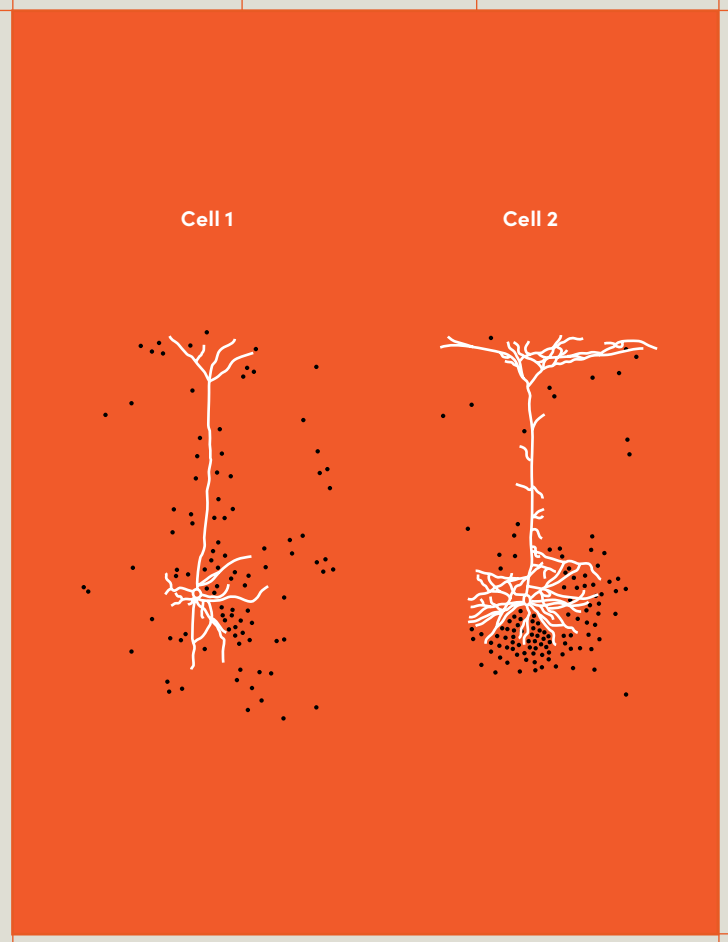
Cortical Circuits

Models	Brain Regions	Research Methods
Rodent	Visual cortex	Imaging; Electrophysiology; Behaviour

Postdoctoral Researcher
Camille Mazo

PhD Students
Gabriela Fioreze
Hedi Young
Marina Fridman
Oihane Horno (Co-Sup with Christian Machens)
Radhika Rajan
Rodrigo Dias
Solene Sautory (Co-Sup with Zachary Mainen)
Marie Fayolle
Beatriz Moura

Research Technicians
Margarida Baeta
Beatriz Belbut



The strength of distant cortical inputs onto two different neurons in the mouse visual cortex (each neuron projecting to a different area) is illustrated here by dot-density (higher density dots correspond to stronger inputs).

petreanulab.org

How the brain builds a representation of the environment from sensory stimuli

The Cortical Circuits lab applies a structure-to-function approach to understand the neural basis of visual perception. The researchers use optical and electrophysiological techniques to study the wiring logic of cortical circuits in areas that are required for visual perception in rodents. The team applies advanced optical methods to map the connectivity of axons that link distant areas of the neocortex with unprecedented detail. They also measure the activity of the same circuits in mice performing perceptual tasks using two-photon imaging, high-density microelectrode arrays and whole-cell recordings.

This combined approach allows the researchers to understand both the computations implemented by cortical circuits as well as how they emerge from the underlying neuronal network. They are testing to what extent conserved circuits motifs perform similar computations across the neocortex and how sensory evidence and internal factors are combined to build a coherent model of the world.

"In 2019, we published a preprint about a study focusing on the inter-connectivity rules of neurons in the visual cortex of mice. Our results reveal distinct circuitry architecture that supports a role of these circuit elements in hierarchical recurrent computations.

Another highlight is the graduation of Marina Fridman, a doctoral student in the lab, who successfully defended her thesis, titled: 'Contextual modulation of visual thalamocortical circuits'."

Laminar-specific cortico-cortical loops in mouse visual cortex. *Hedi Young, Beatriz Belbut, Margarida Baeta, Leopoldo Petreanu. bioRxiv. doi: https://doi.org/10.1101/773085*

Alfonso Renart

Circuit Dynamics & Computation

Models	Brain Regions	Research Methods
Rodent Human	Auditory Cortex Prefrontal Cortex	Behaviour; Electrophysiology; Analysis; Theory

Postdoctoral Researcher
Davide Reato

PhD Students
João Afonso
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Raphael Steinfeld
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Frederico Severo (Co-Sup with Noam Shemesh)

Research Technicians
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Christina Juhlin
Ricardo Monteiro

MSc Students
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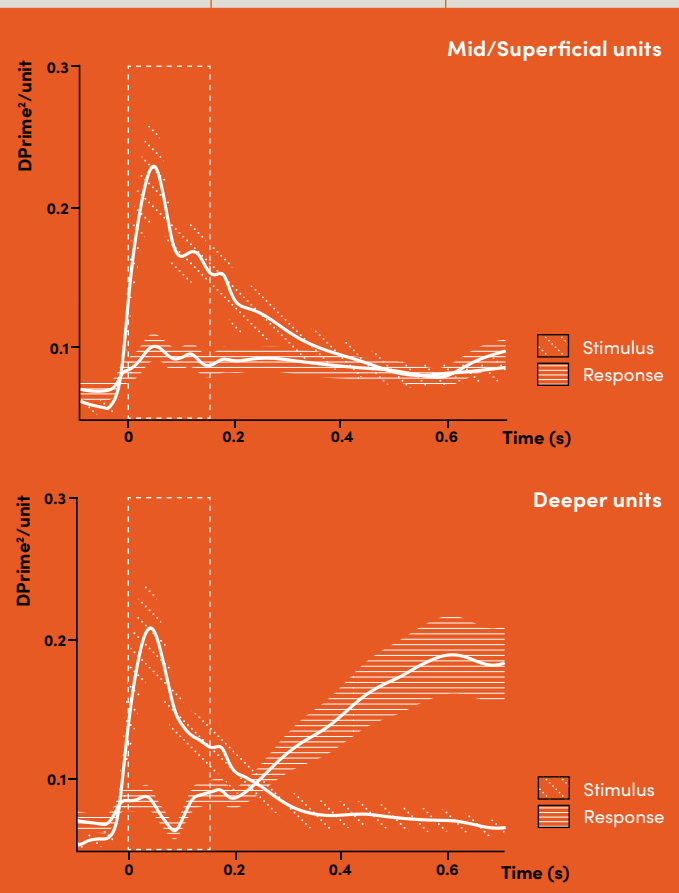
Íris Damião

Undergraduate Student
Miguel Bengala



Responses of neurons in the auditory cortex of a mouse performing a delayed frequency discrimination task. Although neurons in both the mid/superficial and the deep layers represent the identity of the sound during sound presentation (dotted rectangle), this information decays in time. Neurons in the deep layers represent the upcoming response of the mouse during the delay period.

renartlab.org

Identifying the specific computations underlying flexible sensory-and memory-guided decisions and describing their implementation in terms of the dynamics of populations of neurons

The Circuit Dynamics and Computation lab is interested in identifying generic principles underlying decision making, both at an algorithmic level, and ultimately in terms of their implementation in the brain. Their current work revolves around three lines of research: (i) the neural basis of classic psychophysical regularities — which provide quantitative signatures of perceptual decisions; (ii) normative models of perceptual choice; (iii) how different aspects of the dynamics of cortical circuits — such as their overall level of synchronization or the interplay between different cortical layers — impact sensory discriminations.

The lab seeks for experimentally accessible consequences of these computational principles. Their research strategy places emphasis on exploiting manipulations and analysis of behaviour in order to specify the computations underlying a particular task. They also seek to relate these computations and the activity of neural populations recorded using large-scale electrophysiology.

"In 2019, the lab was very active in terms of dissemination. We presented our work in the Advanced School for Modeling of Behaviour (Barcelona, September), the Predictive Brain Conference (Marseille, September), the US Society for Neuroscience (Chicago, October) and the International Society for Psychophysics (Antalya, November)."

Carlos Ribeiro

Behaviour and Metabolism

Models	Brain Regions	Research Methods
Fruit fly	Whole brain	Neurogenetics; Optogenetics; Neuroanatomy; Molecular biochemistry; Nutritional & microbial manipulations; Behaviour

Postdoctoral Researchers
Daniel Münch
Darshan Dhakan
Gili Ezra-Nevo
Ibrahim Taştekin
Silvia F. Henriques
Zita Carvalho-Santos
Raquel Barajas-Azpeleta

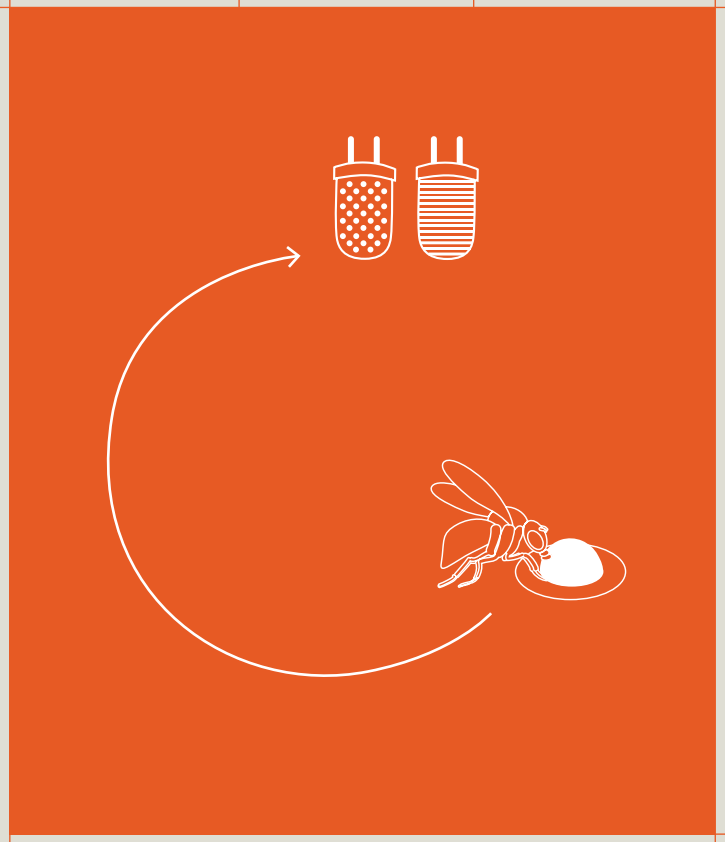
PhD Students
Dennis Goldschmidt
Patrícia Francisco

Research Technicians
Célia Baltazar
Lúcia Serra
Rita Figueiredo

Fulbright Scholar
Brittany Petros

Visiting Scientist
Teiichi Tanimura
(Nagoya University)

Lab Manager
Ana Paula Elias



"optoPAD" combines advanced optical and genetic techniques with touch-screen technology to monitor and control feeding behaviours and taste sensations in fruit flies. This schematic shows the "optoPAD" system, which is based on the use of closed-loop capacitance measurement of feeding, with optogenetic manipulation of neurons in behaving flies. The interaction of the fly with the food source triggers the activation of the LED, which controls the activity of specific neurons in the brain of the fly.

The image was adapted from: Moreira et al. 2019.

ribeirolab.org

The neural mechanisms of nutrition

To study the neural mechanisms of nutrition, the lab uses the fruit fly, one of the most powerful and versatile genetic animal model currently available due to its long history of important contributions to medicine and our understanding of biology. The fruit fly allows researchers to combine a wide array of tools and approaches: genetic circuit manipulations, activity imaging, automated quantitative methods for studying behaviour, microbiome manipulations and tissue-specific large scale RNAi screens. Team members use these tools to implement an integrative neuroscience approach, necessary to solve this whole-organism problem.

When animals lack specific nutrients they develop a craving for food containing them. The mechanisms in the brain driving animals to choose foods with nutrients their bodies need are largely unknown. To investigate this important question, the team developed a new behavioural setup called the "optoPAD" with which they can create "virtual taste realities" for flies. The flies had been genetically engineered to express light sensors in sweet or bitter cells on their "tongue". The researchers used light to stimulate these taste neurons when the animal touched specific food patches making it believe that the food contained specific nutrients. This open-source technology opens new avenues for dissecting the brain processes driving nutrient specific cravings.

"Disseminating our work to a wider audience is an important goal for us. We were therefore extremely honored to have our work featured in an ARTE documentary on the effect of food on the brain. In 'Eat Yourself Smart and Happy' we join a group of experts from around the world to discuss how we use *Drosophila* at the Champalimaud Foundation to explore the impact of food and the microbiome on our eating decisions."

Maria Luisa Vasconcelos

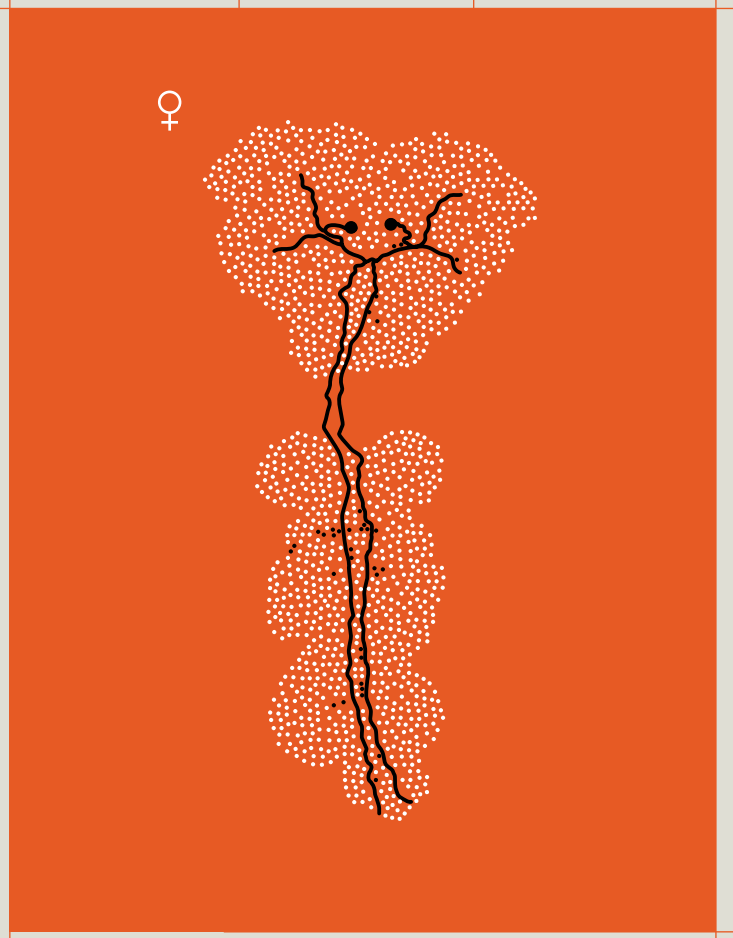
Innate Behaviour

Models	Brain Regions	Research Methods
Fruit fly	Whole brain	Optogenetics; Imaging; Behaviour; Genetics

Postdoctoral Researcher
Cecilia Mezzera

PhD Students
Cristina Ferreira
Eliane Ochôa Arez
Miguel Gaspar

Research Technician
Sophie Dias



Optogenetic activation of descending neurons induces ovipositor extrusion. A schematic of a fly nervous system with descending neurons labeled in black.

vasconceloslab.org

Identification of the neural circuits and mechanisms that control innate, or instinctive, behaviours

To dig down into the neural circuitry of innate behaviour, the Innate Behaviour lab focuses on two main behaviours – the relatively simple avoidance of a repulsive odour and the more intricate courtship behaviour. Both behaviours are studied in the fruit fly *Drosophila melanogaster*, a powerful model system that offers a wide range of advanced techniques. These include genetic manipulations to help identify which neurons are involved in specific behaviours, optogenetic tools to monitor the activity of neurons, and highly detailed video monitoring to establish the most precise relationship between behaviour and neural activity.

Using this combined approach, the team was able to establish a direct link between neural activity and behaviour, when they discovered a group of neurons (called apterous neurons) that have direct control over sexual receptivity in female flies. When the researchers silenced these particular neurons, females significantly reduced their receptivity towards males. Besides, they were able to pinpoint a specific behavioural hallmark that was affected - the walking pace of the female. Together, these results represent an important step towards gaining a better understanding of the neural mechanisms that control female receptivity. For the next step, the team is trying to pin down the neural circuitry these neurons tap into to find out how they exact this powerful effect on the behaviour of the female.

"In 2019 we published our work demonstrating that the lateral horn mediates innate olfactory responses. We used a behavioural experiment in which fruit flies avoid carbon dioxide to test the involvement in this response of different neurons in the lateral horn. We found that two sets of neurons mediate carbon dioxide response. These neurons do not mediate the avoidance response to the other aversive odors tested, indicating selectivity for carbon dioxide."

Avoidance response to CO2 in the lateral horn. *Varela N, Gaspar M, Dias S, Vasconcelos ML. PLoS Biology. 17(1):e2006749. doi: 10.1371/journal.pbio.2006749.*

Bruno Costa-Silva

Systems Oncology

Models	Region of Interest	Research Methods
Mouse	Whole organism	Flow cytometry; Cell culture; Animal models of cancer

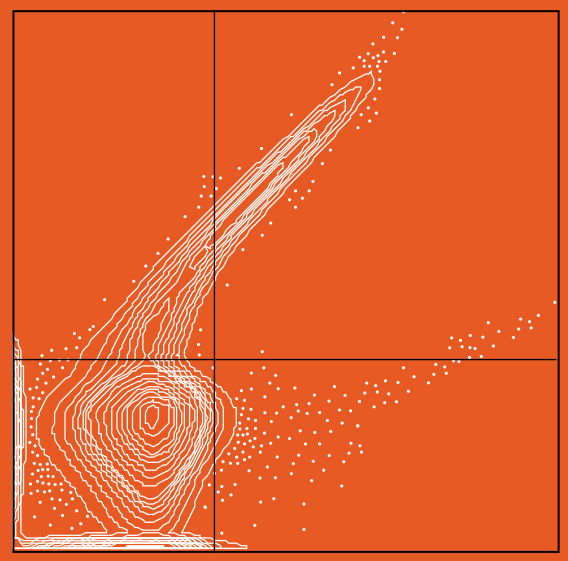
Postdoctoral Researchers
Ana Gregório
Silvia Baptista

PhD Students
Christine Semira
Joana Maia
Julia Elzanowska
Nuno Couto

Senior Research Technician
Christian Bodo

Research Assistant
Maria Carolina S. Moraes

Visiting Scientist
Andreia Otake



We showed the application of a new technology to the follow-up of the response of pancreatic cancer patients to chemotherapy. Reduction in the plasma levels of specific extracellular vesicles populations identified in our lab were linked to positive responses to therapy, while increment of these populations correlated with loss of response. This illustration depicts the characteristic data obtained with this method.

costasilvalab.org

How the exchange of extracellular vesicles, a natural form of communication in the body, can be utilized by cancerous tumours for growth and metastasis

The general interest of the Systems Oncology lab is to understand how the crosstalk between tumour cells and non-tumour cells supports or prevents oncologic disease. Specifically, the lab studies how the exchange of extracellular vesicles, a natural form of communication in the body, can be utilised by cancerous tumours for growth and metastasis. Recent results from the team have shown not only that these vesicles are different in cancer patients, but also that they can activate healthy cells at remote locations to support tumour metastasis.

Following these results, the lab currently focuses on developing animal models of tumour initiation, progression and metastasis, in combination with the characterisation of extracellular vesicles isolated from tumour cell lineages and oncologic patients with diverse clinical profiles. By using this approach, the lab aims to gain a mechanistic understanding of this form of communication with the end goal of developing tools for early detection, follow-up and treatment of cancer.

"The Flow Cytometry strategy developed in our group enables detailed population analysis of extracellular vesicles. When compared to conventional methods, it decreases sample volume requirements while substantially reducing the overall processing time. By doing so, it multiplies by hundreds of times the number of different analytes that can be studied from a single collection of biofluid."

Eduardo Moreno

Cell Fitness

Models	Region of Interest	Research Methods
Human Mouse Fruit fly	Epithelial and neuronal tissue	Genetics; Microscopy; Live imaging

Postdoctoral Researchers
Ana Cristina Queirós
Catarina Brás Pereira
Dina Coelho Da Silva
Mario Aguilar

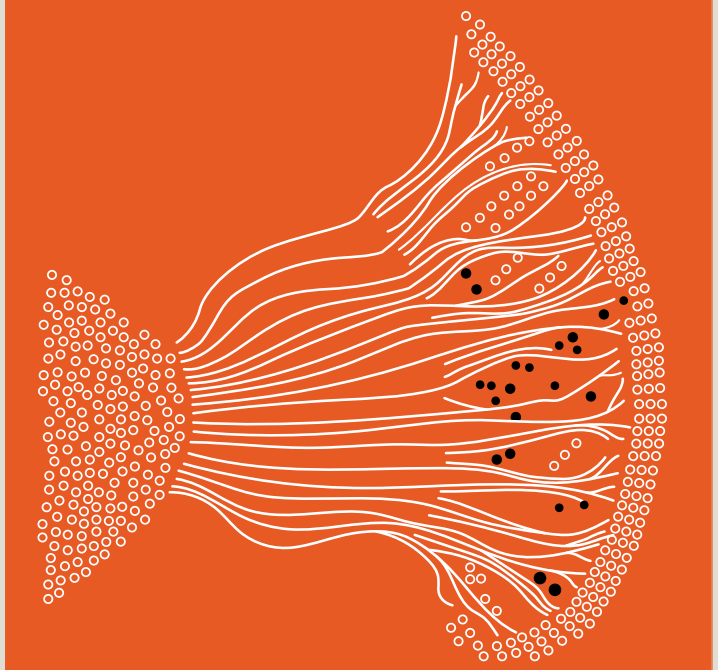
PhD Students
Andrea Spinazzola
Andrés Gutiérrez
Denise Camacho
Irene Argudo
Maria Bettencourt
Maria Carolina Rodrigues
Mariana M. dos Reis

MSc Students
Antonio Palma
Catarina Costa
Leonor Peixoto

Research Technicians
Joana Couceiro
Miguel Pinto
Pedro Durão

Interns
Inês Ribeiro
Nuno Gouveia
Nuno Valério
Sofia Martins

Visiting Scientists
Esha Madan
Rajan Gogna



This illustration represents a pupal brain of *Drosophila* in a scenario where competition is blocked by knocking-out azot, the "fitness checkpoint". Circles represent neurons. Filled circles are azot-expressing neurons that were marked to die, but have not, because azot was blocked.

moreno-lab.org

The mechanisms by which cells of multicellular animals perform fitness detection and selection of neighbouring cells

The group studies the mechanisms of cell competition in processes such as ageing, development, tissue regeneration and cancer. Work from the team has provided significant insight into these mechanisms, including the identification of "fitness fingerprints", a molecular code used by cells to exhibit their fitness level. According to their findings, fitness fingerprints allow neighbouring cells to recognise and eliminate less-fit cells. The team showed that this process happens during ageing, regeneration and cancer. Specifically, they found that fitness-based cell selection could be manipulated to delay ageing and tissue fitness decay as well as to prevent the expansion of cancer (cancer cells often exhibit themselves as "superfit" cells, which leads to the elimination of healthy cells around them). A new type of competition was discovered and named "mechanical competition" in which a high density of cells leads to compression of tissue and thereby to cell elimination. They are currently in the process of testing whether mechanical competition is important for tumour expansion into healthy tissue.

Work in the lab is done in the fruit fly animal model, where they apply advanced genetic techniques to manipulate the functions of genes related to cell fitness, in combination with microscopy and live imaging. The team studies epithelial tissue, which is known to give rise to 95% of cancer types, including breast, lung and skin cancer. They also study the role of fitness-based cell selection among neurons during brain development, neurodegeneration and brain ageing. Also, they have recently started studying the conservation of the process in human cells and mouse models.

"During 2019 my team and I have found new pathways regulated by mechanical forces (Moreno et al., *Curr. Biol.*, 2019) and the role of fitness fingerprints in human cancer (Madan et al., *Nature*, 2019). Our results show that ancient mechanisms of cell recognition and selection are active in humans and affect oncogenic growth. The Madan et al. study was selected as one of the best discoveries of the year by the European Association of Cancer Research (EACR)."

Competition for space induces cell elimination through compaction-driven ERK downregulation. *Moreno E, Valon L, Levillayer F, Levayer R. Current Biology. 29(1):23-34. doi: 10.1016/j.cub.2018.11.007.*

Flower isoforms promote competitive growth in cancer. *Madan E, Pelham CJ, Nagane M, Parker TM, Canas-Marques R, Fazio K, Shaik K, Yuan Y, Henriques V, Galzerano A, Yamashita T, Pinto MAF, Palma AM, Camacho D, Vieira A, Soldini D, Nakshatri H, Post SR, Rhiner C, Yamashita H, Accardi D, Hansen LA, Carvalho C, Beltran AL, Kuppusamy P, Gogna R, Moreno E. Nature. 2019 Aug;572(7768):260-264. doi: 10.1038/s41586-019-1429-3.*

Christa Rhiner

Stem Cells and Regeneration Lab

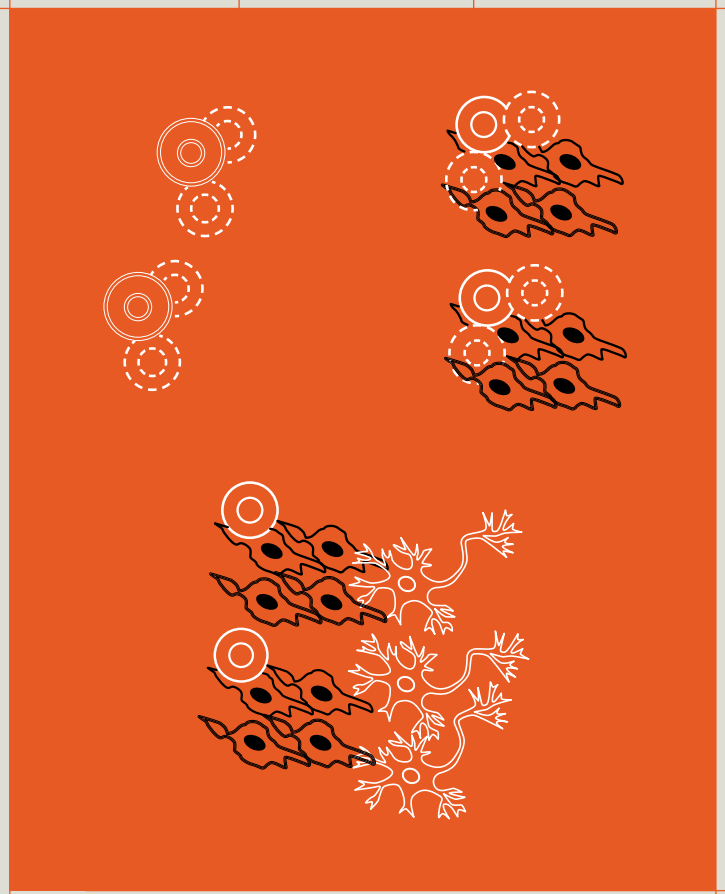
Models	Region of Interest	Research Methods
Fruit fly	Entire brain	Genetics; RNA-sequencing; Confocal microscopy; Behavioural assays

Postdoctoral Researcher
Marta Neto

PhD Students
Anabel Rodriguez Simões
Mariana Santos

MSc Students
Andreia Augusto
Margarida Caio

Research Technician
Carolina Alves



This schematic shows a phase in a programme that drives neural stem cell activation upon brain injury. In this phase, we isolated regenerating cells after traumatic brain injury from dissociated adult fly brains. In the following phase, we performed RNA sequencing to identify early signatures which can switch on dormant neural progenitor cells that are capable of forming new neurons in the damaged brain area.

rhinerlab.org

How adult stem cells can switch from being dormant to actively dividing in situations relevant for tumour formation or tissue regeneration after injury

The Stem Cells and Regeneration lab is interested in isolating the factors that bring about the activation of adult stem cells during tissue regeneration after injury or tumour formation. To that end, the team studies the molecular mechanisms through which neural stem cells are activated and produce new nerve cells in the adult brain.

The methods utilised in the lab include genetics, RNA-sequencing, high-end confocal microscopy and behavioural assays to test recovery of neural function. The team applies these methods in the adult fruit fly brain, within a region called the optic lobe.

Recent work from the lab has resulted in the discovery of damage-responsive stem cells in this area and the identification of several candidate genes that are thought to underlie this process. Currently, the team is characterising these genes while concurrently working on identifying other brain regions that are able to regenerate. Ultimately, the team's discoveries may lead to new therapies to facilitate tissue repair, such as brain regeneration after stroke, and preventing dysregulated stem cell proliferation that may lead to tumour formation.

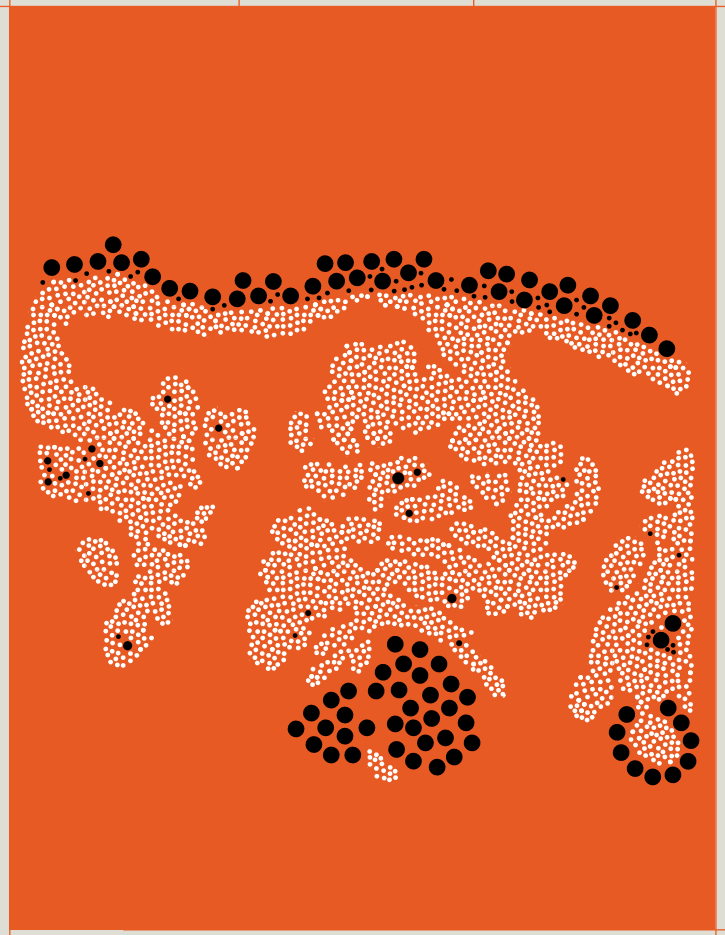
"In 2019 we set-up and optimized the procedures to isolate small populations (200-300 cells) of dividing cells from the adult fly brain, which gives us access to the gene expression profiles of rare stem cell population and their progeny at the population and single cell level. The crucial points in the workflow consist in preparing a single cell suspension of intact neurons, glia and other cells from freshly dissected and dissociated brains and sort the cells by in house Flow Cytometry within a short time to obtain native expression patterns."

Adriana Sánchez Danés

Cancer and Stem Cell Biology

Models	Region of Interest	Research Methods
Rodent Human	Skin Brain	Clonal analysis; Transcriptomics; Genetic mouse models of cancer; Organoids and imaging techniques

Lab Manager
Raquel Gonçalves



This illustration represents basal cell carcinoma tumours (black) in the skin. These tumours can arise upon the deletion of the Ptch1 gene.

fchampalimaud.org/researchfc/groups/grupo-cancer-and-stem-cell-biology

Understand the mechanisms involved in pediatric and adult cancer progression

Most tumours are heterogeneous at the cellular and (epi)genetic levels. This heterogeneity has been proposed to be responsible for tumour progression, metastasis and resistance to therapy. The goal of the Cancer and Stem Cell Biology Lab is to understand the contribution of the different tumour cell populations and genetic alterations to cancer progression and response to therapy.

The team pursues this goal by combining genetic lineage tracing, clonal analysis, imaging techniques, tumour organoid cultures and functional experiments in vivo and in vitro. Specifically, the researchers use the most frequent human cancer – basal cell carcinoma – and one of the most common pediatric cancers – medulloblastoma – as the models for their studies.

"I was delighted to integrate my lab in the Champalimaud Physiology and Cancer Research Programme in late 2019 (via the ERA Chair project QuantOCancer) and look forward to showcasing our research and building collaborations. New lab members - technicians and postdocs - will be joining the lab in February 2020. Welcome!"

Henrique Veiga-Fernandes

Immunophysiology

Models	Region of Interest	Research Methods
Rodent	Mucosal barriers, such as the intestine and the lungs	Genetic; Molecular and cellular approaches; Flow cytometry; Confocal microscopy; *In vivo* models of disease

Postdoctoral Researchers
Cristina Godinho da Silva
David Brea-Lopez
Julie Chesné
Manuela Ferreira
María Martínez
Marko Sestan
Rita Domingues
Roel Klein Wolterink
Roksana Pirzgalska

PhD Students
Ana Filipa Cardoso
Kristin Fischer
Miguel Rendas
Rita Domingues
Vânia Cardoso

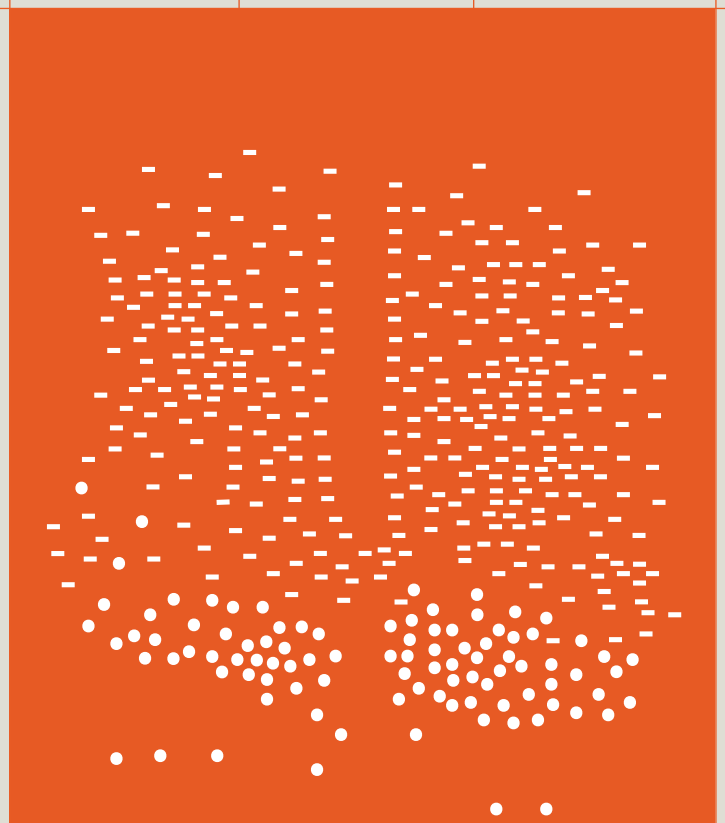
Research Technicians
Bruno Raposo
Ericka Dinis
Ines Godinho
Sara Correia

MSc Students
Ana Beatriz Rasteiro
Gonçalo Malpica
Raquel Silva
Raquel Soares

Visiting Scientists
David Malta
Patrícia Bastos
Carolina Duro
Liliana Correia

Lab Manager
Hélder Ribeiro

Administrative Assistant
Vasco Correia



This schematic represents neuron-labeling of the mouse suprachiasmatic nuclei – the brain region that controls the organism's circadian rhythm. Different shapes (circles and bars) represent neurons labeled for different cell markers.

veigafernandeslab.org

The role of cross-talk between neurons of the peripheral nervous system and the immune system in the prevention and resolution of disease

The Immunophysiology lab explores the role of cross-talk between neurons and the immune system in the prevention and resolution of disease. To that end, the team mainly focuses on mucosal barriers, such as the intestine and the lung. These organs are in permanent contact with the external environment and have a complex and dense network of neuronal and immune cells. This combination of features makes these organs an optimal site to reveal how the neural and immune systems work together to preserve health.

Using this approach, the lab has recently revealed a surprising role of the neural network that surrounds these organs: immune regulation. The team discovered that while the immune system is the one that actively fights infection, the neurons are the ones that are in charge of detecting the invasion and setting the immune response in motion. These findings may have tremendous potential in the design of novel therapeutic approaches to disease as they pinpoint new selective targets that can be harnessed in allergy, inflammation, obesity and cancer.

"We found that circadian-controlled neuroimmune circuits operate at an organismal level to regulate the function of group 3 innate lymphoid cells (ILC3s), shaping intestinal health and lipid metabolism, in mice.

Our findings shed light into how environmental cues, such as light/dark cycles, impact on immune cell function and tissue physiology."

Light-entrained and brain-tuned circadian circuits regulate ILC3s and gut homeostasis. *Godinho-Silva C, Domingues RG, Rendas M, Raposo B, Ribeiro H, da Silva JA, Vieira A, Costa RM, Barbosa-Morais NL, Carvalho T, Veiga-Fernandes H. Nature. 2019 Oct; 574(7777):254-258. doi: 10.1038/s41586-019-1579-3.*

Mireia Castillo-Martin

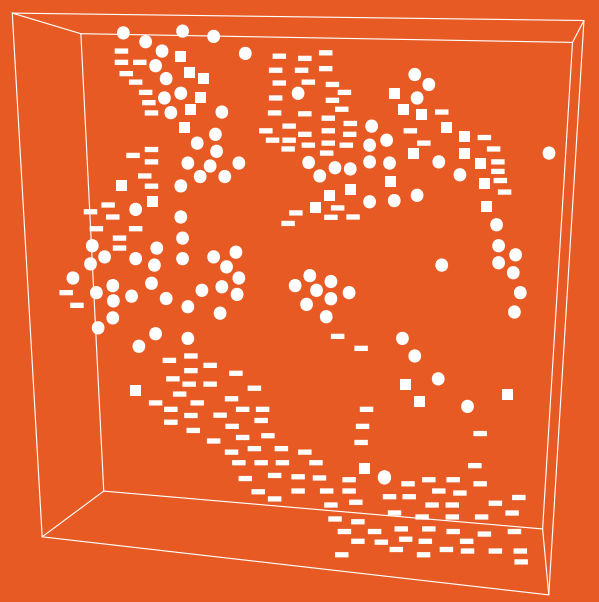
Molecular and Experimental Pathology

Models	Region of Interest	Research Methods
Human	Pancreas	Cell cultures; Tumour xenografts; Immunohistochemistry; Multispectral microscopy; Flow cytometry; comparative pathology

Research Assistant
Javier Martín-Fernández

MSc Students
Andreia Maia
Inês Franco
Isabel Pimenta
Susana Dias

Bachelor Student
Ana Raquel Borralho



An illustrative representation of a 3D image of human pancreatic intraepithelial neoplasia (upper-right) and adjacent ductal adenocarcinoma (left) from a representative Formalin-fixed paraffin-embedded tissue block. Areas rich in molecules characteristic of tumour cells (CK19 and AGR2) are represented by circles and bars (respectively). Areas of overlap are represented by squares.

fchampalimaud.org/researchfc/groups/grupo-molecularexperimentalpathology

Identification of molecular signatures in neoplastic cells and characterization of immune infiltrates in different carcinomas with the aim to develop novel therapeutic options

The Molecular and Experimental Pathology Lab has the main goal of studying tissue specimens by using state-of-the art technologies. On one side, the research focus is the characterisation of specific molecular signatures in human cancer tissue specimens by combining genomic and phenotypic information, merging tumour mutational status with multispectral immunofluorescence expression results. On the other side, the team aims to study the immune cells in the tumour microenvironment in order to understand the mechanisms of immunescape and to develop novel therapeutic approaches to overcome it. We have recently developed a new method for 3D imaging analyses of thick tissue specimens with the idea of improving the knowledge of spatial distribution of tumour cells and surrounding microenvironment.

"During this last year I have established different collaborations with other basic investigators inside the Champalimaud Centre for the Unknown and from other countries to develop novel multiplex immunofluorescence panels to be analysed with the multispectral microscope.

We have also worked on the improvement of immunostaining and clearing techniques of formalin-fixed paraffin embedded (FFPE) tissue blocks, in order to produce 3D images of human pancreatic ductal adenocarcinoma specimens. Put together, these two methodologies may completely change the way we look at tissue specimens opening new insights in histopathology analyses.

At the end of 2019, we have submitted the study of Andreia Maia's master thesis for publication and it will be published soon in Clinical Cancer Research. In this manuscript we describe the importance of ΔNp63 and AGR2 in the progression of non-muscle invasive bladder cancer and their clinical implications."

Durval C. Costa

Radiopharmacology

Models	Region of Interest	Research Methods
Human	Multiple organs	Quantitative radiopharmaceutical imaging (SPECT and PET/CT); Algorithms for radiation dosimetry

Mathematician
Francisco Oliveira

Physicists
Paulo Ferreira
Rui Parafita

Researcher
Sílvia Almeida

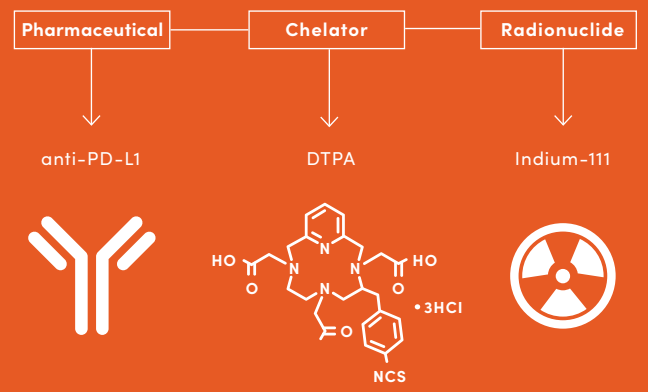
Pharmacist
Ana Capacho

PhD Students
Carla Oliveira
Sara Ferreira

MSc Students
Claudia Constantino
Miguel Andrade
Mariana Silva
Rita Oliveira

Research Technicians
Ana Canudo
Bárbara Freitas
Helena Delgado
Juliana Correia
Mariana Silva
Marisa Machado
Rita Oliveira
Sandra Chaves
Sónia Teixeira
Miguel Andrade

Nuclear Medicine Physicians
Angelo Silva
Joana Castanheira
Sofia Vaz
Carla Oliveira



PD-L1 is a molecule that is present in some populations of tumour cells and has been the target of certain immunotherapy treatments. This diagram outlines the labelling of an anti-PD-L1 antibody with a radionuclide. This radiopharmaceutical will allow whole-body *in-vivo* assessment of tumour PD-L1 expression. When its development is complete, it will help determine which patients are more likely to respond favourably to certain types of immunotherapy treatment.

fchampalimaud.org/researchfc/groups/grupo-radiopharmacology

Improvement and dissemination of radiopharmaceutical-based diagnostic and therapeutic approaches in research and medicine

The clinical use of radiopharmaceuticals for SPECT (Single Photon Emission Computed Tomography) and PET (Positron Emission Tomography) is based on the pharmacodynamics and pharmacokinetics properties of radionuclide labelled molecules. The cellular and sub-cellular specific binding of radiopharmaceuticals helps in the diagnosis and therapy of several diseases by identifying the functional abnormality within tissues and cells.

SPECT and PET imaging processing and analysis are crucial to obtain meaningful and quantitative data to classify disease stages and assess response to therapy regimens. The Radiopharmacology team is dedicated to developing and using new radiopharmaceuticals, to improving radiation dosimetry incumbent to the use of internal radiation sources, and to improve processing and analysis by developing software to classify and quantify disease due to cellular functional abnormalities.

"The Radiopharmacology lab is linked to all the ongoing activities within the Nuclear Medicine clinical service. For that reason, we call ourselves "Nuclear Medicine-Radiopharmacology". Our ultimate aim is to provide a diagnostic and therapy service of excellence and try to organise research and new developments related to the use of radiopharmaceuticals. We cooperate with other departments at CF as well as with external institutions to pursue our goals. So far, during the 8 years in which the lab has been running, we have been successful in securing more than 2M€ of research-grant funds.

Our latest achievement is the successful grant application under the COMPETE PORTUGAL 2020 funding scheme. The goal of the project is to develop methods to better analyse, classify and quantify PET/CT with radiopharmaceutical data, to ultimately improve diagnosis of patients with Lymphoma and their response to treatment. The project started in August 2019 and will end in July 2022."

Rita Fior

Cancer Development & Innate Immune Evasion

Models	Region of Interest	Research Methods
Zebrafish	Whole body	Zebrafish xenografts; Cell biology; Molecular biology

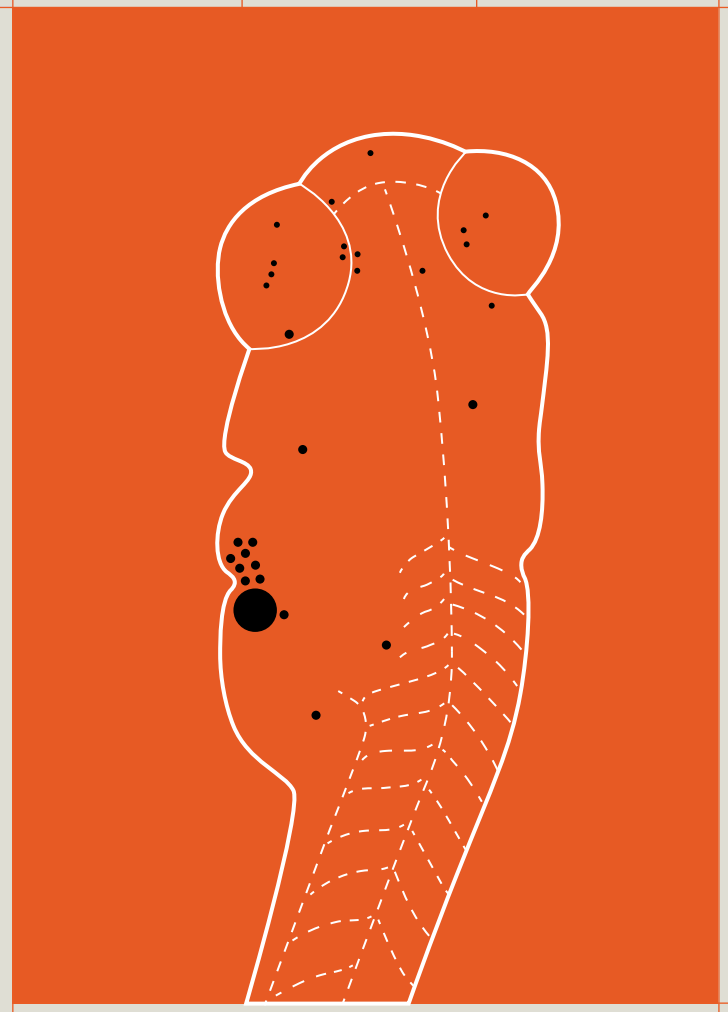
Lab Manager
Bruna Costa

Postdoctoral Researchers
Marta Estrada
Raquel Mendes

PhD Students
Mayra Martinez
Vanda Póvoa

MSc Students
Ana Varanda
Micaela Domingues

Research Assistants
Cátia Almeida
Ana Lograd0 (Co-Sup with Cristina João, CR)



This illustration represents a zebrafish *larvae* injected with human cancer cells (in black).

fchampalimaud.org/researchfc/groups/grupo-cancer-development-and-innate-immune-evasion

Cancer, immunology, tumour microenvironment

The Cancer Development & Innate Immune Evasion lab persues two main research objectives:

The first is to develop tools for personalised medicine. Despite advances in targeted cancer treatments, we still lack methods to predict how a specific cancer in a specific patient will respond to a given therapy. Consequently, patients go through rounds of trial-and-error, to find the best treatment, often subjected to unnecessary toxicity. The lab is developing a system where patient-derived tumour-samples are implanted into zebrafish larvae. These "avatars" are used as sensors for cancer behaviour and personalised therapy screening (Fior et al, 2017). Early results are very promising and the team is currently pursuing this venue of research in various cancer types.

The second goal of the lab is to study how tumours evade the immune system. To thrive, tumour cells employ mechanisms that circumvent the immune response. By combining live imaging, genetic and chemical tools, the team is studying the process of innate immune evasion and intra-tumoral clonal interactions using the zebrafish-larvae xenograft model. The researchers believe that understanding the process of innate immune rejection/ evasion may lead to new avenues of anti-cancer therapies to be combined with immune-checkpoint blockers, increasing efficacy rates and taking immunotherapy to more patients.

"In 2019, I was nominated and elected member of the board of the international Zebrafish Disease Model Society. This organisation society produces regular meetings and also promotes public awareness of the zebrafish model through outreach initiatives.

Another highlight happened early in 2019, when our research was featured in the first issue of the year 2019, of the journal National Geographic. It was part of a special issue on 'How personalised medicine is transforming your health cares".

Cristina João

Myeloma and Lymphoma Research Programme

Models	Region of Interest	Research Methods
Human	Blood Bone marrow Secondary lymphoid tissues	Clinical studies; Liquid biopsies; miRNA; Proteomics; Cell culture; Computational algorithms

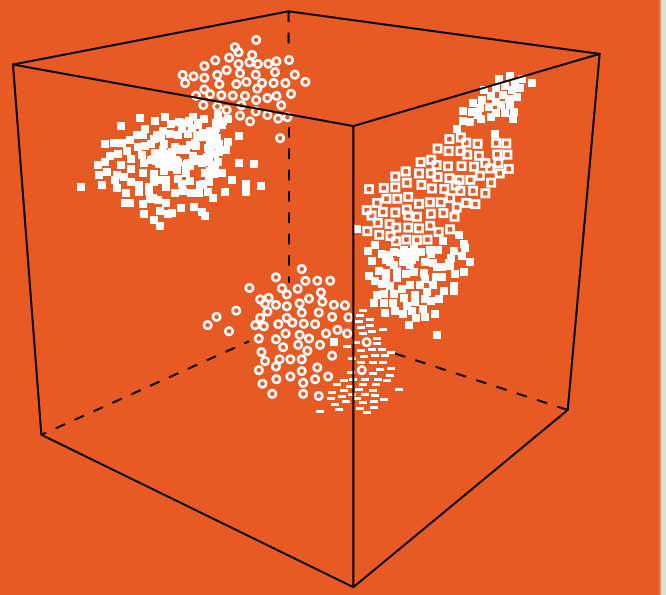
Postdoctoral Researcher
Emilie Arnault Carneiro

PhD Students
Bruna Ferreira
Joana Caetano

MSc Student
Carolina Pestana

Research Technicians
Filipa Barahona
Raquel Lopes

Allied Clinical Team
Paulo Lúcio, MD PhD
Manuel Neves, MD
Sónia Leocádio, MD, PhD Student
Marisa Salgado, Nurse
Teresa Borges, Nurse
Laura Fernandes, Nurse



Illustrative 3D representation of different immune cell populations identified in multiple myeloma using a multiparametric flow cytometry approach.

fchampalimaud.org/researchfc/groups/grupo-myeloma-lymphoma

To improve the diagnosis, immunophenotypic and molecular characterization of Multiple Myeloma and Lymphoma

The experimental work of the Myeloma Lymphoma Research Programme includes a broad spectrum of research activity, where clinical haematologists from the Haemato-Oncology Unit and non-clinical researchers from Champalimaud Research, work together to expand their knowledge of the biology of mature lymphoid neoplasms and their treatment.

Currently, we have several experimental research projects in collaboration with research groups including the Systems Oncology Group, the Computational Clinical Imaging Group and the Cancer Development and Innate Immune Evasion Group. These projects address questions such as mechanisms of progression of Multiple Myeloma, novel methods of evaluating bone disease, minimal residual disease in multiple myeloma and tailored therapy based on "in vitro" drug sensitivity evaluation.

"In 2019, our team grew and started implementing the grant we received from Fundação para a Ciência e a Tecnologia (FCT), fully establishing the lab as part of Champalimaud Research.

We also established additional research collaborations. Internally, we initiated three research projects supported by internal kickstarters grants (two in collaborations with Nickolas Papanikolaou and one with Rita Fior), thereby expanding our internal relationships with other labs at CR. Externally, we established a close collaboration with Rune Matthiesen's group at CEDOC.

Finally, I would also like to highlight communication with the scientific community. We presented our original work at the European Hematology Association meeting in Amsterdam and at the Portuguese Society of Hematology meeting in Braga."

Markus Maeurer

Immunotherapy / ImmunoSurgery

Models	Region of Interest	Research Methods
Rodent	Multiple organs	Cell culture; RNA & DNA sequencing; Flow Cytometry; Cell-cell interaction analysis; Computational techniques; Live cell-cell imaging

Postdoctoral Researcher
Joana Lérias

MSc Students
Carolina Condeço
João Martins
Inês Silva

Research Technicians
Eric de Sousa
Pedro Noronha
Georgia Paraschoudi

Visiting Scientist
Martin Rao

Functional anatomy of immune cell – tumour interactions. The molecular composition of a sample of a pancreatic tumour and the immune cells present in the tissue, is presented. This analysis links the detailed molecular structure of individual immune cells to tumour recognition, that will allow to design biologically relevant, targeted immunotherapies.

fchampalimaud.org/researchfc/groups/grupo-immunotherapy-immunosurgery

Developing methodologies for clinically relevant targeted immune recognition against cancer

The Immunotherapy / ImmunoSurgery lab is currently setting up a research and clinical structure to offer cellular treatment for cancer patients with a strong pre-clinical and clinical interaction to: (i) better understand the tumour-host relationship; (ii) map each patient's individual mutational burden and the immunological 'texture' of the patient's immune responses ('adaptomics'); and (iii) identify biologically relevant immunological strategies for improved cellular therapy concepts in the treatment of patients with cancer.

"In 2019, The Immunotherapy/Immunosurgery lab has been implementing two experimental platforms for deciphering anti-cancer immune responses and for developing biologically and clinically relevant methods. Namely: (i) micro-dissecting tissue specimens on the single cell level; and (ii) studying cell - cell interaction using 'live microscopy' that can monitor immune cell - tumour interaction continuously from one hour up to an entire week. These methods can be performed using matched tumour - cell line and anti-cancer directed immune cells, or even freshly isolated cancer tissue from biopsies. This approach will aid in testing which immunological strategy is most advantageous for expanding anti-tumour immune response."

Albino Oliveira-Maia

Neuropsychiatry

Models	Region of Interest	Research Methods
Human Mouse	Prefrontal cortex Ventral tegmental area Basal ganglia	Gustatory psychophysics; Behaviour; Calcium imaging; Optogenetics; Transcranial magnetic stimulation; SPECT

Senior Scientist
Ricardo Matias

Postdoctoral Researchers
Ana Fernandes
Carolina Seybert
Julia Queiroz
Joaquim Alves da Silva

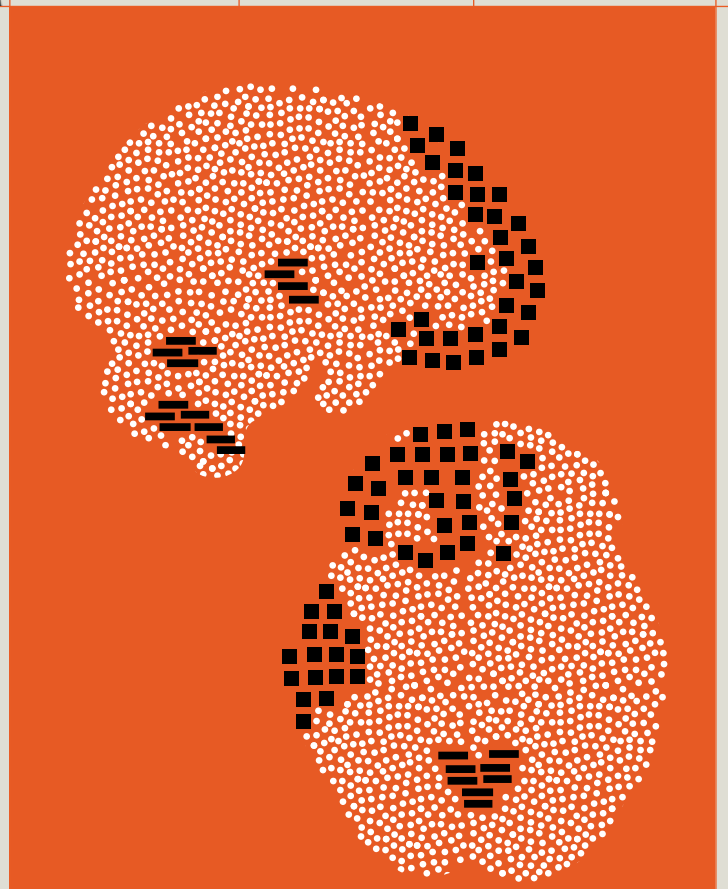
PhD Students
Gabriela Ribeiro
Gonçalo Viegas Cotovio

MSc Students
Daniel Silva
Francisco Viana
Sofia Marques

Research Technicians
Libat Weizman
Margarida Oliveira

Adjunct Members (Clinic)
Bernardo B.Corrêa
José Oliveira
Jaime Grácio
Silvia Almeida
Luzia Travado
José Maria Bravo Marques

Collaborators
Beatriz Costa (Clinical Research Unit)
Diana FrasquilhO (Breast Unit)
Berta Sousa (Breast Unit)
Maria João Susano (Anesthesiology Dep.)
Raquel Lemos (ISPA)
Daniel Houghton (UCP)
Eva Nogueira (FPCEUP)
Ana Maia (CHLO)
João Ramos (CHLO)
Pedro Rodrigues (CHPL)
Tiago Quendera (Mainen)



Functional connectivity network map of brain lesions associated with mania in patients with secondary bipolar disorder. Across two different patient cohorts, mania lesions had shared functional connectivity to the right orbitofrontal cortex, right inferior temporal gyrus and right frontal pole, that was not observed for control lesions.

fchampalimaud.org/researchfc/groups/grupo-neuropsychiatry

To advance the understanding of neuropsychiatric disorders and their treatment

The Neuropsychiatry Unit started in 2013, as an interface between the Champalimaud Clinical Centre and the Champalimaud Neuroscience Programme. The team combines clinical care and translational research in mental and behavioural health, focusing on topics that are close to the research interests of the neuroscience branch of Champalimaud Research.

At the Neuropsychiatry Unit, psychiatrists and psychologists both deliver care at the Clinical Centre, and work with other clinical and non-clinical researchers to deepen knowledge about neuropsychiatric disorders and their treatment.

"In 2019 we started the NEUROCOMP study, funded by FCT and BBRF. This study involves multimodal assessment of patients with obsessive-compulsive disorder, including clinical characterisation, behavioural tasks, neuroimaging and measurements of inflammatory and immune markers. This year we also obtained an H2020 grant from the European Commission, that will fund a Consortium proposing to use Artificial Intelligence to identify early markers of depression in patients with cancer."

Nickolas Papanikolaou

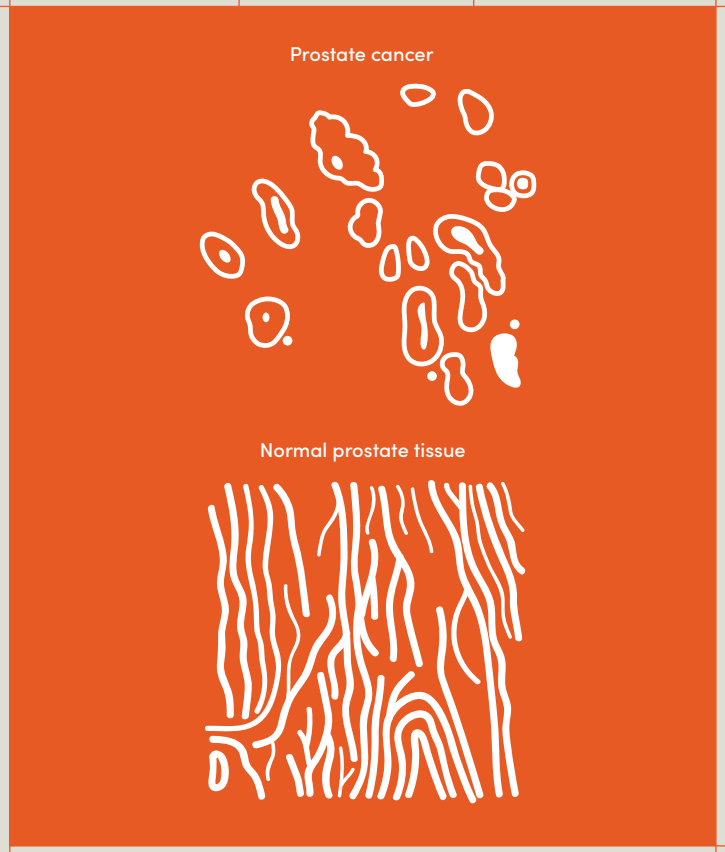
Computational Clinical Imaging

Models	Region of Interest	Research Methods
Human	Multiple organs	Modeling of biomedical signals (diffusion, perfusion); Texture and radiomics analysis on standard of care medical images

Postdoctoral Researcher
Eunice Carrasquinha

PhD Students
José Maria Moreira
João Santinha

Research Associates
João Santinha
Miguel Chambel
Ana Castro Verde



Our Prostate Cancer Detection Model was based on a Convolutional Network for Classification and Detection and Transfer Learning. It was trained on approximately 30K patches of digital histopathology images (like the one illustrated above), providing very high accuracy (94.3%) for automatic detection of prostate cancer. The model was developed in collaboration with FC Pathology service (Prof. Antonio Beltran) and was the topic of the master thesis of Mrs Carolina Seabra.

fchampalimaud.org/researchfc/groups/grupo-computational-clinical-imaging-group

Development of novel computational models with a focus on Radiomics and methods for quantitative image analysis

The current research activities of the Computational Clinical Imaging Group, focus on the application of mathematical modeling, statistics, and software development to support biomedical and clinical research, mainly in the field of medical image processing, visualisation, and analysis. The core research focus of the group is the development of clinically meaningful radiomics signature that will help clinicians on the decision making process regarding disease detection, characterisation, prediction of treatment response and prognostication of clinical outcomes.

"The CCIG has extended the International Radiomics Network by signing new members to the network from France, Austria, Italy, Greece and Sweden acting as a hub, providing radiomics modeling expertise to common projects in the fields of breast cancer, pancreatic cancer, and brain tumours. The network today comprises well known academic hospitals like Huddinge Karolinska in Stockholm, Sweden, Hopitan Beujon in Paris, France, Institute Europeo di Oncologia in Milan, Italy and AKH in Vienna, Austria. I was elected as Fellow in the International Cancer Imaging Society and was assigned to organize a single day hands-on workshop for Radiomics starting from the fall of 2020. As a recognition of the expertize of CCIG, I was invited to be the section editor on AI, Radiomics and Machine Learning at the official journal of ICIS, which is Cancer Imaging."

Noam Shemesh

Preclinical MRI

Models	Region of Interest	Research Methods
Human	Multiple organs	Ultrahigh field magnetic resonance imaging (MRI); Functional microstructural and metabolic imaging; Optogenetics, Behaviour

Postdoctoral Researchers
Andrada Ianus
Clémence Ligneul
Cristina Chavarrías
Julia Huntenburg
Rafael Henriques
Rui Simões
Sónia Gonçalves
Tal Shemesh

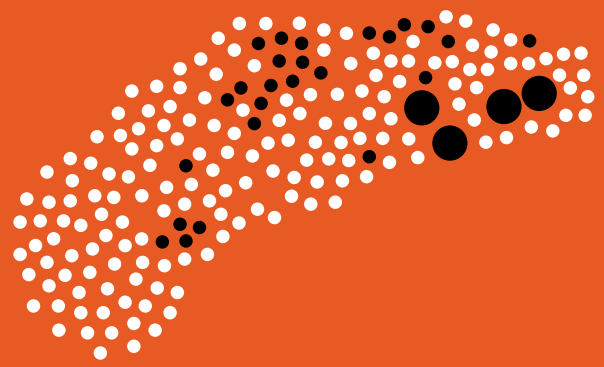
Visiting Scientists
Cassandra Sampaio
Joana Cabral

Collaborator
Magda Teles

PhD Students
Carlos Bilreiro
Frederico Severo
Inês Santiago
Madalena Fonseca
(CoSup with Zachary Mainen)
Rita Gil

MSc Students
Bárbara Costa
Rita Alves

Research Technicians
Beatriz Cardoso
Francisca Fernandes
Ruxanda Lungu



This illustration depicts a precancerous lesion in a mouse pancreas observed through MRI microscopy.

shemeshlab.org

Advanced Magnetic Resonance at ultrahigh field for fundamental and translational research in neurobiology and cancer

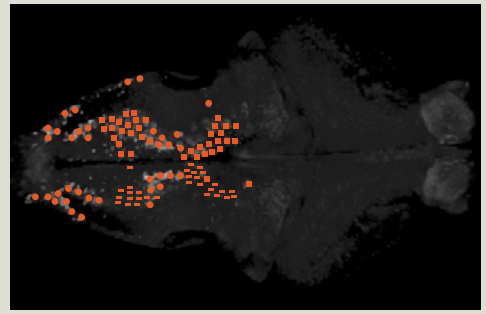
fMRI is a non-invasive, powerful tool for studying various neuroscience and biomedical questions. Current fMRI methods work by performing indirect measures of neural activity by following accompanying changes in blood volume and oxygenation level. However, changes in blood flow, in addition to being an indirect measure, occur over a timescale of seconds, while neural activity occurs within a fraction of a single second.

This difference in time scale points out an obvious limitation of current fMRI techniques – they are too slow to resolve many important processes in the brain. To address these issues, the team's first steps, for which they have received support from the European Research Council, have been focused on developing novel techniques that harness the power and versatility of MRI to perform direct measurements of neural activity on a much faster timescale. For instance, the team harnesses ultrahigh magnetic fields and diffusion to image the dynamics of (hypothetical) cell swellings that are known to be coupled with neural activity, as well as neurotransmitter release in the brain. These various measurements are performed in-vivo using state of the art 9.4T and 16.4T scanners, in both anaesthetized and behaving rodents.

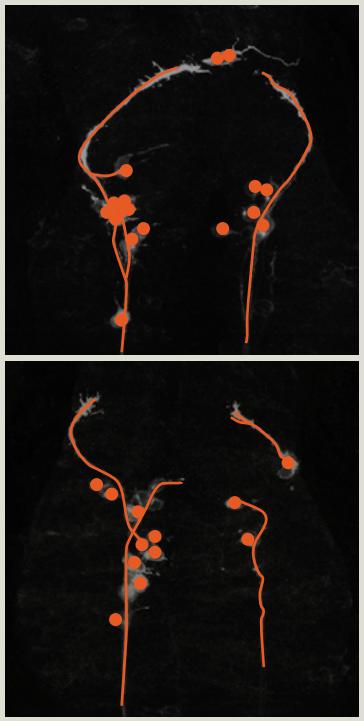
"Two of my students secured PI positions: Jelle Veraart, who is now an assistant professor in NYU, and Madalena Fonseca who joined the University of Oxford as a senior research associate."

Research Associates

Using two-photon imaging of zebrafish larvae brains and neuronal population analysis techniques, we can define and map populations that carry different types of information. In this illustration, different shapes represent subpopulations of neurons related to rotational and translational motion.



CR's Research Associates are senior investigators who manage independent projects in association with particular labs at CR.



The process of extension of neuronal projections can be followed in the zebrafish embryo by imaging specific neurons (grey) at different times (top, bottom).

Ruth Diez del Corral ▲

Development of Neural Circuits

Associated with the Vision to Action lab
Team: Mariana Viegas, MSc student

The nervous system is composed of a large variety of neuronal and glial cell types that are interconnected to create functional circuits. The connectivity of neurons is largely established during embryonic development when neurons extend projections to contact their targets. Most of the molecular mechanisms implicated in this process so far, have been identified mainly using cell cultures and their interaction and role in the context of the whole organism is still an open question.

With the use of techniques such as confocal and light-sheet microscopy for whole embryo and brain imaging together with transgenic zebrafish strains expressing fluorescent proteins in specific neuronal subpopulations, we are exploring the extension of the early neural projections in the living zebrafish embryo.

Eric DeWitt ▲

Computational Cognitive Decision Science

Associated with: Systems Neuroscience lab

Efficiently learning the costs and benefits of different behaviours is necessary for making informed choices and critical to the success of adaptive systems, both natural and artificial. Our group is interested in understanding this learning and decision making process in humans, animals, and groups using theoretical models to guide behavioural and neural experiments. Our primary research focus is on how choices are made in mammalian brains using reinforcement learning as a theoretical framework. Reinforcement learning is a general theoretical framework that describes how an animal or artificial system should (or could) solve the problem of choosing the 'best' behaviour in any given situation. By comparing behaviour and neural activity to the predictions of specific reinforcement learning models, we hope to both improve the models and better understand the computations of the brain. Our group also uses neuroscience to inform and develop other computational and theoretical approaches, like deep reinforcement learning neural networks and behavioural economic models. We are now exploring group learning and decision making, leveraging the computational experimental approach used to study individual behaviour.

We believe in collaborative, cooperative science and work with many groups in Champalimaud Research as well as in other institutions worldwide.

Claudia Feierstein ▲

Neural Circuits for Visuomotor Behaviour

Associated with: the Vision to Action Lab

How does our brain use information to select appropriate behaviours? We address this question by looking at zebrafish, a small fish which at the larval stage is small and transparent, making it easy for us to peek into their brains noninvasively. Using state-of-the-art microscopes, we can then image the activity of the whole brain, while tracking their behaviour using high-speed cameras.

We can then ask: how can the larva's behaviour, or its sensory environment, explain the neuronal activity that we measure? In the last year, in collaboration with the Machens lab, we applied analysis methods to investigate how large groups of neurons process information. In this way, we hope to understand how different circuits in the brain contribute to different processes, from sensation to selection of a behavioural response.

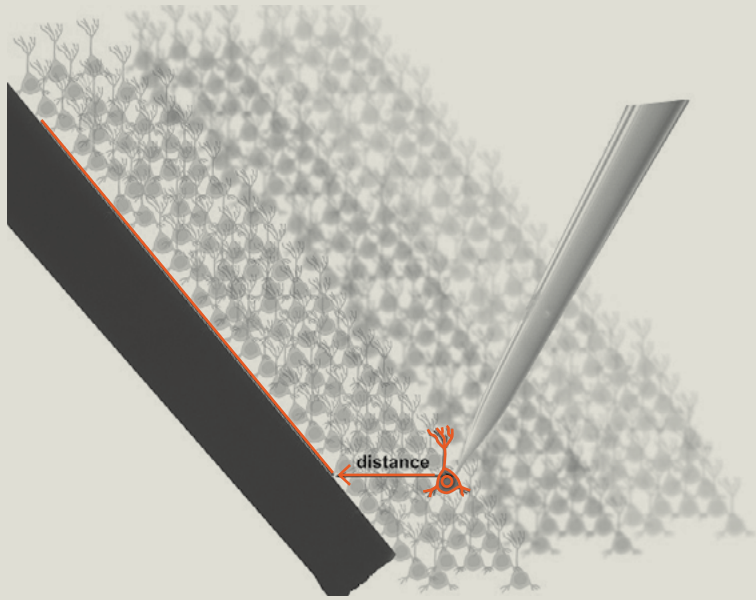
Adjunct Labs

In addition to research labs located at the Champalimaud Centre for the Unknown, the research team of CR also has adjunct labs, which work in complementary scientific areas.

Adam Kampff
Intelligent Systems

Affiliation: The Sainsbury Wellcome Centre, University College London

The goal of the Intelligent Systems lab is to identify the general principles of brain function that support intelligent behaviour and to implement them in machines. Specifically, they focus on how the brain constructs a representation of the environment: How is this representation learned? How is it encoded in the activity of neural networks? How is it used to control adaptive behaviour?



The Kampff lab is now testing novel devices for simultaneously recording from large populations of neurons throughout the brain.

Rui Oliveira
Social NeuroEndocrinology

Affiliation: Instituto Superior de Psicologia Aplicada & Instituto Gulbenkian de Ciência

The main research interest of the Social NeuroEndocrinology lab is the integrative study of social behaviour that combines the study of proximate causes (gene modules, hormones, neural circuits, cognitive processes) and ultimate effects (evolutionary consequences). In particular, the team is interested in understanding how brain and behaviour can be shaped by the social environment, and how the cognitive, neural and genetic mechanisms underlying plasticity in the expression of social behaviour have evolved.

Publications

CR's publications during 2019 mirror the expanding scope of the programme. They include novel insights in fundamental research topics as well as in clinical fields. Many publications are the fruit of collaborative interactions among different groups within the Champalimaud Centre for the Unknown.

In 2019, CR investigators published

Highlights

Outcompeting cancer

Suppressing the capacity of tumours to destroy the healthy tissue that surrounds them is essential for fighting cancer. A study by the **Cell Fitness lab** in human-derived tumours reveals a potential way of doing just that. The study reveals a competition mechanism used by human cancer cells for killing their neighbours and demonstrates that combining substances that block this mechanism with chemotherapy results in more effective tumour elimination. These findings may lead to the development of novel cancer therapies.

Flower isoforms promote competitive growth in cancer. Madan E, Pelham CJ, Nagane M, Parker TM, Canas-Marques R, Fazio K, Shaik K, Yuan Y, Henriques V, Galzerano A, Yamashita T, Pinto MAF, Palma AM, Camacho D, Vieira A, Soldini D, Nakshatri H, Post SR, Rhiner C, Yamashita H, Accardi D, Hansen LA, Carvalho C, Beltran AL, Kuppusamy P, Gogna R, Moreno E. Nature. 572(7768):260-264. doi: 10.1038/s41586-019-1429-3.

Untangling space and time in the brain

How do our brains know when and where to place our feet in order to prevent us from tripping each time we find ourselves on a new terrain such as an icy path, or a sandy beach? In an innovative study, scientists at the **Neural Circuits and Behaviour lab**, find remarkable similarities between the way humans and mice learn to adapt their manner of walking and pinpoint a site in the brain that controls two components crucial for mastering this task – space and time.

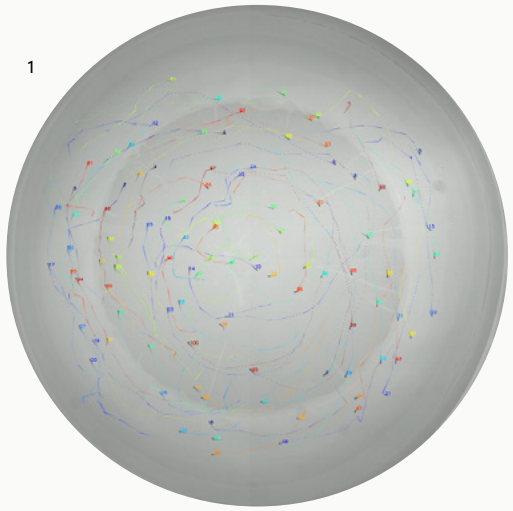
Spatial and temporal locomotor learning in mouse cerebellum. Darmohray DM, Jacobs JR, Marques HG, Carey MR. Neuron. 102(1):217-231.e4. doi: 10.1016/j.neuron.2019.01.038.

Where is George? Ask this software to look at the crowd [1]

A team of researchers at the **Collective Behaviour lab** developed a state-of-the-art tracking software called *idtracker.ai*. The software uses a mix of conventional algorithms and artificial intelligence to reliably track each and every individual in a moving crowd of dozens.

idtracker.ai: tracking all individuals in small or large collectives of unmarked animals. Romero-Ferrero F, Bergomi MG, Hinz RC, Heras FJH, de Polavieja GG. Nature Methods. 16(2):179-182. doi: 10.1038/s41592-018-0295-5.

1



Zebrafish "avatars" can help decide who should receive radiotherapy treatment

To date, there is no method for clearly determining whether radiotherapy will be an effective treatment for individual cancer patients. This is a significant problem as patients may be unnecessarily subjected to potentially severe side effects. A new assay, developed by the **Cancer Development and Innate Immune Evasion lab**, offers a promising solution with rapid, personalised radiotherapy compatibility testing, using zebrafish as avatars.

Developments in zebrafish avatars as radiotherapy sensitivity reporters - towards personalized medicine. Costa B, Ferreira S, Póvoa V, Cardoso MJ, Vieira S, Stroom J, Fidalgo P, Rio-Tinto R, Figueiredo N, Parés O, Greco C, Ferreira MG, Fior R. EBioMedicine. 102578. doi: 10.1016/j.ebiom.2019.11.039.

2

Major breakthrough in centuries old puzzle [2]

Weber's law is the most firmly established rule of psychophysics — the science that relates the strength of physical stimuli to the sensations of the mind. Despite being almost 200 years old, no clear way has been found to select among its many proposed explanations. Now, scientists from the **Circuit Dynamics & Computation lab** have discovered a new psychophysical rule that allowed them to identify a unique and robust explanation of Weber's law.

The mechanistic foundation of Weber's law. Pardo-Vazquez JL, Castiñeiras-de Saa JR, Valente M, Damião I, Costa T, Vicente MI, Mendonça AG, Mainen ZF, Renart A. Nature Neuroscience. 22(9):1493-1502. doi: 10.1038/s41593-019-0439-7.

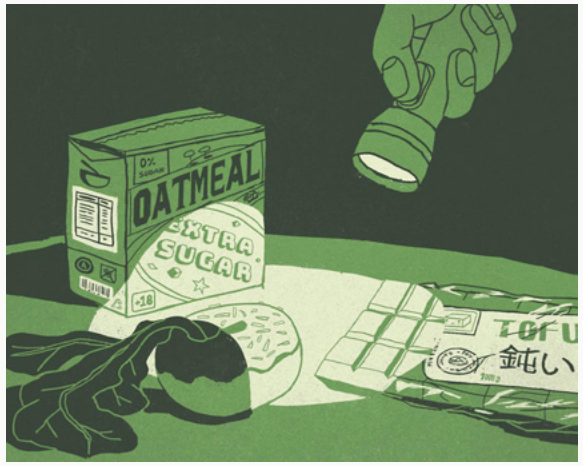
How sleepless nights compromise the health of your gut

Why are individuals that have irregular schedules more susceptible to gut inflammation and obesity? A study by the **Immunophysiology lab** reveals a link between gut immune function and the brain's circadian clock that may very well be the answer.

Light-entrained and brain-tuned circadian circuits regulate ILC3s and gut homeostasis. Godinho-Silva C, Domingues RG, Rendas M, Raposo B, Ribeiro H, da Silva JA, Vieira A, Costa RM, Barbosa-Morais NL, Carvalho T, Veiga-Fernandes H. Nature. 574(7777):254-258. doi: 10.1038/s41586-019-1579-3.

Virtual reality takes a leap into taste [3]

3



optoPAD is a newly developed system for creating virtual taste realities created by the **Behaviour and Metabolism lab**. It combines advanced optical and genetic techniques with touch-screen technology to monitor and control feeding behaviours and taste sensations in fruit flies. This new tool, which is now being freely shared with the scientific community, significantly extends the toolset available to study feeding behaviour in this model organism, which in turn may provide important insight into the neural circuitry that underlies food choice.

optoPAD, a closed-loop optogenetics system to study the circuit basis of feeding behaviours. Moreira JM, Itskov PM, Goldschmidt D, Baltazar C, Steck K, Tastekin I, Walker SJ, Ribeiro C. Elife. 8. pii: e43924. doi: 10.7554/eLife.43924.

Solving the "Catch 22" of rectal cancer

When rectal cancer infiltrates adjacent lymph nodes, patients may have a better clinical outcome if chemotherapy or radiotherapy are administered prior to the standard surgery to remove the tumour. However, the status of these lymph nodes can only be precisely assessed upon removal during surgery.

To find a way out of this "Catch 22", a multidisciplinary team of scientists and clinicians at the Champalimaud Centre for the Unknown, led by the **Preclinical MRI lab**, developed a new noninvasive MRI methodology, that is able to identify whether lymph nodes have been infiltrated by malignant cells with high accuracy. Such a characterisation can help define treatment strategy for rectal cancer patients and may have future implications for other malignancies.

Susceptibility perturbation MRI maps tumour infiltration into mesorectal lymph nodes. Santiago I, Santinha J, Ianus A, Galzerano A, Theias R, Maia J, Barata MJ, Loução N, Costa-Silva B, Beltran A, Matos C, Shemesh N. Cancer Research. 79(9):2435-2444. doi: 10.1158/0008-5472.CAN-18-3682

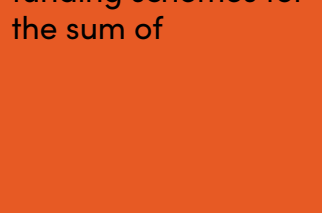
Full 2019 publications list can be found on page 124

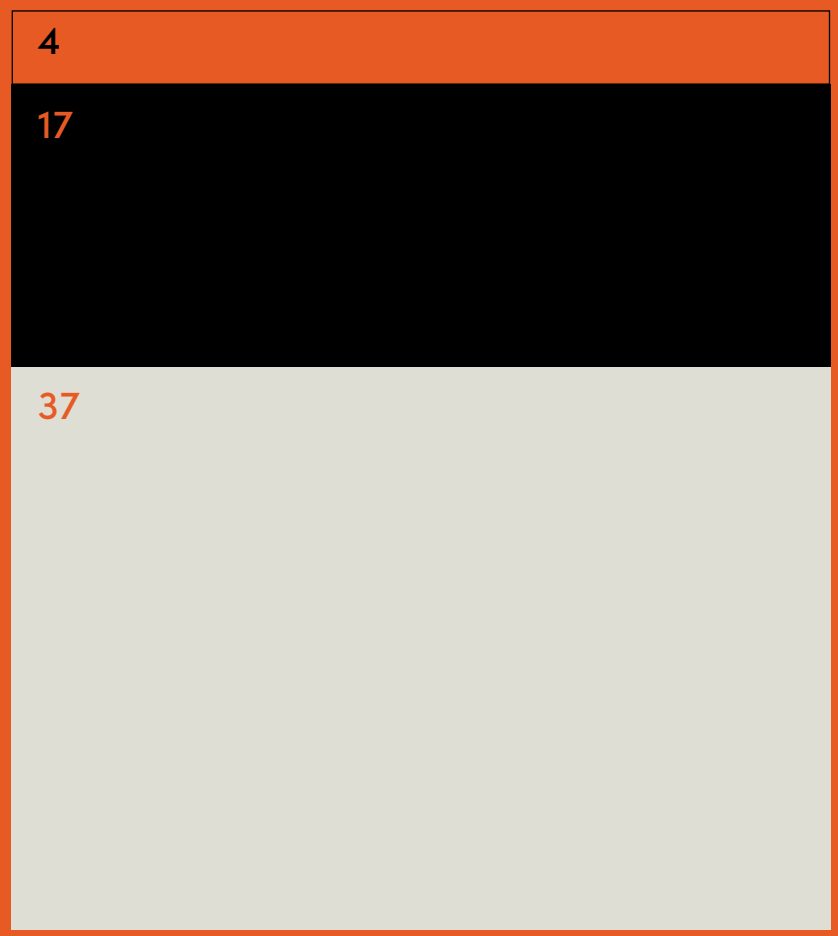
Competitive External Funding

In 2019, CR Researchers were awarded 12 projects & 21 individual funding schemes for the sum of

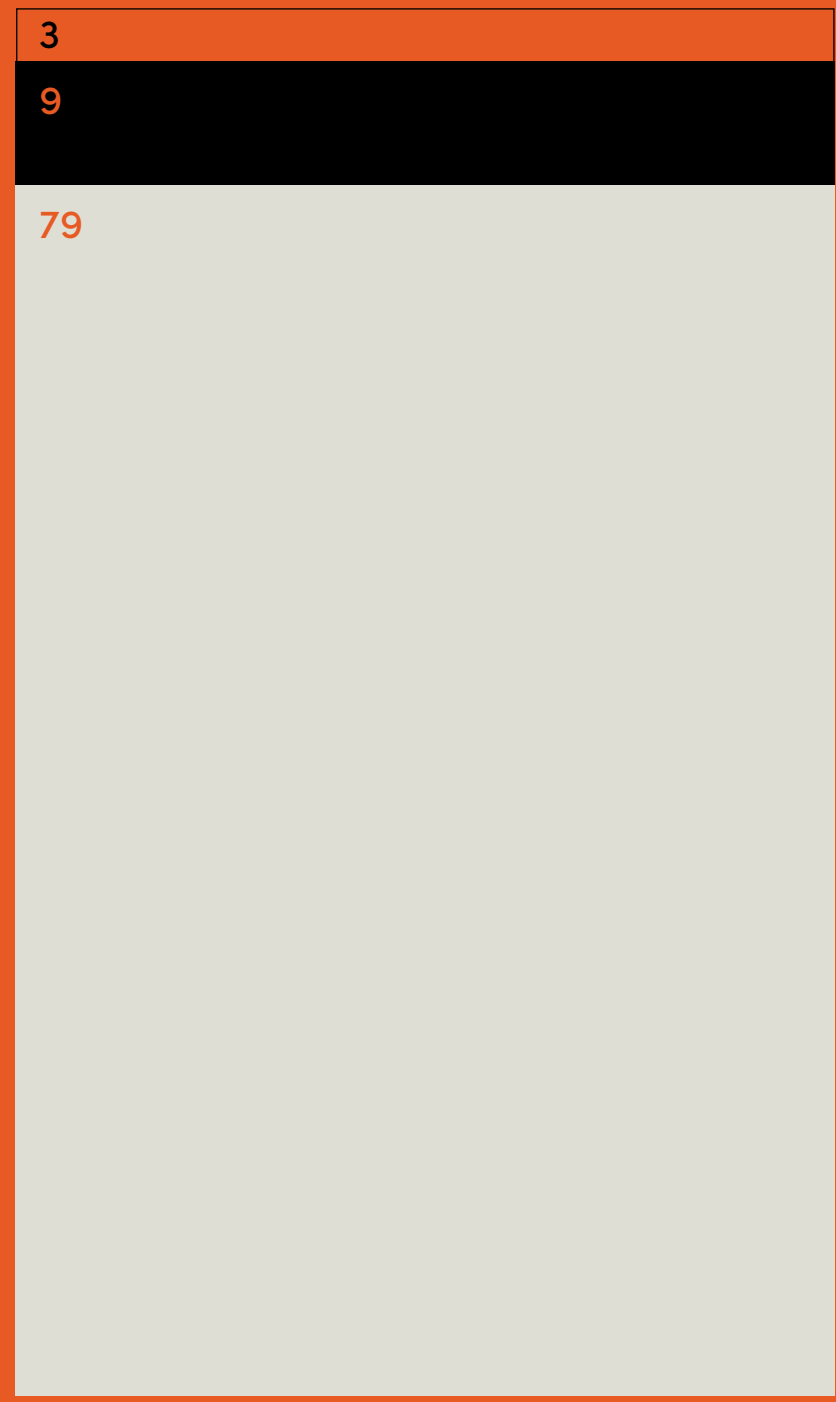
€8.67M

A total of 142 external competitive funding schemes were running in CR during 2019.





Individual Funding & Fellowships



Projects

Highlights

International collaborations

The Champalimaud Centre for the Unknown is part of the Horizon 2020 Consortium project "Predicting Effective Adaptation to Breast Cancer to Help Women to BOUNCE Back", as a 4th site for the clinical studies of the project. Locally, the project is coordinated by Fatima Cardoso, head of the Breast Unit at the Champalimaud Clinical Centre. Two CR groups are involved in the project - **Albino Oliveira-Maia and Nikolaos Papanikolaou.**

Mireia Castillo-Martin and Bruno Costa-Silva both participate in Health Research Projects funded by the la Caixa Foundation. The projects the researchers are contributing to are titled: "Eradicating prostate cancer metastasis before clinical manifestation", and "Defining the role of exosome-secreted micropeptides in pancreatic cancer", respectively.

Projects

The Champalimaud Research Programme

has been recognised as an Excellent R&D Unit in the 2017/2018 R&D Institutional Evaluation call conducted by the Portuguese National Foundation for Science and Technology (FCT). As a result, the Programme **will receive financial support from the FCT in the sum of €1.7 Million**, for the period of 2020 through 2023.

Megan Carey

head of the Neural Circuits and Behaviour lab **was awarded a Consolidator Grant of €2 Million by the European Research Council.** These funds will be used to further her investigation into how the activity of neurons throughout the brain produces learned and coordinated movements.

José Oliveira (Oliveira Maia lab)

received a NARSAD Young Investigator Award by the Brain and Behaviour Research Foundation to pursue his research project on the influence of markers of immune dysfunction on orbitofrontal cortex recruitment during a decision-making task in obsessive-compulsive disorder.

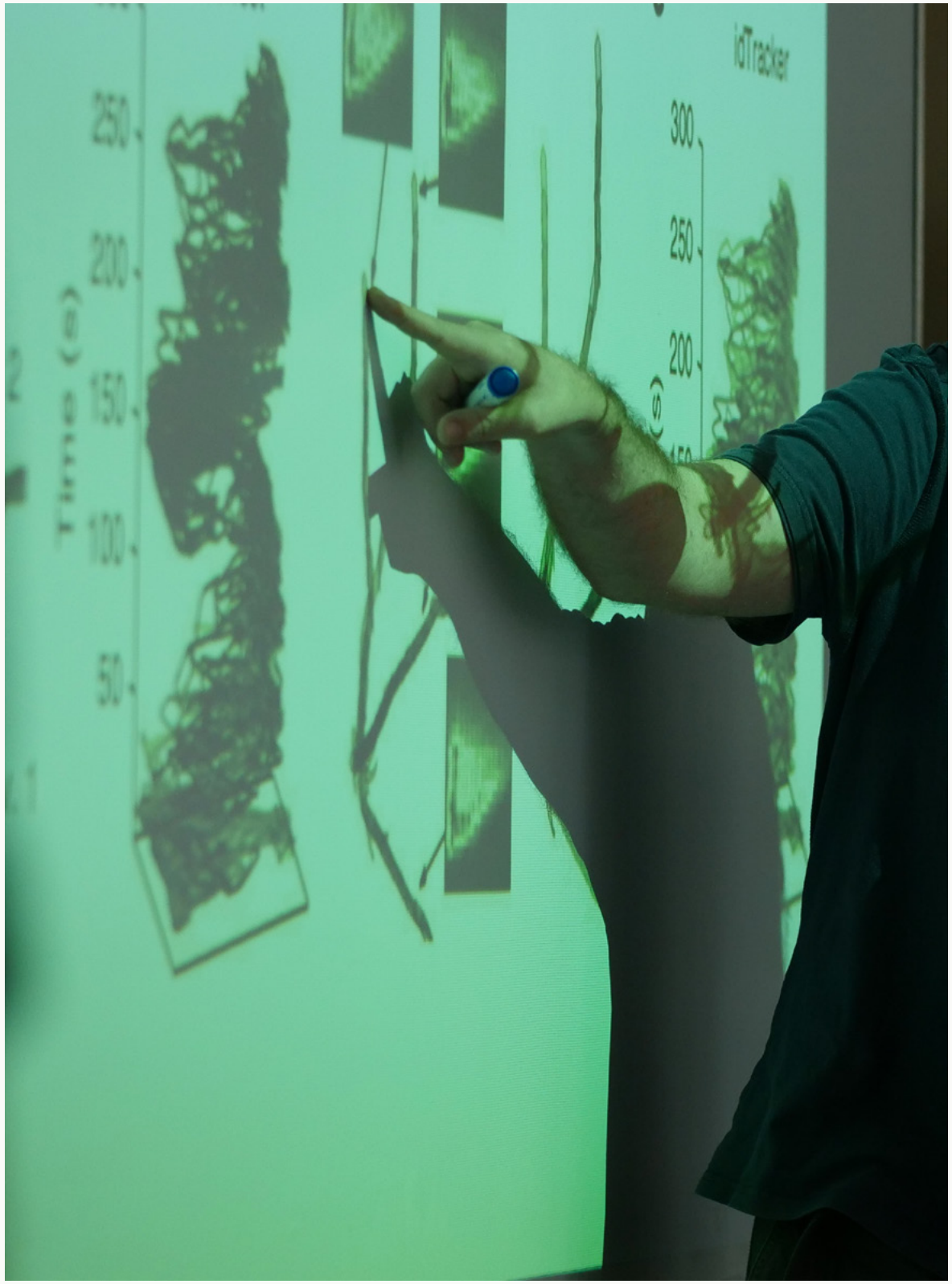
Fellowships

Roeland Wolterink, a postdoctoral researcher at the Veiga-Fernandes lab, was award a prestigious fellowship by the Cancer Research Institute to study the architecture and language of pulmonary neuroimmune communication.

Five postdoctoral researchers were awarded the highly-competitive Horizon 2020 Marie Curie Individual Fellowships: David Brea López (Veiga-Fernandes lab); Julia Huntenburg (Mainen lab); Maria Martinez (Veiga-Fernandes lab); Rui Simões (Shemesh lab); and Ibrahim Tastekin (Ribeiro lab).

María López and Marko Sestan, two postdoctoral researchers at the lab of Henrique Veiga-Fernandes, received long-term fellowships by the European Molecular Biology Organization (EMBO).

Full Competitive External Funding list can be found on page 128



Education

Since the beginning, CR has regarded educating scientists as one of its main objectives. To this end, the CR has been dedicating considerable efforts to the development and implementation of outstanding educational programmes, advanced courses and workshops. Among these, two main endeavours are the International Neuroscience & Physiology Doctoral Programme and the CAJAL Advanced Training Courses.

International Neuroscience & Physiology Doctoral Programme - INPDP

The INPDP aims at providing students with a broad and integrative education in neuroscience with a focus on the neuronal and circuit basis of behaviour.

A main goal of the programme is to foster and encourage active participation, independence and critical thinking of the students. INPDP students come from all over the world and from a range of backgrounds, including the life sciences, physics, psychology, mathematics and computational sciences.

During the first year of this four-year programme, students attend courses that cover basic topics in contemporary biology and neuroscience. The courses have a strong practical component, which includes a variety of experimental preparations. During this year, students also perform laboratory rotations, which allow them to familiarise themselves with the research done in the different labs and help them with selecting the lab where they will conduct their doctoral research. Students are followed by a thesis committee which monitors their progress and provides input throughout their graduate education. The INPDP is an accredited programme and degrees are granted by one of our two academic partners, Universidade Nova de Lisboa and the Instituto Superior de Psicologia Aplicada. PhD students enjoy a vibrant academic environment at the Champalimaud Foundation, with a weekly schedule of both internal and guest seminars, as well as access to a wide range of meetings and workshops. INDP students also have the opportunity and funding to organise their own advanced courses, as well as an annual retreat.

Education committee:
Eugenia Chiappe, Christa Rhiner, Joe Paton

Coordinator:
Thiago Carvalho

Managers:
Simone Zacarias, Maria Teresa Dias

Graduate programme 2019
Scientific Advisory Board, visiting committee:
Carlos Belmonte, Instituto de Neurociências de Alicante; Gilles Laurent, Max Planck Institute for Brain Research; Alessandro Treves, Neuroscience coordinator, International School for Advanced Studies

Highlights

Joaquim Contradanças and Miguel Paço, of the INPDP class of 2017/18 received Boehringer Ingelheim Fellowships.

This prestigious fellowship is awarded to "outstanding junior scientists worldwide who wish to pursue an ambitious PhD project in basic biomedical research in an internationally leading laboratory". The students will continue to develop their research projects, while acquiring leadership and communication skills through an exclusive training programme provided by the Boehringer fellowship programme.

Class of 2019

Standing (L→R)
Rita Figueiredo
Sofia Freitas
Raquel Silva
Anh Nguyen
Jaime Arlandis
Beatriz Belbut
Ines Dias
Joana Carmona

Sitting (L→R)
Merit Kruse
Violetta LaFranca

CAJAL Advanced Neuroscience Training Programme

The CAJAL Advanced Neuroscience Training Programme consists of six yearly courses, two held at the Champalimaud Centre for the Unknown in Lisbon and four in Bordeaux Neurocampus. These two institutes were chosen to be the first centres in Europe that will host recurring neuroscience training courses, following a model that has been successfully running in the USA for decades.

Interacting with Neural Circuits
July 14 - August 3

Directors:
Leopoldo Petreanu (CR), Michael Häusser (Univ. College London), Menno Witter (Kavli Institute for Systems Neuroscience)

Understanding how activity in neural circuits drives behaviour is a fundamental problem in neuroscience. Making this link requires detailed information about the cell types and their connectivity, as well as the spatiotemporal patterns of activity in neural circuits in the intact brain during behaviour. Moreover, probing causal relationships between cellular and circuit-level processes and behaviour requires perturbation of specific elements of the circuit in a temporally and spatially precise manner.

This is a three-week course combined a lecture series featuring top speakers from around the world with a practical "hands-on" introduction to the latest methods for probing neural circuits. The aim was to first teach students the theoretical foundation of the techniques (weeks 1 and 2), and then provide them with sufficient practical experience (weeks 2 and 3) so that they will be able to establish these approaches when they return to their laboratories.

Computational Neuroscience
August 11-31

Directors:
Brent Doiron (Univ. of Pittsburgh), Maria Geffen (Univ. of Pennsylvania), Jakob Macke (Technical Univ. of Munich), Joe Paton (CR)

Computational Neuroscience is a rapidly evolving field whose methods and techniques are critical for understanding and modelling the brain, and also for designing and interpreting experiments. Mathematical modeling is an essential tool to cut through the vast complexity of neurobiological systems and their many interacting elements.

This three-weeks school taught the central ideas, methods, and practice of modern computational neuroscience through a combination of lectures and hands-on project work. Each morning was devoted to lectures given by distinguished international faculty on topics across the breadth of experimental and computational neuroscience. During the rest of the day, students worked on research projects in teams of two-three people under the close supervision of expert tutors and faculty.

Find the Thesis list on page 139

Events

To complement research-related activities, CR also organises scientific events on a regular basis.

23
Colloquia Seminars

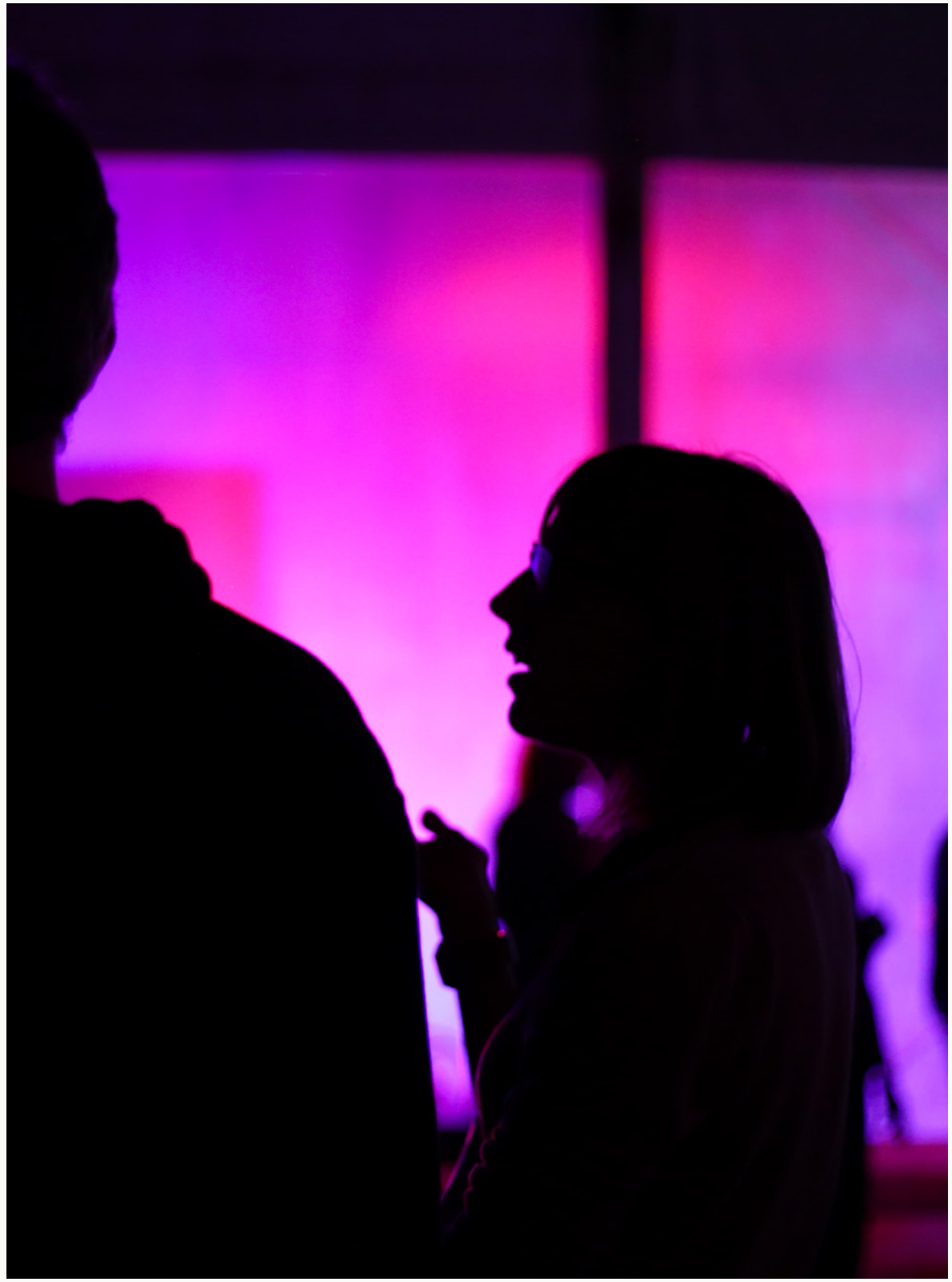
7
Theory Seminars

5
Conferences

4
Courses

1
Annual Retreat

1
Hackathon



Highlights

Champalimaud Research Symposium 2019: Tissue Environment in Health and Disease

October 8-10

The IUBMB Focused Meeting — 2019 Champalimaud Research Symposium Tissue Environment in Health and Disease — was held at the CCU from the 8th to the 10th of October 2019. The Symposium addressed how intrinsic and extrinsic environments impact on tissue homeostasis.

The meeting featured keynote lectures by Professor Elaine Fuchs and Professor Richard Locksley, who headed a diverse list of 17 distinguished speakers. In addition, the symposium included several talk presentations by selected participants (based on abstract-submission) and daily poster sessions.

The topic was highlighted from different angles and included a discussion on the homeostatic mechanisms that underlie inflammation, injury, ageing and oncogenic transformation in different tissues of our body. Invited speakers have therefore covered aspects from immunology, cell signaling, genetics and tissue regeneration in different model organisms.

The Symposium was held at the CCU, on the waterfront in central Lisbon. This unique venue, together with an exciting list of invited speakers, has fostered a lively and stimulating scientific meeting.

Symposium chairs:
Christa Rhiner, Eduardo Moreno and Henrique Veiga-Fernandes

Organisers:
Ana Casaca, Patrícia Correia and Pedro Alves

Symposium participants enjoying a coffee break at the Darwin's Café terrace

Elaine Fuchs
Keynote
The Rockefeller University, USA

Richard Locksley
Keynote
University of California San Francisco, USA

Ajay Chawla
University of California San Francisco, USA

Andrea Brand
The Gurdon Institute, UK

Bart Deplancke
EPFL, Switzerland

Christa Rhiner
Champalimaud Research, Portugal

Clemens Schmitt
Max-Delbrück-Center for Molecular Medicine, Germany

Eduardo Moreno
Champalimaud Research, Portugal

Judith Campisi
Buck Institute & Berkeley Lab, USA

Jun Huh
Harvard University, USA

Jürgen Knoblich
Institute of Molecular Biotechnology, Austria

Lucy Erin O'Brien
Stanford University School of Medicine, USA

María Dominguez
Neuroscience Institute of Alicante, Spain

Mathias Heikenwälder
German Cancer Research Center, Germany

Tor Erik Rusten
Oslo University Hospital, Norway

Yasmine Belkaid
National Institute of Allergy and Infectious Diseases, USA

Symposium on Imaging Hallmarks of Cancer. Pancreatic Cancer: From Cell Biology to Treatment

November 15

The “Imaging Hallmarks of Cancer” symposium was organised by Celso Matos, CR co-Director and Head of the Imaging Department at the Champalimaud Clinical Centre, in collaboration with the European School of Radiology (ESOR).

This advanced multidisciplinary symposium bridged basic biological science and modern clinical practice with a special focus in pancreatic cancer. Internationally renowned experts reviewed the challenges and opportunities in pancreatic cancer research, highlighting the potential of modern imaging modalities to drive breakthroughs in pancreatic cancer, and to envision new developments in pancreatic cancer treatment.

Cool Tools for Science: Users Innovation

May 29

In its 1st edition, “Cool Tools For Science” - an event for Life Sciences and Health researchers - gathered more than 70 participants, from Portugal and abroad. Users of research infrastructures were invited to present customised tools developed by themselves to solve problems for which there is no general solution available. 26 tools from a multiplicity of research areas were presented in short pitches and/or demonstrations. Prizes were given to the coolest innovation and to the coolest presentation.

Event organisers:
Biodata.pt; CONGENTO; RNEM - Portuguese Mass Spectrometry Network

Local organisers:
João Cruz and Laura Ward

The Champalimaud Auditorium in repose between talk sessions

Know more about CR 2019 Events on page 134

Culture

As the CR community grows, its culture evolves with it. In the last few years, CR members introduced several new initiatives, as well as carried on with long-lasting, successful activities, such as the annual retreat, thereby continuously enriching the social and scientific life at CR.

Kickstarter

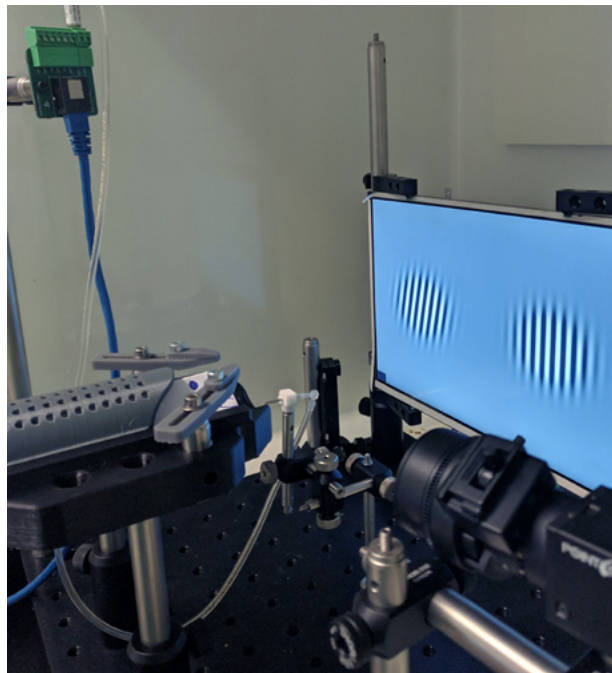
The CR Kickstarter is a new internal funding mechanism designed to promote internal collaborative projects and the development of shared ideas and resources. In this initiative, which has been successfully running at CR since 2016, a portion of each lab's budget is allocated to projects proposed in this system. Anyone may propose projects, which must involve, or benefit, a group wider than one lab, along with a minimum required budget. If the project can gain enough support and meets the eligibility requirements, it will be funded.

In 2019, 16 new projects received support from the CR community that addressed a range of needs. These include projects dedicated to developing analysis and behavioural software, purchasing technical equipment and producing various types of educational events.

CISS Champalimaud Internal Seminar Series

Each week, two CR researchers deliver a 25-minute presentation about their work, after which they receive feedback and questions from the CR community. These events, in addition to creating an atmosphere that facilitates collaboration, also provide a platform for junior researchers to advance their skills in preparing and delivering oral presentations to large audiences.

Organisers:
Pedro Garcia da Silva
Marta Moita
Zachary Mainen



An example of a Kickstarter project where behavioural rigs were built using tools developed at CR (Bonsai and HARP). The rigs will be used by several CR labs to study visual attention and expectation in mice.

Monthly Charity Bake Sale

The monthly charity bake sale started in 2017 by a group of CR members dubbed "The Baking Lab", who decided to channel their love of baking towards charity. Besides the long list of dedicated bakers who rotate between events, other volunteers also contribute with juice, coffee and tea that benefactors receive for free to accompany their afternoon pastry.

In 2019, the group organised 11 events to support both national and international charities.

© Ben Ashby. Unsplash.com

Organisers:
Irene Argudo
Márcia Matos
Victòria Brugada

Charities:
Nuvem Vitória
Ajuda de mãe
Plataforma de apoio aos refugiados
Help Moçambique
CC Parede
Maria Cristina Foundation
Missão Patas Felizes
Make a Wish Foundation
UNICEF_Syria Children
Refood Lapa
Oceanos sem plásticos

Greener labs - Greener planet: increased use of reusable experimental equipment can help reduce waste

Green Team @ CCU

Motivated by the environmental crisis facing society, and conscious of the large carbon and waste footprint of biomedical sciences, in 2019 various initiatives were started by the CCU community. These included a recycling scheme for disposable coffee capsules; the bulk buying of reusable coffee capsules; distributing reusable water bottles to all staff; removing all plastic cups from water machines and including 'Green Tips' in the weekly newsletter.

These small steps galvanised the creation of a community-led group - the Green Team @CCU - with the goal to conserve natural resources and transform the CCU into a positive example of environmentally friendly practices in research and medicine. The Green Team @CCU is currently collaborating with research teams in the UK to explore and test the best ways to conduct our work in an environmentally responsible manner, and in 2020, with Lisbon the Green Capital of Europe, aims to create a network of institutes in Lisbon to share environmental best practices in medicine and research.

CR Annual Retreat

The Annual Retreat is a major event that gathers all CR members in a remote location for a period of four days. The retreat serves the purpose of familiarising individual scientists with each other's work while creating a sense of community. It combines scientific events, such as poster sessions, with creative cultural and social activities. As the CR continues to grow in numbers and scope of research, these events, now more than ever, serve as an important means of maintaining the scientific culture of collaboration and cooperation at CR.

June 25–28

Location:
Vila Galé Clube de Campo, Alentejo

Retreat committee:
Catarina Pimentel
Gonçalo Guiomar
Irene Argudo
João Pereira
Patrícia Correia
Roksana Pirzgalska
Ruth Diez del Corral
Susana Lima

Science Communication & Outreach

One of CR's stated goals is to share knowledge not only within the scientific community but also with the community at large. Many CR researchers, at all career stages, adopt this vision and choose to organise and participate in various outreach activities, both at and outside of the CCU.

Highlights

First ProjectAr Watch - Talk - Act: "Chasing Coral"

This new event series, which sprung out of the outreach event-series, Ar | Respire Connosco, aims to raise awareness for emerging societal issues while backing them up with science. ProjectAr links the screening of movies and documentaries with an open conversation, that will hopefully raise awareness for emerging societal issues from a scientific perspective. In the first ProjectAr, which happened during "Global Climate Change week", we organised a free, public screening of the documentary "Chasing Coral". The film was followed by two short presentations by marine biologists, and an open discussion among all participants.

Team:
Catarina Pimentel, Patrícia Correia, Catarina Ramos, Eline Smaragdi, Rita Figueiredo, Marta Correia, Diogo Matias, Alexandre Azinheira, Pedro Alves, Kristin Fischer, Tatiana Silva, Tiago Quendera, Laura Ward, Francisco Romero

Neuronautas: young brain explorers - CR's Academia Gulbenkian do Conhecimento is off to a great start

The ambitious citizen science project "Neuronautas", which was selected in 2018 to be part of the first Academias Gulbenkian do Conhecimento , ran its "pilot" edition in 2019. The Neuronautas academy aims to train young people to follow their curiosity, question their own assumptions and challenge the unknown. To this end, a team of scientists, science communicators and alumni of the Champalimaud Foundation, developed an experimental methodology where highschool students explore concepts in neuroscience by learning how to effectively utilize commonly available equipment and software.

Team:
Goncalo Lopes, Danbee Kim, Nuno Loureiro, Rita Baptista, João Frazão, Catarina Ramos

NEURO NAUTAS

The Educational project “Metacognition Lab: Learning to Learn” receives a BPI “la Caixa” Infância Award

LaMAA (Laboratório de Metacognição: Aprender a Aprender), was one of the winners of the BPI “la Caixa” Infância 2019 Awards. The programme aims to promote the application of metacognition techniques to the learning process, with the goal of helping users to learn how to learn.

Metacognition relates to knowing what you know. These courses aim to facilitate the understanding of these concepts and to “calibrate” the study method. This programme answers an important educational need, as there are currently no Portuguese courses that apply metacognition approaches to the learning of different disciplines in a coherent and integrated way.

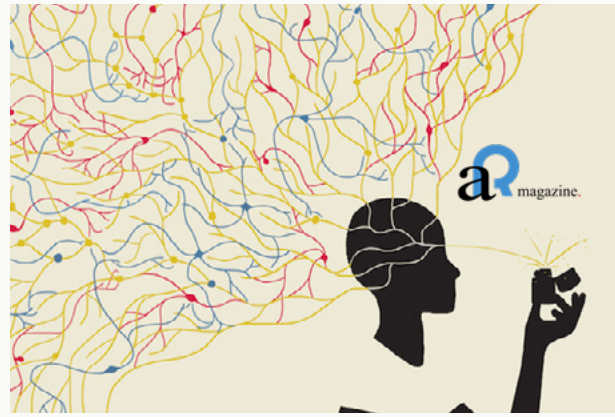
The first two courses will be dedicated to Neuroscience and Machine Learning. The programme will be developed and implemented by a team of engineers from TreeTree2 and Instituto Superior Técnico, and neuroscientists from the Champalimaud Foundation.

Team:
André Mendonça, Catarina Ramos

Artificial Intelligence in Health, Robotics and Programming: Next Einstein Forum Cabo Verde Africa Science Week

The third event of the Next Einstein Forum - Africa Science Week Cape Verde 2019 took place over the course of four days (26 to 29 September) at the island of Santiago, in São Lourenço dos Órgãos in Cape Verde. A team of CR scientists participated in the event, during which about 150 children and teenagers, mostly girls, developed skills in a wide range of topics including robotics and its applications in our daily lives, health, programming and the web.

Team:
Filipe Rodrigues, Hugo Marques, João Frazão



With 15,000 visitors, Ar Magazine is reaching curious minds around the globe

How do sleepless nights influence the health of your gut? How can a novel AI method revolutionise the study of collective behaviour? Ar Magazine features news about recent discoveries, short videos, comics, poems and interviews, all with a science-twist. In 2019, 29 unique pieces were published, drawing more than 15.000 visitors world-wide.

A special highlight of Ar Magazine during 2019 was the short-videos series “Science Snapshots”. This series features the most recent breakthroughs made by the investigators of the Champalimaud Centre for the Unknown as they tackle some of biology’s greatest mysteries.

The full playlist is available on www.youtube.com

Team:
Ana Gerschenfeld, Catarina Ramos, Liad Hollender

Know more about Outreach on page 136

Outreach

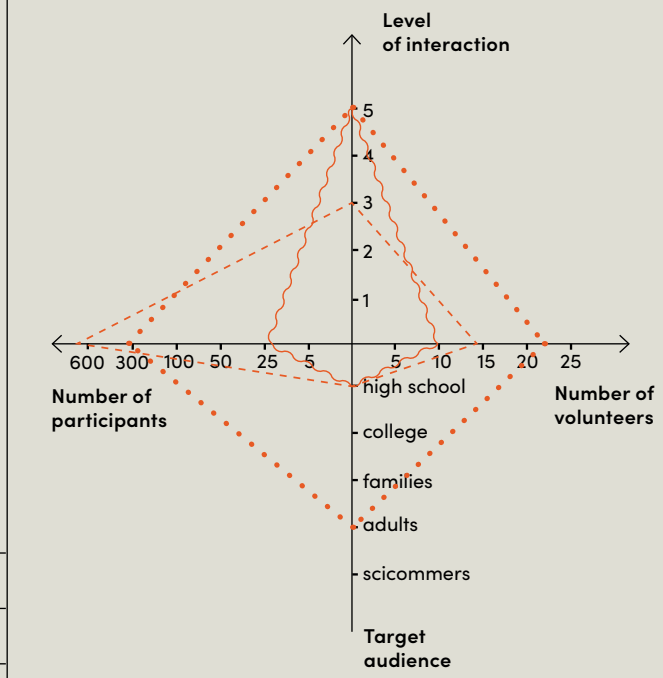
At the CCU

- Academia Gulbenkian do Conhecimento "Neuronautas"
- Job shadowing
- LaMAA: Laboratório de Metacognição Aprender a Aprender
- MICRODay
- ProjectAR: "Chasing Coral"
- School visits

6 Initiatives

45 Volunteers

~1100 Public



Online

Brain Awareness Week images and videos campaign

Science snapshot videos (CR Youtube)

~2500 new followers

Outside the CCU

120 years of Colégio Valsassina. F. C. Gulbenkian

2nd Citizen Sceince Meeting. Academia Nacional das Ciências

2nd Excellence in Science Communication Workshop. European Research Council, Brussels

Brain Awareness Week. Fábrica das Artes

Congressos dos Cozinheiros. LX Factory

HAC. IST

Jobshop. Instituto Superior Técnico (IST)

Jortec. Fac. Ciência e Tecnologia UNova

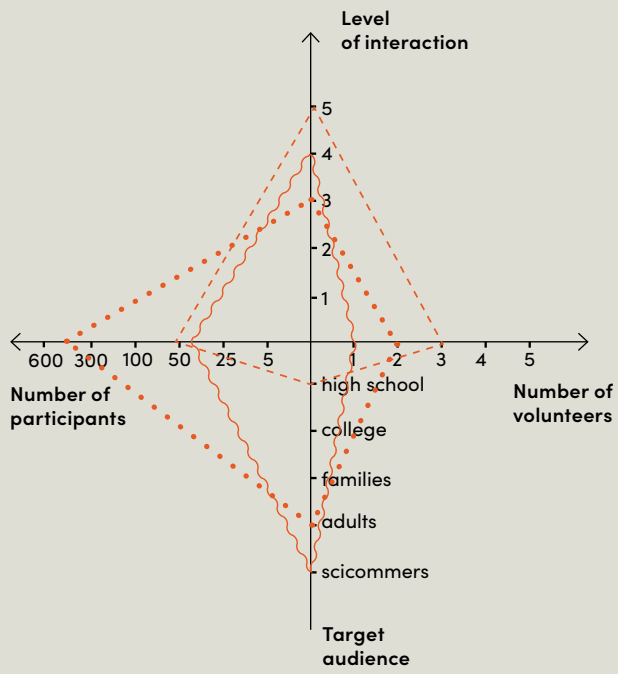
Next Einstein Forum. Cape Verde

Special Team. IST

Science on Stage Festival. Cascais

Wider than the Sky public events. F.C. Gulbenkian

12 Initiatives **20** Volunteers **~2250** Public



Thank you

Albino O.Maia
Ana Cruz
Ana Fernandes
Anna Pezzarossa
Beatriz Belbut
Bruna Costa
Carlos Ribeiro
Catarina Brás
Catarina Pimentel
Christian Machens
Clara Ferreira
Danbee Kim
Daniel Nunes
Davide Accardi
Denise Camacho
Edite Figueiras
Eline Smaragdi
Filipe Rodrigues
Francisco Romero
Gautam Agarwal
Gonçalo Lopes
Hugo Marques
Inês Soeiro
João Afonso
João Frazão
João Marques
Joe Paton
Julia Huntenburg
Kcénia Bougrova
Kristin Fischer
Laura Ward
Leonor Morgado
Lucas Martins
Margarida Anjos
Maria Inês Vicente
Marta Estrada
Matheus Farias
Michael Pereira
Mirjam Heinemans
Nuno Calaim
Nuno Loureiro
Patrícia Correia
Pedro Alves
Rita Baptista
Rita Fior
Ruth Diez del Corral
Sander Keemink
Simone Zacarias
Susana Lima
Tatiana Silva
Teresa Dias
Thabèlò Khoboko
Thiago Carvalho
Tiago Costa
Tiago Quendera
Zach Mainen

Facilitating research with dedicated administrative and technical support

CR Support Units

The CR Support Units (CRSU) provide all administrative, financial and operational assistance to the CR community. Accompanying the evolution and growth of CR, the support provided to CR's scientists also continuously grows in organisation and capacities. The CRSU team aims to provide all science administration, management and communication support to boost the work of scientists, maximising the focus on research.

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CRSU Highlights

Graduate Programmes Office @ IST Jobfest

The Graduate Programmes Office responded to the invitation of the AEIST (Associação de Estudantes do Instituto Superior Técnico) to participate in the IST Jobfest of 2019, with a team counting two INPDP students - Matheus Farias and Lucas Martins and both programme managers - Simone Zacarias and Maria Teresa Dias.

The INPDP booth had a steady crowd of undergraduate students, attracted by the setup the team brought from the CCU. The students stayed a while, chatting with the INPDP student about their research and experience at the programme.

Science Communication Office: CR in the Media

In 2019, the Science Communication Office produced 17 press releases and liaised 22 media requests. Several press releases evoked significant interest in the media, such as those that announced the publication of research articles from the de Polavieja, Ribeiro and Veiga-Fernandes labs. These articles featured innovations in the fields of collective behaviour, food-choice and the interaction between the immune and the nervous systems, respectively. A notable media request was made by the magazine National Geographic. The magazine interviewed CR investigator Rita Fior for an article about breakthroughs in personalised medicine.

Among the long list of responsibilities of CRSU's operations manager is the safety and functionality of the CCU's Open Labs.

Direction Support Team

The Direction Support Team receives, delegates and implements direct instructions from the Research Direction Team and the Director of Research Support. This team also serves as a primary contact point for any problem-solving needs within CR, being able to advise on the resources available to the CR community.

Director of research support: **Ryan Herbert**
Executive coordinator: **Inês Soeiro**
Operations manager: **Cátia Feliciano**
Financial manager: **Joaquim Teixeira**

Events

The Events unit supports scientific events organised by CR. From the large annual events like the CR Retreat and Symposium to our weekly CISS and Colloquium, the team will be able to help you with all event-related details, from conception and planning to logistical details such as travel and accommodation, venue set-up, catering and event management. This unit also supports the Faculty's events and other ad-hoc events such as Ar events and other outreach initiatives. The team also consolidates the management of all communal AV equipment, as well as expertise in videography and photography.

Coordinator: **Patrícia Correia**
Events organiser: **Ana Casaca**
Events assistant: **Pedro Alves**
AV technician: **Alexandre Azinheira**

Lab Administration

The Laboratory Administrator team provides support to the scientists working at CR so that they can focus on research. Every laboratory is assigned a Lab Administrator that works closely with the PIs and lab managers assisting the labs in their ordering process, budget management, travel arrangements, and other tasks necessary to managing the lab. The lab administrators coordinate with other CR support units and CF departments such as post-award, logistics, accounting, IT, and maintenance, as well as external agents such as suppliers, service providers, and shipping companies.

Coordinator: **Raquel Gonçalves**
Lab administrators: **Vesna Petojevic, Telma Carrilho, Lauren Noblet, António Raposo, Rita Saraiva, Ana Margarida Nunes**

Human Resources & Fellows Support Office

Every person that joins CR enters through the HR & Fellows Support Office. Whether it's a PI or an intern or simply a guest, the HR & Fellows Support Office advises on all essential procedures: contracts, social security, medical insurance, etc. The Office also supports all CR recruiting processes, including that of the graduate programme.

CR has almost 430 affiliated fellows, 330 of whom have ongoing fellowship contracts with the Champalimaud Foundation (CF). The Office's role is to facilitate communication between CR and CF's Central Administration departments, as well as to ensure that all commitments to the fellows are met.

HR liaison: **Teresa Carona**
HR & fellows assistant: **Pedro Alves**

The Human Resources & Fellows Support Office helps CR members through the maze of Portuguese bureaucracy so that they can relax and focus on their work.

Office for Sponsored Programmes Post-Award

CR's Post-Award team at the Office for Sponsored Programmes (OSP) provides support in management and administration of external funds for research, including financial and scientific reporting, eligibility of expenditure, compliance and external audits.

The Post-Award team also functions as a facilitator of more bureaucratic aspects of grant management, thereby creating a bridge between the CR Scientific Community and the funding agencies. Post-award's support is also provided by a resident team of project officers from Verbochave, Consultoria Lda.

Coordinator: **Joaquim Teixeira**
Scientific Officer: **Francisco Semedo**
Project Officers: **Carina Quintal, Helena Duarte, Henrique Moreira, Inês Bonifácio, Pedro Monteiro, Sofia Venâncio, Vanda Vicente.**

Pre-Award

The Pre-Award team, among other responsibilities, provides support to the researchers hosted at the Champalimaud Center for the Unknown – CCU throughout the first stages of the grant life cycle: i) the identification of external funding opportunities for research; ii) the preparation and submission of research applications from the initiative of the researchers to external funding; iii) the negotiation of successfully funded projects up to the signing of the official documents.

Coordinator: **Joana Lamego**
Grant managers: **Andreia Tavares, Bruno Ceña, Filipa Cardoso, Mariana Santa-Marta**

Graduate Program Office

This Graduate Program Office runs mainly through the Teaching Lab and Classroom, the hubs of our PhD programme and all courses happening at CR. The team deals with the administrative and logistic aspects of the INPDP programme, the CAJAL courses and other teaching events. The team also manages the CR library, the Teaching Lab space, and the Classroom bookings. The Office also provides assistance to the student's social events, supports the INPDP recruiting process, and hosts the annual INPDP SAB visits.

Graduate programme managers: **Maria Teresa Dias, Simone Zacarias**

Student checking out zebrafish larvae at the INDPD stand at the IST Jobfest.

Visit from an elementary school during the 2019 Brain Awareness Week.

Science Communication Office

The Science Communication Office is responsible for disseminating information on the activities and ongoing or emerging objectives of the Champalimaud Research to all relevant parties. In particular, this Unit is responsible for maintaining fluent internal and external communication channels, including CR's online presence, liaising with the media and the production of communication documents / materials, such as the annual report. In parallel, this Unit coordinates science communication initiatives that range from science education and outreach events to the organization of scientific meetings. The team is also able to support the CR community in their scientific endeavours, with in-house scientific design and illustration.

Coordinator: **Catarina Ramos**
Science writers: **Ana Gerschenfeld, Liad Hollender**
Science education & outreach officer: **Raquel Gomes**
Graphic designers: **Diogo Matias, Marta Correia**
Science graphic designer: **Gil Costa**
Multimedia producer: **Alexandre Azinheira**

Project Managers

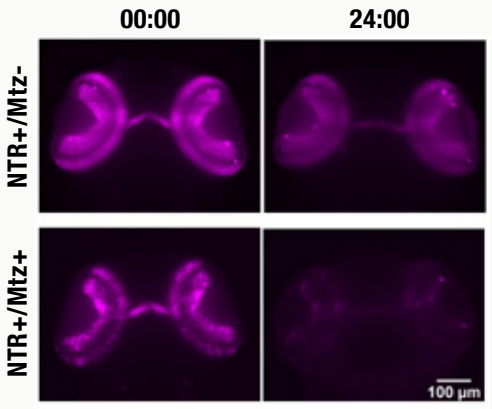
The Project Managers are responsible for the day-to-day implementation of large scale institutional and consortia projects. They play a pivotal liaison role, acting as the centre of communication for all internal and external stakeholders, monitoring project progress, identifying risks, coordinating technical reporting and ensuring effective dissemination.

Managers: **João Cruz, Laura Ward**

Scientific and Technological Platforms

The Scientific and Technological Platforms of the Champalimaud Centre for the Unknown carry out technical-scientific and specialised support work for the activities of research groups and clinicians. They operate in a wide range of areas, from the development of sophisticated technologies in animal models, imaging tools, hardware and software, to resource management and research infrastructures.

Platforms Highlights



Zebrafish retina captured in an innovative imaging chamber.

© ABBE Platform

Advanced BioImaging and BioOptics Experimental platform: Introducing state-of-the-art imaging tools

In 2019, the Advanced BioImaging and BioOptics Experimental platform successfully concluded its first research project titled "Use of light-sheet imaging to assess pharmacological manipulation effects on zebrafish neural development", which led to the realisation of an innovative imaging chamber for drug testing.
The chamber is optically transparent, biocompatible and of small inner volume, and is capable of imaging cleared samples in the centimeter scale from organs of rodents to entire organisms (such as zebrafish larvae). The project was accepted for an oral presentation at the Spanish & Portuguese Advanced Optical Microscopy Conference of 2019.

Histopathology platform: Implementing techniques for advanced tissue analysis

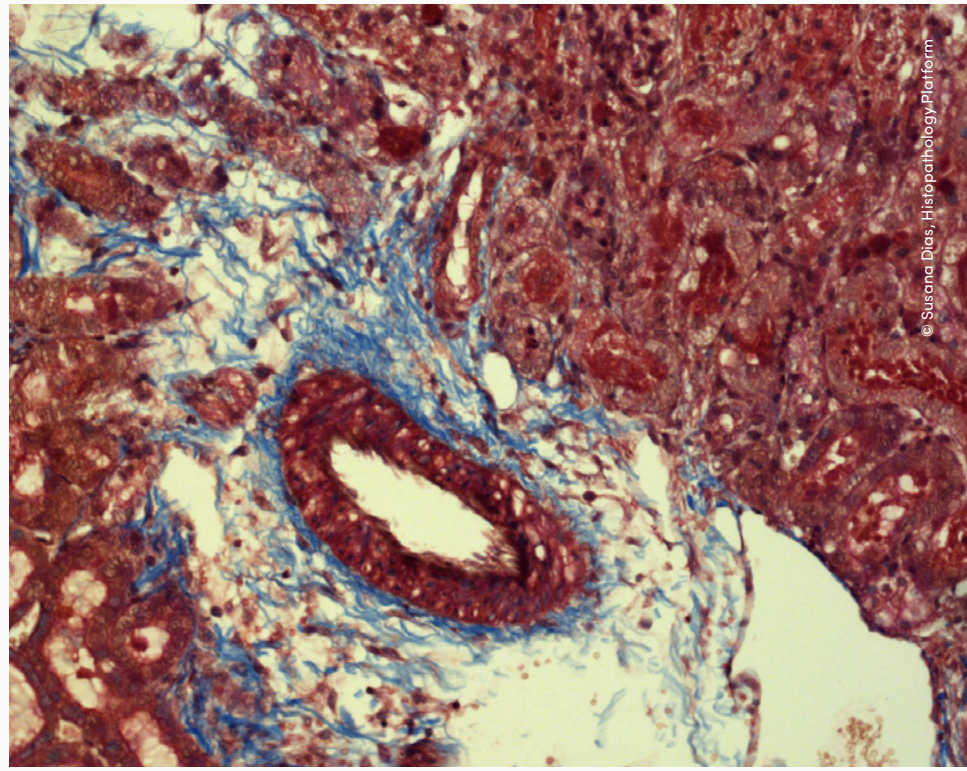
In 2019, the histopathology platform has implemented several new techniques for tissue processing and analysis. Among these are clearing techniques necessary for preparation of the tissue for microscopy, implementation of paraffin services for fine sectioning of tissues and additional histochemistry techniques for tissue analysis, such as the identification of structural abnormalities.

Fly platform: Landing in the *Drosophila* World – *Drosophila* Introductory Course

The first "Landing in the *Drosophila* World Course" took place in September 2019 at the Champalimaud Centre for the Unknown. The course was an initiative of CONGENTO, that was carried out through the joint efforts of three institutions: CEDOC, CF, and IGC, and the participation of 19 invited speakers from these research centres. These were intense days, but well enjoyed by everyone, both organisers and students.

Scientific Hardware Platform: Pushing Science Forward With Open-Source Hardware

During 2019, the Scientific Hardware platform kept expanding its open-source tools portfolio and spreading the word among the neuroscience community. Through a close connection with the most popular open-source projects, the platform is now well known and is a worldwide reference when it comes to open-source hardware. This was the year where the platform shipped more open-source tools around the globe. All these units were developed in-house.



© Susana Dias, Histopathology Platform

4-µm thick section of a mice kidney stained with Masson's trichrome (20x). Masson's trichrome is used to differentiate between collagen fibers and smooth muscle.

Glasswash and Media Preparation Platform

The Glasswash and Media Preparation Platform (GMPP) provides clean and sterilised labware such as glass,plastics and instruments to researchers and laboratories; prepares commonly used solutions, media culture and standards for Research groups and platforms. The GMPP also prepares complex or new formulations, requested for researchers; helps and advises the research community about biosafety rules, good practices and waste management. Finally, GMPP also provides bacteriological control in several platforms and clinical unities.

Platform manager: **Maria Vito**
Laboratory technicians: **Patrick Teca , Soraia Rodrigues, Maria Madalena Seixas**

Histopathology Platform

The Histopathology platform provides technical and scientific support to the CR community regarding tissue processing, sectioning, staining and clearing. The platform processes mouse, rat, human, fly and zebrafish samples through different techniques, such as paraffin embedding, vibratome and cryostat sectioning, immunohistochemistry of thin sections and thick blocks, staining techniques and several clearing techniques. In addition to implementing cutting-edge techniques, according to needs of the scientific community, the Histopathology platform is also responsible for protocols optimisation.

Histopathology technicians: **Susana Dias, Sérgio Casimiro, Inês Marques, Maria Inês Romano**

Advanced BioImaging and BioOptics Experimental Platform (ABBE)

The Advanced BioImaging and BioOptics Experimental (ABBE) platform provides training and access to a variety of cutting-edge light microscopes and image analysis software.

2019 was a year of progress in the ABBE platform. The team was joined by Anna Pezzarossa, a microscopy and imaging specialist. In addition, the platform increased its light-sheet fluorescence microscopy capabilities with the acquisition of a light-sheet based machine. On the imaging analysis side, the facility also increased its range of services with "Merlin" - a new workstation with cutting edge capabilities.

In May, 2019, the platform, in concert with the national PPBI network of microscopy departments, has opened its doors to the public with MICRODia: an outreach event for high-school students. The day included a visit to the facility where the students learned about the principles of fluorescence and had the possibility to see their own DNA using microscopy.

Coordinator: **Pedro Garcia da Silva**
Group head: **Davide Accardi**
Senior technician: **Anna Pezzarossa**
Technician: **Leonor Morgado**

Fish Platform

The Fish Platform oversees an animal facility housing and breeding zebrafish, the second most used animal model in biomedical research, with very rigorous health and welfare standards. It works closely with the Molecular and Transgenic Tools platform to provide advanced research services such as transgenic and gene-edited zebrafish and also collaborates with other institutions and companies to develop new protocols and technologies. Its ambitious research service portfolio and scientific program have granted the Platform a substantial international reputation through several peer-reviewed publications and presentations at international meetings. The Fish Platform is also part of (CONGENTO), where it plays a pivotal role by delivering zebrafish services and providing facility management consulting to both the national and international research communities.

Coordinator and head: **Ana Catarina Certal**
Facility manager: **Joana Monteiro (CONGENTO)**
Research technicians: **Mariana Sampaio, Olivia Knight (CONGENTO), Inês Oliveira**
Facility technicians: **Carolina Cabrera (CONGENTO), Seidy Semedo, Maria João Pereira**

"Hands-on" experience at the Landing in the *Drosophila* World – *Drosophila* Introductory Course.

Flow Cytometry Platform

The goal of the Flow Cytometry Platform is to offer technical and scientific advice regarding the use of flow cytometry instruments to Champalimaud Foundation community and also to external research groups. This platform provides training in flow cytometry concepts, expertise for experimental planning and support in instrument' operation and data analysis.

Since 2017, the Flow Cytometry platform is part of the FLxFlow community – a Portuguese network for Flow Cytometry, which aims to bring together core Flow Facilities in the Lisbon area with the goal of enabling the access of scientists to cutting edge applications.

Coordinator: **Pedro Garcia da Silva**
Group head: **Ana Vieira**
Technician: **Renato Colaço**

Fly Platform

The Fly platform provides state-of-the art conditions for breeding, maintenance and manipulation of *Drosophila* to all CR researchers. Apart from management and maintenance of all shared equipment and spaces, it provides technical services ranging from core activities such as medium production and stock maintenance, to higher technically demanding procedures such as organ dissection, staining and embryo microinjection. Importantly, by closely working with other CR Platforms, the Fly platform is in a position to offer full turnkey projects to its users. Such examples include transgenic and mutant stock generation (from strategy choice and vector design to embryo microinjection, fly screening, genotyping and stock balancing) done in close collaboration with the MTT Platform, or the registry of brain confocal imaging (from organ dissection and staining to confocal imaging and registry), done in close collaboration with the ABBE and Software platforms. The Fly platform is part of the trans-institutional infrastructure CONGENTO, through which it offers services to external users as well.

Coordinator: **Isabel Campos**
Manager: **Liliana Costa**
Technicians: **Catarina Craveiro, Carina Portugal, Ana Reis, Sofia Silva, Patrícia Valentim, Zichiena Zovo**

Rodent Platform

The Rodent platform is primarily responsible for the maintenance and veterinary assistance of all CR rodent animal models, strictly following European Guidelines (Directive 2010/63/UE of September 22, 2010), National Laws (Decree Law 113/2013, of August 7) and Federation of European Laboratory Animal Science Associations (FELASA) guidelines and recommendations concerning laboratory animal welfare, scientific use and proper education/training of all personnel performing animal work.

Apart from managing and maintaining all shared equipment and spaces in the facility, Rodent platform staff members are also providing daily care and monitoring of animals during housing and experiments. Importantly, all CR labs can also rely on the platform for a comprehensive colony management ranging from weaning and sampling to genotyping, complying with the best animal welfare practices and refinement and reduction policies. The Rodent platform also runs a set of highly specialised and technically demanding services, some of which are done in close collaboration with the MTT Platform.

Coordinator: **Isabel Campos**
Veterinary: **Dolores Bonaparte**
Manager: **Rita Torre**
Technicians: **Catarina Craveiro, Ana Pereira, Cláudio Macedo, Erineo Silva, Eduardo André, Wilcilaya Pontes**
Colony managers: **Ana Vaz, Bruno Novais, Ana Rita Gonçalves, Carlos Silva, Joshaba Abreu, Wilma Sobral, João Pereira, Leonor Gomes**

Molecular and Transgenic Tools Platform

The Molecular and Transgenic Tools Platform (MTTP) performs complex cloning and gene editing projects. It assists users during all stages from the conceptual design by providing support in molecular biology strategies from basic services to complex cloning of knock-out and knock-in constructs to generate new cellular, zebrafish, fly or mouse models.

The MTTP also harbours a viral-vector production service and has several collaborations for continuous development and implementation of new viral systems. The platform acts as a hub of shared resources and expertise not only for the CR, but also for the national and international research communities, academic and industry, by providing services through CONGENTO.

Coordinator and head: **Ana Catarina Certal**
Molecular tools manager: **Ana Raquel Tomás**
Virus and cell manager: **Ana Cunha (CONGENTO)**
Research technicians: **Mariana Velez, Daniela Freire**

HARP board at the Scientific Hardware Platform

Scientific Hardware Platform

The platform is responsible for developing and participating in projects that have a high impact on science. As they are intrinsically inseparable, the field of electronics and mechanics are addressed. The platform provides the full pipeline of hardware development from requirement specification and analysis, design, development, implementation, validation procedures and test execution. It also handles diverse services, including 3D printing services, day-to-day support and management of both electronic and mechanical workshops.

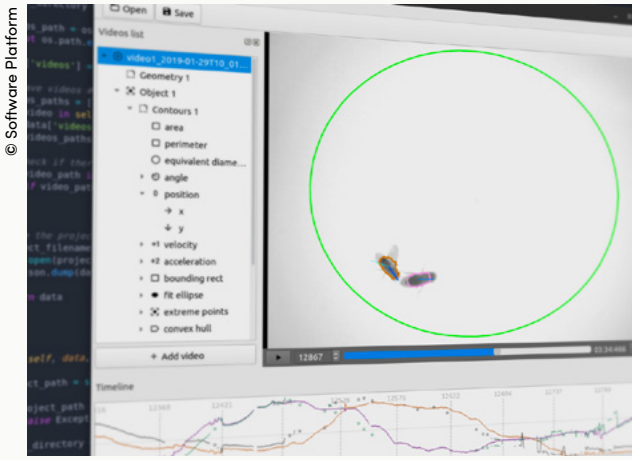
Hardware developers: **Filipe Carvalho, Artur Silva, Paulo Carriço**
Technicians: **Dario Bento, Laurent Lachaud**

Scientific Software Platform

The Scientific Software Platform aims to support high-level scientific research by providing high-quality software support and ensuring the performance of CR computational infrastructures. With educational backgrounds in Software, Electrical and Physics Engineering, the platform's team members have a broad range of skills and knowledge in areas such as computer vision, image processing, machine learning, hardware control, graphics, web, data management and systems administration. In 2018, the team focused on the development of the PyBpod and Python Video Annotator for behavioural analysis, and on the improvement of the data flow pipeline. The later improvement was achieved with the construction of a high performance computational and storage cluster and by the installation of an internal high-speed network to connect the data acquisition equipment to the computational resources.

Coordinator: **Pedro Garcia da Silva**
Group head: **Ricardo Ribeiro**
Cloud specialist: **Joao Baúto**
Data manager: **Hugo Cachitas**
Software developer: **Luís Teixeira**

© Software Platform



This image shows software developed by the Scientific Software Platform for annotation of behavioural videos.

The Nitty Gritty

For those who want to know more in detail what we've done

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Funding

Institutional Projects

European Commission - Horizon 2020

Human brain project specific grant agreement 2
Call/Programme: H2020-SGA-FETFLAG-HBP-2017
Active period: 01/04/18-31/03/20

Leveraging the unique organismic approach to health and disease of the Champalimaud Foundation through the inception of a quantitative biomedicine research programme focused on cancer
Call/Programme: H2020-WIDESPREAD-2016-2017
Active period: 01/10/18-30/09/23

Fundação para a Ciência e a Tecnologia

Unidade de I&D Programa Champalimaud de Neurociências
Call/Programme: Fundação para a Ciência e a Tecnologia
Active period: 01/01/19-31/12/19

Champalimaud Research Programme
Call/Programme: 2017/2018 R&D Unit evaluation
Active period: 01/01/20-31/12/23

Portugal 2020 (PT2020)

CONGENTO - Consortium for Genetically Tractable Organisms
Call/Programme: 01/SAICT/2016
Active period: 01/06/17-31/05/20

PT2020 – BIOIMAGING-INFRAESTRUTURAS / PPBI - Portuguese Platform of Bioimaging
Call/Programme: 01/SAICT/2016
Active period: 01/06/17-31/05/20

Biodata.pt - Portuguese Biological Data Network
Call/Programme: 01/SAICT/2016
Active period: 19/06/17-17/06/20

FCImuno - Centro de Valorização e Transferência de Tecnologia em Imunoterapia da Fundação D. Anna de Sommer Champalimaud e Dr. Carlos Montez Champalimaud
Call/Programme: LISBOA-46-2018-22
Active period: 01/01/19-31/12/20

Research Projects/ Grants

American Portuguese Biomedical Research Fund

Rita Fior
Erythrocyte Surveillance - the immune system looking within?
Call/Programme: APBRF
Active period: 21/08/18-31/12/21

Brain and Behavior Research Foundation

Romain Ligneul (Mainen lab)
From Neuronal Firing to Behavior: Breaking Down the 5-HT Chain Events
Call/Programme: 2017 NARSAD Young Investigator Grant
Active period: 15/01/18-14/01/20

José Oliveira (Oliveira-Maia lab)
Influence of markers of immune dysfunction on orbitofrontal cortex recruitment during a decision making task in obsessive-compulsive disorder
Call/Programme: NARSAD Young Investigator
Active period: 15/07/19-14/07/21

Breast Cancer Now

Bruno Costa-Silva
Bosutinib effects in pre-metastatic niche formation and lung metastasis in breast cancer
Call/Programme: Catalyst Programme
Active period: 04/06/18-03/06/21

Cancer Research UK

Carlos Ribeiro (Project head PI: Julia Cordero, University of Glasgow)
Call/Programme: Pioneer Award
Project Title: *Drosophila* as a model to study mechanisms of cancer-driven behavioural changes

European Commission - Horizon 2020

Megan Carey
Cerebellar circuit mechanisms of coordinated locomotion in mice — LOCOMOUSE
Call/Programme: ERC-2014-STG
Active period: 01/05/15-30/04/20

Megan Carey
Cerebellar circuits for locomotor learning in space and time (LOCOLEARN)
Call/Programme: ERC 2019-CoG
Active period: 01/05/20-30/04/25

Eugenia Chiappe
Circuit mechanisms of self-movement estimation during walking
Call/Programme: ERC-2017-STG
Active period: 01/11/17-31/10/22

Rui Costa
Behaviour Phenotyping using Inertial Sensors (WEAR)
Call/Programme: ERC-2018-POC
Active period: 01/01/19-30/06/20

Bruno Costa-Silva (Coordinated by: STICHTING VUMC)
European Liquid Biopsies Academy - Towards widespread clinical application of blood-based diagnostic tools
Call/Programme: H2020-MSCA-ITN-2017
Active period: 01/01/18-31/12/21

Susana Lima
Hypothalamic circuits for the selection of defensive and mating behaviour in females
Call/Programme: ERC-2017-COG
Active period: 01/03/18-28/02/23

Zachary Mainen
Modulation of cortical circuits and predictive neural coding by serotonin — 5HTCircuits
Call/Programme: ERC-2014-ADG/ ERC-2014-ADG
Active period: 01/01/16-31/12/20

Marta Moita
Actively Frozen - contextual modulation of freezing and its neuronal basis (A-FRO)
Call/Programme: ERC-2018-CoG
Active period: 2019-2024

Albino Oliveira-Maia & Nickolas Papanikolaou; (Coordinated by: HELSINGIN JA UUDENMAAN SAIRAANHOITOPIIRIN KUNTAYHTYMÄ - HUS. *Coordinator at CCU: Fatima Cardoso)
Predicting Effective Adaptation to Breast Cancer to Help Women to BOUNCE Back
Call/Programme: H2020-SC1-2017-CNECT-2
Active period: 01/11/17-31/10/21

Albino Oliveira-Maia (Coordinated by: WATERFORD INSTITUTE OF TECHNOLOGY - WIT)
A federated artificial intelligence solution for monitoring mental health status after cancer treatment
Call/Programme: H2020-SC1-DTH-2019
Active period: 01/01/20-31/12/22

Michael Orger
Whole-brain circuits controlling visuomotor behavior
Call/Programme: ERC-2017-COG
Active period: 01/02/18-31/01/23

Michael Orger (Coordinated by: INSTITUT DU CERVEAU ET DE LA MOELLE EPINIERE - ICM)
Zebrafish Neuroscience Interdisciplinary Training Hub (ZENITH)
Call/Programme: H2020-MSCA-ITN-2018
Active period: 01/10/19-30/09/23

Joe Paton
Basal ganglia circuit mechanisms underlying dynamic cognitive behavior
Call/Programme: ERC-2017-COG
Active period: 01/04/18-01/04/23

Noam Shemesh
Sensing activity-induced cell swellings and ensuing neurotransmitter releases for in-vivo functional imaging sans hemodynamics — DIRECT-fMRI
Call/Programme: ERC-2015-STG
Active period: 01/03/16-28/02/21

Henrique Veiga-Fernandes
Glia-derived factors in innate lymphoid cell sensing and intestinal defence
Call/Programme: ERC-2014-CoG
Active period: 01/06/17-30/06/20

Henrique Veiga-Fernandes
Neuroimmune activation as a novel therapeutic approach for IBD — NeurIMM
Call/Programme: ERC-2017-PoC
Active period: 01/09/17-28/02/19

European Commission FP7-Seventh Framework Programme

Rui Costa
NEURALCHUNK— Neural bases of action chunking in basal ganglia subcircuits
Call/Programme: ERC-2013-CoG
Active period: 01/11/14-31/10/19

Eduardo Moreno
Active Mechanisms of Cell Selection: From Cell Competition to Cell Fitness.
Call/Programme: ERC-2013-CoG
Active period: 01/09/16-31/05/20

European Foundation for the Study of Diabetes

Roksana Pirzgalska (Veiga-Fernandes lab)
Neuroimmune approach to diabetes-associated infections
Call/Programme: Young Investigator Research Award Application
Active period: 01/01/19-31/12/19

European Molecular Biology Organization (EMBO)

Bruno Costa-Silva
Call/Programme: EMBO-INSTALLATION GRANTS
Active period: 01/06/18-31/05/21

Fundação Bial

Gautam Agarwal (Mainen lab)
Dissecting dynamical components of complex decision-making using a computer game-based task
Call/Programme: Funding for Scientific Research 2018/2019
Active period: 02/01/19-31/12/20

Joe Paton
How do dopamine neurons and striatal populations interact during decision-making?
Call/Programme: Grants 2016/2017
Active period: 17/07/17-17/07/20

Carlos Ribeiro
Harnessing the power of closed-loop neuronal to identify the circuit basis of decision making
Call/Programme: Grants for Scientific Research 2016/2017
Active period: 2017-2019

Fundação para a Ciência e a Tecnologia

Megan Carey
The nature of error signals during locomotor learning
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Rui Costa
Determining the basal ganglia circuits involved in repetitive behaviors in autism spectrum disorders
Call/Programme: ICDT 2014
Active period: 01/05/16-30/04/19

Nicolas Morgenstern (Rui Costa lab)
Call/Programme: Norma Transitória BPD
Active period: 01/01/19-31/12/24

Bruno Costa-Silva (Coordinated by: Rui Oliveira, Fundação Calouste Gulbenkian)
Developmental and transgenerational effects of oxytocin-like peptides on social behavior: an eco-evo-devo approach using zebrafish as a model
Call/Programme: 02/SAICT/2017
Active period: 14/06/18-13/06/21

Bruno Costa-Silva (Coordinated by: Maria Paula Macedo, Universidade Nova de Lisboa)
Metabolic chronic diseases stratification: a case for gut-liver axis derived exosomes.
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Bruno Costa-Silva (Coordinated by: Rune Matthiessen, Universidade Nova de Lisboa)
Estratificação de exossomas de linfoma difuso de grandes células B
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Cristina João (Co-PI: Bruno Costa-Silva)
The role of metastatic microenvironment in Multiple Myeloma extramedullary disease. (EMphAsIS: Extramedular MyelomA microenvironment Study)
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Gonzalo de Polavieja
Decision-making in animal groups: a multidisciplinar approach to understand how social information is processed
Call/Programme: ICDT 2014
Active period: 01/07/16-31/12/19

Rita Fior
Zebrafish patient derived xenografts to predict anti-cancer drug response for personalised medicine
Call/Programme: 02/SAICT/2017
Active period: 01/10/19-30/09/22

Susana Lima
Female socio-sexual behavior: role of hypothalamic neuronal activity across the reproductive cycle
Call/Programme: ICDT 2014
Active period: 01/06/16-31/12/19

Christian Machens
Robustness and Energy-Efficiency of Spiking Neural Networks
Call/Programme: 02/SAICT/2017
Active period: 14/06/18-13/06/21

Bassam Atallah (Mainen lab)
Spatial Attention: dissecting the cortical and subcortical circuitry during rapid routing of sensory information
Call/Programme: 02/SAICT/2017
Active period: 01/06/18-31/05/21

Eran Lottem (Mainen lab)
Serotonergic Control of Decision-Making and Impulsivity
Call/Programme: 02/SAICT/2017
Active period: 01/09/18-31/08/21

Cindy Poo (Mainen lab)
Odors and memory: neural mechanisms for encoding contextual information in olfactory cortex
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Zachary Mainen
Neural mechanism of value based decision making of staying or leaving - Deciding when to initiate locomotion to move to the next reward location
Call/Programme: 02/SAICT/2017
Active period: 03/10/18-02/10/21

Albino Oliveira-Maia; Co-PI: **Zachary Mainen**
Cognitive flexibility, cortical excitability and antidepressive effect of psilocybin
Call/Programme: 02/SAICT/2017
Active period: 03/10/18-02/10/21

Luzia Travado (Oliveira-Maia lab)
Distress and regional brain metabolism: a correlational study in metastatic breast cancer patients
Call/Programme: ICDT 2014
Active period: 01/06/16-31/01/20

João Corrêa (Oliveira-Maia lab)
Obsessive-compulsive disorder and reinforcement learning: exploring the role of the orbitofrontal cortex
Call/Programme: 02/SAICT/2017
Active period: 01/06/18-31/05/21

Ana Fernandes (Oliveira-Maia lab)
From the Vagus Nerve to the Ventral Tegmental Area: A pathway for post-ingestive food reinforcement in the development and treatment of obesity
Call/Programme: 02/SAICT/2017
Active period: 01/08/18-31/07/21

Ana Fernandes (Oliveira-Maia lab)
Call/Programme: Norma Transitória BPD
Active period: 01/01/19-31/12/24

Michael Orger
The neural circuit basis of oculomotor behaviour in zebrafish
Call/Programme: ICDT 2014
Active period: 01/07/16-31/12/19

Michael Orger (Co-PI); PI: Rui Oliveira, Fundação Calouste Gulbenkian
Developmental and transgenerational effects of oxytocin-like peptides on social behavior: an eco-evo-devo approach using zebrafish as a model
Call/Programme: 02/SAICT/2017
Active period: 14/06/18-13/06/21

Michael Orger
Whole-brain mechanisms of operant learning in zebrafish: cells, circuits and behaviour
Call/Programme: 02/SAICT/2017
Active period: 17/07/18-16/07/21

Nikolaos Papanikolaou (Co-PI); PI: **Leonardo Vanneschi**, Universidade Nova de Lisboa
Improving Bio-Inspired Deep Learning for Radiomics
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Leopoldo Petreanu
Cortical circuits for sensory expectations
Call/Programme: 02/SAICT/2017
Active period: 14/06/18-13/06/21

Alfonso Renart
Robustness and Energy-Efficiency of Spiking Neural Networks
Call/Programme: 02/SAICT/2017
Active period: 14/06/18-13/06/21

Christa Rhiner
Molecular mechanisms of adult neural stem cell activation following brain injury in *Drosophila*
Call/Programme: 02/SAICT/2017
Active period: 01/08/18-31/07/21

Carlos Ribeiro
Microbiome, nutrients and the brain: Identifying the molecular programs underlying the impact of essential amino acids and the microbiome on brain function
Call/Programme: 02/SAICT/2017
Active period: 2018-2021

Zita Santos (Ribeiro lab)
Call/Programme: Norma Transitória BPD
Active period: 2019-2024

Noam Shemesh
Mapping specific neural activity by coupling ultrahigh field functional MRI, optogenetics, and calcium recordings
Call/Programme: ICDT 2014
Active period: 01/05/16-31/10/19

Luisa Vasconcelos
Communication during courtship: the role of ovipositor extrusion
Call/Programme: 02/SAICT/2017
Active period: 01/07/18-30/06/21

Luisa Vasconcelos
The social fly: genetic architecture for social learning neural circuits in *Drosophila melanogaster*
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Henrique Veiga-Fernandes
Glia-derived factors in mucosal immune sensing
Call/Programme: ICDT 2014
Active period: 01/06/17-31/05/19

Henrique Veiga-Fernandes
Circadian regulation of innate lymphoid cells
Call/Programme: 02/SAICT/2017
Active period: 14/06/18-13/06/21

Manuela Ferreira (Veiga-Fernandes lab)
Role of diet-derived retinoids in natural intraepithelial lymphocytes and early-life intestinal immunity
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Manuela Ferreira (Veiga-Fernandes lab)
Early-life exposure to mycotoxins and its impact on health
Call/Programme: 02/SAICT/2017
Active period: 01/10/18-30/09/21

Howard Hughes Medical Institute

Joe Paton
HHMI International Research Scholars Program 2017
Call/Programme: HHMI- International Research Scholars Program
Active period: 01/09/17-31/08/22

Kavli Foundation

Carlos Ribeiro
The microbial basis of feeding decisions
Call/Programme: The Kavli Foundation
Active period: 2017-2021

"la Caixa" Foundation

Mireia Castillo (Coordinated by: Arkaitz Carracedo, Asociación Centro de Investigatión en Biociencias)
Eradicating prostate cancer metastasis before clinical manifestation (HiddenMETS)
Call/Programme: la Caixa Health Research 2017 Call
Active period: 01/09/19-31/08/21

Bruno Costa-Silva (Coordinated by: Maria Abad, Centro Nacional de Investigaciones Oncológicas Carlos III)
Defining the role of Exosome-Secreted Micropeptides in Pancreatic Cancer
Call/Programme: "la Caixa" Health Research 2018 Call
Active period: 15/09/19-14/09/22

Leopoldo Petreanu
Optical dissection of cortical circuits for sensory expectations
Call/Programme: HEALTH RESEARCH 2017 CALL
Active period: 01/12/18-30/11/21

Carlos Ribeiro
Identifying and testing the metabolites generated by two psychoactive gut bacteria to alter brain function and behavior
Call/Programme: HEALTH RESEARCH 2017 CALL
Active period: 2018-2021

Liga Portuguesa Contra o Cancro

Rita Fior
Molecular mechanisms of innate immune evasion and rejection
Call/Programme: Liga Portuguesa Contra o Cancro - Núcleo Regional do Sul (Terry-Fox)
Active period: 20/04/18-19/03/21

National Institutes of Health

Christian Machens (Coordinated by: Adam Kepecs, Cold Spring Harbor Laboratory)
Computational and circuit mechanisms for information transmission in the brain
Call/Programme: CFDA N.93.853
Active period: 30/09/15-31/08/19

Paul G. Allen Family Foundation

Henrique Veiga-Fernandes
Deciphering peripheral neuroimmune architecture by intercellular labelling
Call/Programme: Allen Distinguished Investigators Program
Active period: 15/12/18-01/12/21

Portugal 2020

Durval Costa (Coordinated by: Enermeter)
Bone Tumor Scan - CAD
Call/Programme): 33/SI/2015
Active period: 01/09/16-30/11/19

Durval Costa (Coordinated by: Neadadvance)
LyRaCAD .: Sistema CAD para análise de imagens PET/CT com FDG em linfomas - uma abordagem Radiomics
Call/Programme: 31/SI/2017
Active period: 12/08/19-11/08/22

Rui Costa (Project coordinator: Inovamais)
BRAIN-LIGHTING - Sondas neuronais dotadas com interação elétrica, ótica e comunicação sem fios para controlo de neurónios-alvo
Call/Programme: 08/SI/2015
Active period: 01/04/16-30/09/19

Simons Foundation

Christian Machens
Communication between neural populations: circuits, coding, and behaviour
Call/Programme: Life Sciences - Simons Collaboration on the Global Brain Research Award
Active period: 01/07/17-30/06/22

Zachary Mainen
SPI Churchland A: International Brain Laboratory (IBL)
Call/Programme: Life Sciences - Simons Collaboration on the Global Brain Research Award
Active period: 01/07/17-30/06/22

Union for International Cancer Control

Luzia Travado (Oliveira-Maia lab)
Validation of CALM psychosocial therapy in MBC patients in Portugal
Call/Programme: UICC - SPARC - Metastatic Breast Cancer Challenge - 2017 Call
Active period: 01/01/18-31/12/20

VAC-Associação Viver a Ciência

Rita Fior
Molecular mechanisms of innate immune evasion and recognition
Call/Programme: 10º Prémio Crioestaminal 2017
Active period: 01/01/19-31/12/20

VolkswagenStiftung

Michael Orger
How spontaneous behaviour emerges from brain-wide neural network dynamics
Call/Programme: VWS-VolkswagenStiftung (Life)
Active period: 01/01/19-31/12/23

Fellowships

AXA

Fanny Cazettes (Mainen lab)
Neural representations of policy uncertainty underlying adaptive behaviour
Call/Programme: AXA Post-Doctoral Fellowships 2016
Active period: 01/07/17-31/12/19

Boehringer Ingelheim Fonds

Miguel Paço (Chiappe lab)
Finding the neuronal basis of *Drosophila* courtship chasing sensorimotor control
Active period: 01/01/20-31/12/21

Joaquim Contradanças (Orger lab)
Whole-brain mechanisms of operant learning in zebrafish: cells, circuits and behavior
Call/Programme: PhD Fellowships
Active period: 01/01/20-31/12/21

Cancer Research Institute

Roeland Wolterink (Veiga-Fernandes lab)
Deciphering the architecture and language of pulmonary neuroimmune communication
Call/Programme: CRI Irvington Postdoctoral Fellowship Program
Active period: 01/04/20-31/03/23

Erasmus University Medical Center

Ivo Marcelo (Rui Costa Lab)
Neurobiology of social cognition
Call/Programme: ERASMUS MC
Active period: 01/10/14-31/05/20

European Commission - Marie Skłodowska-Curie actions

Bruno Costa-Silva
Phenotypic characterization of Liver-derived exosomes populations associated with liver metastasis in pancreatic cancers — ONCOSYSTEMS
Call/Programme: H2020-MSCA-IF-2016
Active period: 01/07/17-30/06/19

Constanze Lenschow (Lima lab)
Anatomical and functional characterization of the neural circuits controlling ejaculation
Call/Programme: H2020-MSCA-IF-2017
Active period: 01/06/20-31/05/22

Julia Huntenburg (Mainen lab)
Deciphering the effects of locus coeruleus activity on whole-brain dynamics and neurovascular coupling
Call/Programme: H2020-WF-01-2018
Active period: 01/10/19-30/09/21

Leopoldo Petreanu
Do cortical feedback connections store statistical knowledge of the environment?
Call/Programme: H2020-MSCA-IF-2017
Active period: 01/03/18-30/03/19

Davide Reato (Renart lab)
Functional role of neuronal spontaneous activity for sensory processing
Call/Programme: H2020-MSCA-IF-2016
Active period: 01/09/18-31/08/20

Cristina Chavarrias (Shemesh lab)
Neuronal MRI: Harnessing chemical exchange between N-Acetylaspartate and water for functional imaging of neural activity — Neuronal MRI
Call/Programme: H2020-MSCA-IF-2016
Active period: 01/05/17-28/08/19

Rui Simões (Shemesh lab)
Monitoring cancer heterogeneity based on the dynamic assessment of the Warburg effect under metabolic perturbation
Call/Programme: H2020-MSCA-IF-2018
Active period: 02/05/19-01/05/21

Henrique Veiga-Fernandes
Tracing of pulmonary neuro-immune networks
Call/Programme: H2020-MSCA-IF-2017
Active period: 14/03/18-13/03/20

David Brea López (Veiga-Fernandes lab)
Neural regulation of the immune system in the Gut
Call/Programme: H2020-MSCA-IF-2018
Active period: 01/09/20-31/08/22

European Commission - Widening Fellowships

Ibrahim Tastekin (Ribeiro lab)
Dissecting how the *Drosophila* brain regulates behavioral sequences of feeding to ensure protein homeostasis
Call/Programme: H2020-WF-01-2018
Active period: 2019-2021 (Awarded 2019)

Maria Martinez (Veiga-Fernandes lab)
Commensal microbiota regulation of neuro-immune networks
Call/Programme: H2020-WF-01-2018
Active period: 01/09/20-31/08/22

European Molecular Biology Organization (EMBO)

Constanze Lenschow (Lima lab)
Anatomical and functional characterization of the neural circuits controlling ejaculation and the post-ejaculatory refractory period
Call/Programme: Long-Term Fellowships
Active period: 01/01/18-31/12/19

Ana Rita Mendes (Lima lab)
Functional characterization of the spinal ejaculation network
Call/Programme: Short-Term Fellowships
Active period: 14/10/19-03/11/19

María López (Veiga-Fernandes lab)
Commensal microbiota regulation of neuro-immune networks
Call/Programme: Long-Term Fellowships
Active period: 01/09/19-31/08/21

Marko Sestan (Veiga-Fernandes lab)
It takes two for tango: Neuroimmune regulation of metabolic homeostasis
Call/Programme: Long-Term Fellowships
Active period: 01/03/20-28/02/22

Fundaçáo para a Ciência e a Tecnologia

Hugo Marques (Carey lab)
The nature of error signals in locomotor learning
Call/Programme: 2016 Postdoctoral Fellowships
Active period: 01/09/17-31/08/23

Andreia Maia (Castillo-Martin lab)
Expansion of natural killer cells as a complementary approach for adoptive cell therapy in advanced colorectal cancer' (NKAT-CRC)
Call/Programme: 2019 PhD Fellowships
Active period: 01/01/20-31/12/23

Nuno Rito (Chiappe lab)
Neural basis of a visually guided oriented behavior in *Drosophila melanogaster*
Call/Programme: 2017 PhD Fellowships
Active period: 01/08/18-31/07/22

Miguel Paço (Chiappe lab)
Studying the control system guiding *Drosophila* during female tracking
Call/Programme: 2018 PhD Fellowships
Active period: 15/03/2018-31/12/2019

Daniela Pereira (Rui Costa lab)
Call/Programme: Individual Call to Scientific Employment Stimulus
Active period: 01/06/19-31/05/25

Ana Carolina Marques (Costa-Silva lab)
Nanobiosensing platform based on MIP-SERS for breast cancer exosome characterization and detection
Call/Programme: 2016 PhD Fellowships
Active period: 09/01/17-31/08/21

Vanda Póvoa (Fior Lab)
Dissecting intra-tumour clonal dynamics and its cross-talk with the microenvironment in a zebrafish xenograft model
Call/Programme: 2016 PhD Fellowships
Active period: 31/01/17-28/02/21

Mayra Martinez Lopez (Fior Lab)
Zebrafish Avatars as a model for chemotherapy and immunotherapy response in bladder cancer
Call/Programme: IGC-IBB PhD programme
Active period: 1/03/18 - 1/03/22

Dario Sarra (Mainen lab)
Serotonin modulation circuitry of patience and impulsivity
Call/Programme: 2017 PhD Fellowships
Active period: 01/01/18-31/12/21

Kcénia Bourgrova (Mainen lab)
The serotonergic-medial prefrontal cortex circuits underlying action decisions
Call/Programme: 2019 PhD Fellowships
Active period: 01/01/20-31/12/23

Matheus Farias (Moita lab)
On the mechanisms by which descending neurons control defensive behaviors of fruit flies
Call/Programme: 2017 PhD Fellowships
Active period: 2018-2022

Mirjam Heinemans (Moita lab)
Social modulation of defensive behaviours in *Drosophila*
Call/Programme: 2019 PhD Fellowships
Active period: 2020-2024

Maria Bettencourt (Moreno lab)
The role of cell fitness in tumor progression and metastasis formation
Call/Programme: 2017 PhD Fellowships
Active period: 01/01/18-31/12/21

Mariana Reis (Moreno lab)
Cell Competition in *Drosophila* organs: the effects of suboptimal cells accumulation and insights into the winner-loser communication in a competition scenario
Call/Programme: 2018 PhD Fellowships
Active period: 01/01/19-31/12/22

Carolina Rodrigues (Moreno lab)
Unravelling the link between Cell Competition and Alzheimer's Disease
Call/Programme: 2018 PhD Fellowships
Active period: 01/07/19-31-06-2023

Raquel Lemos (Oliveira-Maia lab)
Dual Task Cost as a measure of Cognitive Reserve and its application in candidates for Brain Radiotherapy
Call/Programme: 2016 Postdoctoral Fellowships
Active period: 01/02/17-31/07/19

Gabriela Ribeiro (Oliveira-Maia lab)
Modulation of postingestive reward mechanisms by weight loss surgery
Call/Programme: 2017 PhD Fellowships
Active period: 01/01/18-31/12/21

Gonçalo Cotovio (Oliveira Maia lab)
Antidepressant mechanisms of psilocybin: from cortical excitability to brain functional connectivity
Call/Programme: 2017 PhD Fellowships
Active period: 01/08/18-31/07/22

Ana Maia (Oliveira Maia lab)
Immune dysfunction in obsessive-compulsive disorder: from environmental risk factors to clinical and brain imaging correlates
Call/Programme: 2019 PhD Fellowships
Active period: 01/07/20-30/06/24

Lucas Martins (Orger lab)
Light-sheet imaging of functional networks underlying optic-flow processing in the zebrafish brain
Call/Programme: 2017 PhD Fellowships
Active period: 01/08/18-31/07/22

Joaquim Contradanças (Orger lab)
Whole-brain mechanisms of operant learning in zebrafish: cells, circuits and behavior
Call/Programme: 2018 PhD Fellowships
Active period: 15/03/2018-31/12/2019

Elena Hindinger (Orger lab)
The neural control of gait switching in larval zebrafish
Call/Programme: 2019 PhD Fellowships
Active period: 01/01/20-31/12/23

Teresa Serradas Duarte (Paton lab)
Imaging the Neuronal Reorganization in a Sensitive Period of Heightened Plasticity
Call/Programme: 2016 PhD Fellowships
Active period: 04/01/17-31/03/21

Filipe Rodrigues (Paton lab)
Disentangling cognitive & movement parameters in interval timing
Call/Programme: 2017 PhD Fellowships
Active period: 01/08/18-31/07/22

Beatriz Belbut (Petreanu lab)
The functional coupling of cortico-cortical loops during behavior
Call/Programme: 2019 PhD Fellowships
Active period: 01/08/20-31/07/24

Anabel Rodrigues (Rhiner lab)
Molecular Mechanisms of Neural Stem Cell Activation following Brain Injury in *Drosophila melanogaster*
Call/Programme: 2016 PhD Fellowships
Active period: 03/01/17-28/02/21

Mariana Batista Santos (Rhiner lab)
Signatures of damage-responsive neural stem cells (Champalimaud Foundation)
Call/Programme: 2015 PhD Fellowships
Active period (at CF): 04/02/2019-31/01/2020

Rita Figuereido (Ribeiro lab)
The effects of tumorigenesis on nutrient cravings: dissecting the role of cellular metabolism in directing specific nutritional appetites to sustain high cell proliferation rates
Call/Programme: 2019 PhD Fellowships
Active period: 2020-2024

Manuela Ferreira (Veiga-Fernandes lab)
Role of diet-derived retinoids in natural intraepithelial lymphocytes and intestinal defence
Call/Programme: Investigador FCT 2015
Active period: 01/01/17-31/12/21

Cristina Godinho Silva (Veiga-Fernandes lab)
Control of innate lymphoid cells by circadian clock signals
Call/Programme: 2016 Individual Postdoctoral Fellowships
Active period: 03/01/17-28/02/23

Manuela Ferreira (Veiga-Fernandes lab)
Exploratory Research Project
Call/Programme: Programa Investigador FCT
Active period: 20/12/16-19/12/21

Miguel Rendas (Veiga-Fernandes lab)
Regulation of innate lymphoid cells by circadian cues
Call/Programme: 2017 PhD Fellowships
Active period: 01/01/18-31/12/21

David Brea López (Veiga-Fernandes lab)
Regulation of intestinal immunity by brain-derived signals
Call/Programme: Individual call to scientific employment stimulus
Active period: 01/06/19-31/05/25

Human Frontier Science Program

Constanze Lenschow (Lima lab)
Anatomical and functional characterization of the neural circuits controlling ejaculation
Call/Programme: HFSP Postdoctoral Fellowships
Active period: 01/07/18-31/05/20

Camille Mazo (Petreanu lab)
Do cortical feedback connections store statistical knowledge of the environment?
Call/Programme: HFSP Postdoctoral Fellowships
Active period: 31/03/19-30/03/22

Davide Reato (Renart lab)
Role of neuronal spontaneous activity for sensory processing
Call/Programme: 2016 Individual Postdoctoral Fellowships
Active period: 03/01/17-28/02/21

Sociedade Portuguesa de Hematologia

Bruna Velosa Ferreira (João lab)
O papel do micro-ambiente metastático no Mieloma Múltiplo extramedular
Call/Programme: Bolsas de Iniciação à Investigação
Active period: 05/06/18-04/06/20

The Federation of European Biochemical Societies

Ana Queirós (Moreno lab)
Regulation of "fitness fingerprints" mediated cell competition
Call/Programme: FEBS Long-Term Fellowships
Active period: 01/01/19-31/12/20

Education Projects

BPI & "la Caixa" Foundation

Catarina Ramos (Project coordinator: TreeTree2)
Aprender a Aprender: Laboratório de Metacognição, Neurociência e Machine Learning
Call/Programme: Prémio BPI "la Caixa" Infância
Active period: 01/09/19-31/08/20

Fundação Calouste Gulbenkian

Catarina Ramos
Metodologias Experimentais
Call/Programme: Academias Gulbenkian do Conhecimento
Active period: 19/10/18-18/10/21

Support to Conferences & Travel Grants:

Constanze Lenschow (Lima lab)
Funding entity (Call/Programme): IBRO-APRC (Travel Grant and Short Stay 2019 grant)

Gabriela Ribeiro (Oliveira-Maia lab).
Funding entity (Call/Programme): Travel Scholarship; New Investigators Autumn School; Napoli, Italy. European Association for the Study of Obesity

Zachary Mainen
Funding entity (Call/Programme): Wellcome Trust
2019 Champalimaud Research Symposium: Tissue homeostasis in health and disease

Henrique Veiga-Fernandes
Funding entity (Call/Programme): IUBMB-International Union of Biochemistry and Molecular Biology
2019 Champalimaud Research Symposium: Tissue homeostasis in health and disease

Eugenia Chiappe
Funding entity (Call/Programme): KF-The Kavli Foundation
Kavli workshop on neural circuits and behavior of *Drosophila* meeting

Theses

PhD Theses

Catarina Albergaria
Behavioral state modulation of cerebellar associative learning
Thesis advisor: Megan Carey

Dana Darmohray
Cerebellar contributions to locomotor coordination and learning in mice
Thesis advisor: Megan Carey

Elizabeth Rickenbacher
Mechanisms of self-defense suppression of mothers under threat in the presence of offspring
Thesis advisor: Marta Moita

Andres Laan
Testing the predictive power of normative theories in social neuroscience
Thesis advisor: Gonzalo de Polavieja

Antonia Groneberg
Early life social experiences shape social avoidance kinematics in larval zebrafish
Thesis advisors: Gonzalo de Polavieja & Michael Orger

João Afonso
Multiplexed simultaneous representations of cognitive and motor features, in the mouse medial prefrontal cortex, during a memory guided behaviour
Thesis advisor: Alfonso Renart

Luis Moreira
Mate-choice and social preference in Mus musculus females
Thesis advisor: Susana Lima

Marina Fridman
Contextual modulation of visual thalamocortical circuits
Thesis advisor: Leopoldo Petreanu

Nuno Calaím
Robustness of spike coding networks
Thesis advisor: Christian Machens

Paulo Miguel dos Santos Ferreira
Voxel-based dosimetry using multimodal images for patient-specific liver radioembolization with yttrium-90 charged glass microspheres
Thesis advisor: Durval C Costa

Pedro Castro-Rodrigues
Knowledge versus experience: exploring model-based and model-free reinforcement learning in obsessive-compulsive disorder
Thesis advisor: Albino Oliveira-Maia

Ricardo Zacarias
Mechanisms of defensive action selection in flies
Thesis advisors: Marta Moita & Maria Luisa Vasconcelos

Rita Ribeiro da Silva
Immune recovery of HIV infected patients and thymic function
Thesis advisor: Cristina João

MSc Theses

Amber Brands
Conductance-based dynamics in spike-coding networks preserve accurate network representation
Thesis advisor: Christian Machens

Ana Beatriz Varanda
Combined effects of Olaparib and DNA damage inducing therapies in a zebrafish xenograft model of triple negative breast cancer.
Thesis advisor: Rita Fior

Ana Sofia Castro Verde
Quantifying age-related differences in Diffusion Tensor Imaging biomarkers for the male urethral sphincter complex of patients with (suspected) prostate cancer
Thesis advisor: Nickolas Papanikolaou

Bárbara Costa
Towards High-Resolution Resting-State fMRI in the Mouse Brain
Thesis advisor: Noam Shemesh

Carolina Seabra
Prostate Cancer Biochemical Recurrence Prediction After Radical Prostatectomy Using Machine Learning Analysis of Histopathology
Thesis advisor: Nickolas Papanikolaou

Cláudia Santos Constantino
Reproducibility study of tumor biomarkers extracted from positron emission tomography images with 18f-fluorodeoxyglucose
Thesis advisor: Durval C Costa

Daniel Silva
Cortical excitability and its modulation, in vivo, using Transcranial Magnetic Stimulation
Thesis advisor: Albino Oliveira-Maia

João Carvalho
Automatic detection and segmentation of pulmonary lesions on ct scans using deep convolutional neural networks
Thesis advisor: Nickolas Papanikolaou

Inês Dias
Investigating the structural and physiological properties of ventromedial hypothalamic neurons across the estrous cycle of female mice
Thesis advisor: Susana Lima

Leonard Dupont
Error signals during locomotion: spatiotemporal modulation of complex spikes in the mouse cerebellum
Thesis advisor: Megan Carey

Lucas Soares
An unsupervised generative strategy for detection and characterization of rare behavioral events in mice in open-field to assess the effect of optogenetic activation of serotonergic neurons in the dorsal raphe nuclei
Thesis advisors: Zachary Mainen (CR) & Luis Correia (Faculdade de Ciências UL)

Maria Esteves MM
From the vagus nerve to the ventral tegmental area: a pathway for post-ingestive food reinforcement in the development of obesity
Thesis advisor: Albino Oliveira-Maia

Pedro Silva
Comparative analysis of locomotor behaviour and descending motor system anatomy of larval zebrafish and giant danio
Thesis advisor: Michael Orger

Renata Quintinio
Prediction of treatment response in patients with multiple myeloma undergoing chemotherapy using mri derived imaging biomarkers
Thesis advisor: Nickolas Papanikolaou

Susana Dias
3-Dimensional characteriSation of PanIN (pancreatic intraepithelial neoplasia) in cleared human pancreatic cancer tissues by multiplex immunofluorescence
Thesis Advisor: Mireia Castillo-Martin

Agenda

January

15-16 Courses
4 Andor Academy: Frontiers in fast, low-light imaging, microscopy and data visualisation
Host: Davide Accardi
* The event was organised in partnership with Oxford Instruments.

24 Colloquia
François Leulier, Institut de Génomique Fonctionnelle de Lyon, France
Host-Microbiota Mutualism upon Chronic Undernutrition: Lessons from gnotobiotic animal models

29-30 SC Workshop
Grant Writing by Christina Schütte (CEO, Prosciencia)

31 Colloquia
Josh Huang, Cold Spring Harbor Laboratory, USA
Genetic dissection of cortical neuron types and circuits: from transcriptional mechanism to motor control

February

14 Colloquia
Jesse Goldberg, Cornell University, USA
Dopamine neurons change their tuning according to courtship context in singing birds

21 Colloquia
Caroline Fabre, University of Cambridge
Seismic communication between courting *Drosophila* flies

26-27 Conference
International Brain Laboratory PostDoc Summit
Organisers: Eric DeWitt, Guido Meijer

March

6 Workshop
5 Cosyne satellite serotonin workshop
Organisers: Romain Ligneul, Zachary Mainen

14 Colloquia
Anna Devor. University of California, San Diego, USA
Microscopic Foundation of Multimodal Human Imaging

21 Colloquia
Mark Andermann, Beth Israel Deaconess Medical Center & Harvard University, USA
Selective processing of need-relevant cues: a dialogue between hypothalamus, amygdala and cortex

28 Colloquia
João Pedro Pereira, Yale School of Medicine, USA
How to make and when not to make B cells

April

04 Colloquia
Geoffrey Schoenbaum, National Institute on Drug Abuse, Baltimore, MD, USA
The dopaminergic prediction error is not what you may think

09 Meet a Theorist Seminar Series
Maria Luz Cardenas, Institut de Microbiologie de la Mediterranee in Marselille
(M,R) systems of Robert Rosen as the essence of living organisms: metabolic circularity as a guiding vision in Biology

12 Colloquia
John Tuthill, University of Washington, USA
Neural mechanisms of leg proprioception and motor control in *Drosophila*

May

2 Colloquia
Alan Urban, Neuro-Electronics Research Flanders, IMEC, VIB, KU Leuven, Belgium
Brain-wide functional ultrasound imaging (fUSi) of intact circuit dynamics

2-3 Conference
Swiss Portuguese Science and Innovation conference: Switzerland-Portugal 2019
Chairs: Carlos Ribeiro, Ambassador André Regli (Swiss Embassy, Lisbon)

07 Meet a Theorist Seminar Series
Pablo A. Iglesias, Department of Electrical & Computer Engineering, The Johns Hopkins University
The set point of coupled excitable systems: relations to wave propagation and morphology of protrusions in migrating cells

09 Colloquia
Peter Dayan, Max Planck Institute for Biological Cybernetics, Tübingen, Germany
The Good, The Bad, and Something Inbetween: Dopamine in Active Avoidance

15- 20 SC Workshop
Scientific Writing by Ana Gerschenfeld (Science Writer, CCU)

16 Colloquia
Asya Rolls, HHMI-Wellcome International Scholar; Rappaport Institute for Medical Research; Technion, Israel Institute of Technology
Bi-directional communication between the brain and the immune system

22-23 Workshop
Obesity at the interface of neuroscience and physiology
Organisers: Gabriela Ribeiro, Roksana Pierzchalska
* The event was funded by the Novo Nordisk Grant of the European Association for the Study of Obesity for the 2019 European Obesity Day.

23 Colloquia
Kevin Briggman, Center of Advanced European Studies and Research (CAESAR), Germany
Correlating structure and function in the mammalian retina and beyond

29 Workshop
Cool Tools for Science: Users Innovation
Event Organisers: Biodata.pt; CONGENTO; RNEM - Portuguese Mass Spectrometry Network
Local Organisers: João Cruz, Laura Ward

30 Colloquia
Bence Olveczky, Harvard University
Neural circuits underlying motor skill learning and execution

June

04 Meet a Theorist Seminar Series
Mark van Rossum, University of Nottingham, UK
Energy efficient synaptic plasticity

06 Colloquia
Jean-Christophe Billeter, Univ. of Groningen, The Netherlands
Modulation of individual behaviour by social experience

25-28 Event
CR Annual Retreat
Retreat Committee: Catarina Pimentel, Gonçalo Guiomar, Irene Argudo, João Pereira, Patrícia Correia, Roksana Pirzgalska, Ruth Diez del Corral, Susana Lima

July

04 Meet a Theorist Seminar Series
Dmitri Chklovskii, Flatiron Institute, New York
How insects see motion: convergence of theory and experiment

14-3 Aug Courses
CAJAL Neuroscience Training Course 2019 - Interacting with Neural Circuits
Directors: Leopoldo Petreanu, Michael Häusser (Univ. College London), Menno Witter (Kavli Instit. for Systems Neuroscience)
Support: Simone Zacarias, Maria Teresa Dias

August

11-31 Courses
CAJAL Neuroscience Training Course 2019 - Computational Neuroscience
Directors: Brent Doiron (Univ. of Pittsburgh); Maria Geffen (Univ. of Pennsylvania); Jakob Macke (Technical Univ. of Munich), Joe Paton (CR)
Support: Simone Zacarias, Maria Teresa Dias

September

12 Colloquia
Amy Bastian. Johns Hopkins University; Kennedy Krieger Institute
Learning and Re-learning Movement

19 Colloquia
Matteo Carandini. University College London (UCL)
Neural basis of decisions guided by sensory confidence and reward value

20-23 Courses
Landing in the the *Drosophila* World - Introductory Course on Using *Drosophila* as Model Organism
Organisers: Fabiana Herédia and Teresa Gomes (CEDOC), Isabel Campos, João Cruz, Liliana Costa (CR); Gaston Guilgur and Liliana Vieira (IGC)

26 Colloquia
Alex Schier, Harvard University, USA.
Cellular Biographies: Reconstructing Developmental Trajectories

October

01 Meet a Theorist Seminar Series
Rubén Moreno-Bote, Pompeu Fabra University, Barcelona
Aligned neuronal encoding of sensory information, biases and choices in perceptual decision making

03 Colloquia
Javier F Medina, Baylor College of Medicine, USA
Functional organization of neural circuits for supervised sensorimotor learning in the cerebellum

8-10 Conference
Champalimaud Research Symposium 2019: Tissue Environment in Health and Disease
Symposium Chairs: Christa Rhiner, Eduardo Moreno and Henrique Veiga-Fernandes
Organisers: Ana Casaca, Patrícia Correia, Pedro Alves

21 Conference
CONGENTO Annual Meeting
Organisers: Rita Nunes, Joana Monteiro and João Cruz (CR), Márcia Silva (iMM); Sara Marques and José Belo (CEDOC), Manuel Rebelo (IGC)

27 Event
Hackathon by the Data Analyst Working Group
Organisers: Marina Fridman, Gabriela Fioreze

November

05 Meet a Theorist Seminar Series
Rafal Bogacz. University of Oxford, UK
Dopamine as prediction error in active inference

14 Colloquia
Georg Keller.Friedrich Miescher Institute for Biomedical Research (FMI), Switzerland
An experience dependent comparator circuit in layer 2/3 of mouse cortex

15 Conference
Imaging Hallmarks of Cancer
Pancreatic Cancer: From Cell Biology to Treatment
Host: Celso Matos
* in partnership with The European School of Radiology

20 Workshop
Improving Openness in Animal Research in Portugal
Organisers: Isabel Campos, João Cruz, Laura Ward
* in collaboration with the European Animal Research Assoc., the Federation of European Neuroscience Societies, Society for Neuroscience, CONGENTO, QuantOCancer.

21 Colloquia
Yohanns Bellaïche. Institut Curie, France
Morphogenesis of proliferative tissues: scaling between mechanical stress and proliferation.

22 SC Workshop
Scientific Writing by Ana Gerschenfeld (Science Writer, CCU)

December

03 Meet a Theorist Seminar Series
Henning Sprekeler. Bernstein Center for Computational Neuroscience, Berlin, Germany
Encoding and decoding a multiplexed neural code in neural circuits

05 Colloquia
Ilana Witten. Princeton University
Striatal circuitry for reward learning and decision making.

12 Colloquia
Jeremiah Cohen. Johns Hopkins University, USA
Neurophysiology of dynamic decision making

13 Event
1st DevBioMed Symposium - From Development to Medicine and Back
Organisers: Rita Fior & Ana Teresa Tavares (CEDOC) - Portuguese Society for Developmental Biology

The Science Careers Team: Silvana Araújo, Catarina Ramos, Clara Ferreira, João Afonso, Cecília Mezzera

Meet a Theorist Seminar Series (7)
Organisers: Sander Keemink, Christian Machens, Alfonso Renart

2019 Colloquium committee: Catarina Albergaria, Bruno Costa da Silva, Antonia Gronеberg, Cecilia Mezzera, Leopoldo Petreanu

Outreach

January

2 "A special class on... Biology"
Instituto Superior Técnico
Public: Students from different high schools in the Great Lisbon area

22 School visit
CCU
Public: High school students from St Peter's International School, Lisbon

29 School visit
CCU
Public: High school students from Agrupamento de Escolas de Silves and Escola Sec. Dom Manuel Martins, Setúbal

February

5 Jornadas Tecnológicas (JorTec) de Biomédica
Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa
Public: Undergraduate and Master's students

19 School visit
CCU
Public: High school students from Escola Básica e Secundária Anselmo de Andrade in Almada, and Escola Secundária Henrique Medina, Esposende

March

4 School visit
CCU
Public: Students from Agrupamento de Escolas de Beja and Escola Superior de Saúde do Instituto Politécnico de Beja

3-31 Brain Awareness Week: "Cá Dentro - Descobrir o Cérebro"
Centro Cultural de Belém, Fábrica das Artes
Public: Children, Families, Schools

16-22 Brain Awareness Week: Instagram Campaign
Champalimaud Research Instagram profile
Public: (Young) Adults

21 Visit from Escola Ciência Viva
CCU
Public: Students from Escola Básica Adriano Correia de Oliveira and Escola Básica Padre Abel Varzim

26 School visit
CCU
Public: High school students from Escola Sec. Ferreira Dias, Agualva

April

2 School visit
CCU
Public: High school students from Agrupamento de Escolas de Azambuja and Escola A Cidadela, Cascais

5 Academia Gulbenkian do Conhecimento " Neuronautas" Opening Session
CCU
Public: 10th grade students

26 Academia Gulbenkian do Conhecimento " Neuronautas" Session 1
CCU
Public: 10th grade students

30 School visit
CCU
Public: High school students from Escola Secundária com 3.º CEB Poeta Al Berto, Sines and Colégio Miramar, Mafra

May

3 Academia Gulbenkian do Conhecimento " Neuronautas" Session 2
CCU
Public: 10th grade students

8 JobShop
Instituto Superior Técnico
Public: Undergraduate and Master's students

10 Academia Gulbenkian do Conhecimento " Neuronautas" Session 3
CCU
Public: 10th grade students

17 Academia Gulbenkian do Conhecimento " Neuronautas" Session 4
CCU
Public: 10th grade students

18 120 Years of Colégio Valsassina, talk "Neuroscience & Learning"
Fundação Calouste Gulbenkian
Public: Students, teachers and families

21 School visit
CCU
Public: High school students from Escola Secundária

de Arganil- Agrupamento de Escolas de Arganil and Agrupamento de Escolas de Valongo

22 MICRODay
CCU
Public: Students from different high schools in the Great Lisbon area

24 Academia Gulbenkian do Conhecimento " Neuronautas" Session 5
CCU
Public: 10th grade students

28 School visit Date: 28th
CCU
Public: High school students from Agrupamento de Escolas de Valongo

31 Academia Gulbenkian do Conhecimento " Neuronautas" Session 6
CCU
Public: 10th grade students

June

1 Public event integrated in the "Brain wider than the sky" exhibit
Fundação Calouste Gulbenkian
Public: Adults

6 Public event integrated in the "Brain wider than the sky" exhibit
Fundação Calouste Gulbenkian
Public: Adults

7 Academia Gulbenkian do Conhecimento " Neuronautas" Session 7
CCU
Public: 10th grade students

14 Academia Gulbenkian do Conhecimento " Neuronautas" Session 8
CCU
Public: 10th grade students

17-22 Academia Gulbenkian do Conhecimento " Neuronautas" Boot Camp
CCU and outdoor spaces in the neighborhood
Public: 10th grade students

July

15-26 Lab internship, in collaboration with Maria de Sousa Summer Research Program
CCU
Public: High school student

September

4 Academia Gulbenkian do Conhecimento " Neuronautas" Final Session
CCU
Public: 10th grade students

5-6 2-Day Job Shadowing Experience
CCU
Public: 10th grade students

17 School visit
CCU
Public: High school students from Biotech School in Fredericia, Denmark

26 Public Event ProjectAr - "Chasing Coral"
CCU
Public: (Young) Adults

26-29 Next Einstein Forum - Africa Science Week Cabo Verde, Workshop: "Inteligência Artificial em Saúde, Robótica e Programação"
São Lourenço dos Órgãos, Ilha de Santiago, Cabo Verde
Public: Children and unemployed young adults (mostly girls and women)

28 Aprendizagem Científica (HAC) in collaboration with Instituto Superior Técnico
Instituto Superior Técnico
Public: High school students

29-30 Congresso dos Cozinheiros
Pavilhão L/XL, Lx Factory
Public: Adults

October

7 1st Meeting of the Academias Gulbenkian do Conhecimento
Fundação Calouste Gulbenkian
Public: Adults

16 Laboratório de Metacognição e Neurociência - Aprender a Aprender (LaMAA)
in collaboration with the programme After School from Instituto Superior Técnico - Session 1
CCU
Public: Students from different high schools in the Great Lisbon area

17-18 Excellence in Science Communication Workshop - Talk: "Science communication and Outreach at the Champalimaud Centre for the Unknown"
European Research Council Agency in Brussels
Public: Communication teams from ERC host institutions

23 Laboratório de Metacognição e Neurociência - Aprender a Aprender (LaMAA),
in collaboration with the programme After School from Instituto Superior Técnico - Session 2
CCU
Public: Students from different high schools in the Great Lisbon area

24-25 2nd Citizen Science Meeting - Poster: "Neuronautas: an academy for new explorers of the brain"
Academia Nacional das Ciências
Public: Science communicators, citizen science practitioners

30 Laboratório de Metacognição e Neurociência - Aprender a Aprender (LaMAA)
in collaboration with the programme After School from Instituto Superior Técnico - Session 3
CCU
Public: Students from different high schools in the Great Lisbon area

31-3 Science on Stage Festival - Stand and Talk: "What Can Neuroscience and Education Learn from Each Other?"
Centro Congressos de Cascais
Public: STEM teachers from over 30 countries

November

5 School visit
CCU
Public: High school students from Denmark
Team: Rita Fior, Catarina Ramos

5 Laboratório de Metacognição e Neurociência - Aprender a Aprender (LaMAA)
in collaboration with the programme After School from Instituto Superior Técnico - Session 4
CCU
Public: Students from different high schools in the Great Lisbon area

5 School visit
CCU
Public: Undergraduate students from Associação de Estudantes de Farmácia, Universidade de Lisboa

13 Laboratório de Metacognição e Neurociência - Aprender a Aprender (LaMAA)
in collaboration with the programme After School from Instituto Superior Técnico - Session 5
CCU
Public: Students from different high schools in the Great Lisbon area

15 Laboratório de Metacognição e Machine Learning - Aprender a Aprender (LaMAA)
in collaboration with the programme After School from Instituto Superior Técnico - Session 1
Instituto Superior Técnico
Public: Students from different high schools in the Great Lisbon area

20 Laboratório de Metacognição e Neurociência - Aprender a Aprender (LaMAA)
in collaboration with the programme After School from Instituto Superior Técnico - Session 6
CCU
Public: Students from different high schools in the Great Lisbon area

22 Laboratório de Metacognição e Machine Learning - Aprender a Aprender (LaMAA)
in collaboration with the programme After School from Instituto Superior Técnico - Session 2
Instituto Superior Técnico
Public: Students from different high schools in the Great Lisbon area

26 Visit to the CCU
Venue: CCU
Public: Adults, Volkswagen Group

27 Talk "Espreitando para dentro da caixa: o que os neurónios nos podem ensinar sobre o comportamento"
Escola de Ciências Sociais, Universidade de Évora
Public: Undergraduate and Master's students

December

11 Talk "Brain Machine-Interfaces and learning dynamics: controlling external devices with brain activity"
Escola de Ciências Sociais, Universidade de Évora
Public: Undergraduate and Master's students

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