



université  
de BORDEAUX

# Interdisciplinary Institute for Neuroscience

Activity Report

# 2023

2023

# Activity Report

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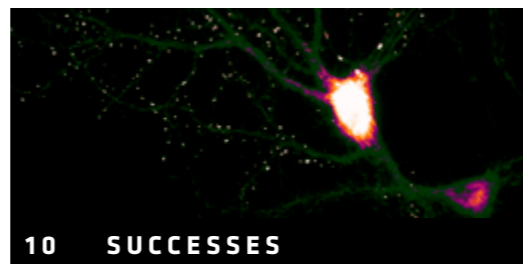
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# EDITO



**Daniel Choquet**

Director (2011-2023)

It is with mixed emotions that I write the editorial of our 2023 Activity Report. After 13 years at the head of our Interdisciplinary Neuroscience Institute, I am handing over this directorship to Laurent Groc. I would like to express my gratitude to all IINS staff for their support, commitment and tireless dedication to neuroscience research.

I am absolutely delighted that Laurent is now taking the helm of our Institute as its new Director. I am confident that with his vision and expertise, the Institute will soar to new heights and continue to prosper and make significant advances in the field of neuroscience.

As a member of this community for many years, I am convinced that our Institute is stronger than ever. Our passion for research and our commitment to interdisciplinarity are constantly guiding us towards new discoveries and remarkable achievements.

I would like to thank all the members of the IINS for their exceptional collaboration over the years. The future of neuroscience is in good hands, and I will continue to participate in and support our research efforts in any way I can.



FIND IINS ON

[iins.u-bordeaux.fr](https://iins.u-bordeaux.fr)



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# EDITO



**Laurent Groc**

Director (2024-)

2023 has been an important "brainstorming" year for IINS! With the transition in the institute direction, we collectively re-invented ourselves in order to adapt and create new experimental platforms and set the path of a new breath for our inner life. The enthusiasm of all of us and the flourishing number of ideas have been the best ever sign of our vitality.

I would like to thank each of you for being part of this effort, setting the best possible ground for the years to come. As new director of the institute, together with Frédéric Gambino who serves a deputy director, one of our key missions for 2024 is to drive and support this major change to keep IINS at the forefront of research and innovation. Of course, this editorial is a very special one. I would like to express my deepest gratitude to our former director, Daniel Choquet. Daniel has been the director of IINS since its creation in 2011. His limitless energy, full devotion, and trust in our capacity to break frontiers in neurosciences have been among the essential keys to our collective successes. Daniel greatly contributed to the bricks and cement that built IINS, making our institute one of the hotspots for neurosciences worldwide. In the name of IINS, warm and sincere thanks Daniel!



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# A WORD FROM



**Jérôme Baufreton**

Director, Bordeaux Neurocampus

It is with great pleasure that I have agreed to introduce this first IINS activity report. The joint research units are the most fundamental building blocks of our research department, and we can be proud of the work carried out by each of them. As the interface between the units and the University of Bordeaux, our department is committed, together with the unit directors, to

defending our professions and developing our scientific research, and I am pleased with the ongoing and fruitful dialogue between us.

In addition, the personnel of each institute, particularly the IINS, play a major role in the visibility and success of all the neurosciences in Bordeaux. The CNRS bronze medal awarded to Mathieu Letellier in 2023 is one of the awards we are most proud of. The many seminars proposed by researchers at the IINS, and the presence of Frédéric Gambino on the scientific committee of the Brain Conference 2023 are the hallmarks of a community united in its dynamism. Nor can I forget everyone's investment in training, and I can not fail to underline the role of IINS members involved in transitions.

At a time when we are celebrating the 30th anniversary of the creation of the Federative Institute for Research in Fundamental and Clinical Neurosciences, an indisputable milestone in the rise of local neuroscience over the last few decades, the IINS has been one of the driving forces behind the development and influence of our community since 2011.

Finally, January 2024 marks the arrival of Laurent Groc as the new Director of IINS. I would like to reiterate my sincere thanks to Daniel Choquet for all his years at the helm of this institute. I wish Laurent Groc every success in leading the IINS and in pushing back the boundaries of our understanding of how the brain works through the analysis of synapses, the essential building blocks of neuronal communication.





Created in 2011, **IINS** gathers 180 scientists from various nationalities and different backgrounds (chemistry, structural biology, molecular and cellular biology, biophysics, clinical medicine, advanced imaging, neurobiology) to understand how the brain functions in healthy and diseased states. **IINS** performs multidisciplinary research at the forefront of synapse biology and physiology of neuronal systems, with an emphasis on the development of new technologies and tools.

**Scientific specialities**

- **Advanced Imaging**
- **Biological Chemistry**
- **Cell Biology**
- **Synapses and Neural Systems Physiology**
- **Synaptopathies**
- **Systems Neuroscience**
- **Software Development**

**Goals**

- To understand the fundamental mechanisms of central nervous system function in normal and pathological states.
- To develop new methods and tools in the fields of structural and chemical biology, biosensors, nano-imaging, *in vivo* imaging and *in vivo* physiology.
- To identify, study and develop tools to control the biochemical, structural and dynamic properties of molecular complexes and synapses, cellular contacts or nanoscale adhesion sites.
- To understand the adaptive functions of the brain at the network and behavioural level.
- To provide access to these technological advances through service facilities, training programs, and partnerships with industry.
- To train the next generation of scientists.

**Department**



Bordeaux Neurocampus groups six research institutes that work on various aspects of brain function in health and disease. It is among the top neuroscience research centres in Europe.

**Parent Institutions**



The National Centre for Scientific Research (Centre National de la Recherche Scientifique) is the French state research organisation operating under the Ministry of Higher Education and Research. The CNRS is the largest fundamental science agency in Europe.



The University of Bordeaux is a major multi-disciplinary teaching and research university with strong local roots and international reach.

# IINS IN A FEW FIGURES



**187** research staff members

**35** permanent researchers

**65** technicians and engineers

**50** PhD and Master students

**30** postdocs

**14** research teams



**33** nationalities

**Formation**



**+160** training courses attended



**60** publications



**20** national and international awards

**10**

national and international grants



**Social Media**



**976** followers **+34%**



**10** academic and industrial partnerships

LinkedIn

Now connected!

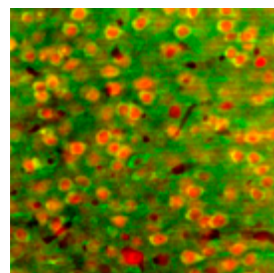
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# LOOKING BACK TO 20 23

## FEBRUARY

### Mario Carta (Team Leader) discovers how our brain encode warm and cold

This major discovery, made in partnership with James Poulet (Max Delbrück centre for molecular medicine in the Helmholtz association, MDC), has led to publication in Nature and in The Conversation. In "The cellular coding of temperature in the mammalian cortex", the two scientists discovered a "thermal cortex" located in a posterior region of the insular cortex. This would enable us to detect cold or hot temperatures.



## MARCH

### Valentin Nägerl (Team Leader) receives the Discovery Award by Wellcome Trust from the University of Oxford

Category: "Molecular interactions of guidance receptors acting in early cortical development". He was awarded the prize for his interdisciplinary work involving structural biology, protein engineering, proteomics, cell biology, advanced imaging and in vivo technology in mice.

Flash to learn about the project



## MAY

### Launch of EURAS project, led by Eric Hosity (Team Daniel Choquet) in Bordeaux

This project is in response to the "Horizons 2020 Projects" call for proposals for the development of new effective therapies for rare diseases. The EURAS project brings together 16 European teams from 13 countries, covering all areas of neuroscience, from genetics and molecular screening to electrophysiology, behaviour and the study of stem cells. The project stems from the initiative of associations of patients with mutations in the genes regulating the RAS protein (SynGAP Elternhilfe), the best known of which is SynGAP1. The IINS's contribution to this project is to identify the molecular signatures common to the different RASopathies and to identify the molecular signatures common to the different RASopathies. RASopathies and testing different drugs to restore normal neuronal development. neuronal development. This work will be carried out in collaboration with the Bordeaux Imaging Center.

## APRIL

### Many IINS scientists win AAPs

#### AAP "Seed Projects" AD-Taste

Cordinator: Mario Carta (Team Leader)

Partner: Guillaume Ferreira (NutriNeuro)

#### AAP "Seed Projects" VGLUT-SCA

Cordinator: Giovanni Stevanin (INCIA)

Partner: David Perrais (Team Leader)

#### AAP "Seed Projects" SYN-PTSD

Cordinator: Sophie Tronel (Neurocentre Magendie)

Partner: Julien Dupuis (Team Laurent Groc)

#### AAP "Seed Projects" MossyOntoSynaptome

Cordinator: Emilie Pacary (Neurocentre Magendie)

Partner: Etienne Herzog (Team David Perrais)

Flash to see the publication



## AUGUST

### Florian Levat (Team Jean-Baptiste Sibarita) publishes in Frontiers

In "Optimizing Voronoi-based quantifications for reaching interactive analysis of 3D localizations in the million range", Florian Levat presents a new hybrid CPU-GPU algorithm for the rapid generation of 3D Voronoi diagrams. Voro3D allows creating Voronoi diagrams of datasets composed of millions of localizations in minutes, making any Voronoi-based analysis method such as SR-Tesseler accessible to life scientists wanting to quantify 3D datasets. In addition, he also improves ClusterVisu, a Voronoi-based clustering method using Monte-Carlo simulations, by demonstrating that those costly simulations can be correctly approximated by a customized gamma probability distribution function.

## OCTOBER

### Zoë Jamet (Team Laurent Groc) receives the Excellent speaker award for International Student Presentations of medical and life science from the University of Tsukuba

Zoë Jamet travelled to Tsukuba in Japan to take part in the Tsukuba 2023 conference. At the conference, she presented a poster entitled "The human brain as the ultimate model to study brain disorders" and gave an oral presentation on "Molecular impact of NMDA receptor autoantibodies". It was this presentation that won her the award.



## NOVEMBER

### Eric Hosity (Team Daniel Choquet) discovers how plants grow when their cells are made up of a rigid wall

in collaboration with the University of Lausanne, the INRAé, the University of Zurich and the University of Antwerp

This discovery has led to publication in Science and and has been the subject of numerous press releases. In "Plant cell wall patterning and expansion mediated by protein-peptide-polysaccharide interaction", the scientists demonstrates that the plants combine sugars and proteins to give the wall its strength and extensibility and enable cells to grow.



Flash to see the publication

## DECEMBER

### A new team soon at the Interdisciplinary Institute for Neuroscience

Mathieu Letellier is a CNRS researcher in neurophysiology, specialising in the molecular and cellular mechanisms of synaptic plasticity. On 1 January 2024, he will set up his own team. It will seek to understand how neurons regulate each of their many connections, an important phenomenon for optimising information storage and cognitive processes.



## OCTOBER

### Yann Humeau's team and Daniel Choquet (Team Leader) publish in Nature Communications

In "CA3 hippocampal synaptic plasticity supports ripple physiology during memory consolidation", the scientists show that AMPAR immobilization in the dorsal hippocampus impairs memory consolidation.



Flash to see the publication

# SUCCESSSES

## About our IINS youngster awards

### Fondation pour la Recherche Médicale end-of-thesis



**Agata Idziak** (Team Daniel Choquet): "The role of AMPA receptor surface mobility in short-term synaptic plasticity"



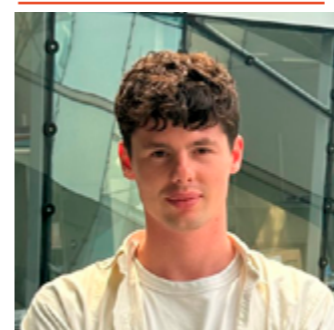
**Zoë Jamet** (Team Laurent Groc): "Autoimmunity and psychosis: molecular study of anti NMDA receptor"



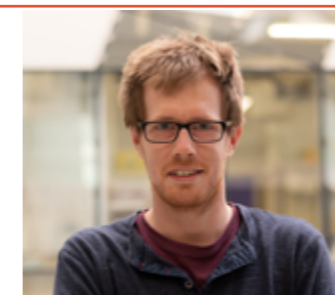
**Federica Quici** (Team Valentin Nägerl): "Superresolution analysis of the nano-anatomical determinants of synaptic function of hippocampal neurons"

### Fondation Médicale pour la Recherche postdoctoral and Marie Skłodowska Curie

#### Fondation Médicale pour la Recherche extension scholarship

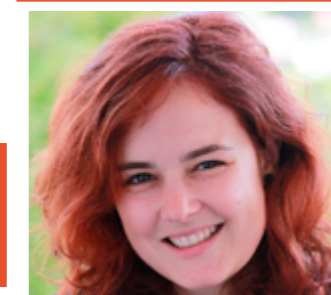


**Paul Lapios** (Team Perrais): "Cellular and Molecular analysis of dopamine transmission in-vitro using purified synaptosomes from mice"



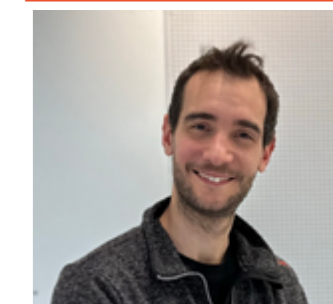
**Charles Ducrot** (Team Olivier Thoumine): "The role of Neuroligin-1 in synapse formation and function"

#### Marie Skłodowska Curie



**Dominique Fernandes** (Team Laurent Groc): "Dynamik: Exploring the role of NMDA receptors in K<sup>+</sup> channel nanoscale organisation, surface dynamics and function"

#### Marie Skłodowska Curie



**Massimo Ruben** (Team Naoya Takahashi): "Spatiotemporal dynamics of top-down inputs during tactile perception"

### They are now researchers

**Morgane Rosendale has been nominated CNRS Research Fellow in the Giannone's team**  
After several years as a postdoctoral researcher, Morgane Rosendale was successful in the 2023 CNRS competition for a position as CNRS. She has joined the team as such.



**Evan Harell has been nominated CNRS Research Fellow in the Roux's team**  
Evan Harrell joined IINS in 2021 as part of Lisa Roux's team. In 2023, he passed the CNRS Section 25 competition and was awarded a CNRS researcher position from January 2024.



## Other awards



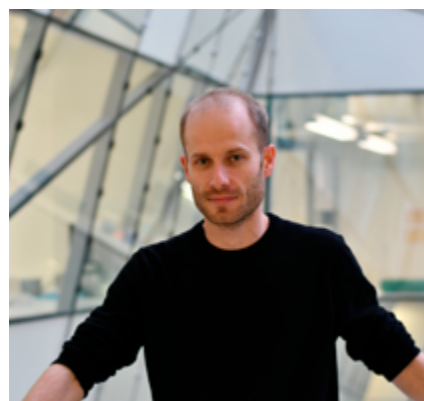
### Daniel Choquet awarded the "Grand Prix 2022 de L'Académie des sciences, belles lettres et arts de Bordeaux"

On Tuesday 26 September, the Académie des sciences, belles lettres et arts de Bordeaux hosted the award ceremony for the Grand Prix de l'Académie de 2022, awarded to Daniel Choquet in recognition of his life's work as a scientist.



### Christophe Mulle named "Chevalier de l'ordre national du Mérite"

Appointed by the French Minister for Research, 2nd June, the award was presented to him by Manuel Tunon de Lara, former President of the University of Bordeaux, in the presence of Dean Lewis, President of the University of Bordeaux. Instituted by General de Gaulle, the "Ordre National du Mérite" is the second national order after the Légion d'Honneur. Its purpose is to reward "distinguished merit" and encourage the country's dynamic forces.



### Mathieu Letellier awarded the CNRS Bronze Medal 2023

On November 15 in Bordeaux, Mathieu Letellier was awarded the bronze medal of the CNRS by André le Bivic, representative of CNRS biology. He received the award for his research on the molecular and cellular mechanisms of synaptic plasticity.

Flash to discover his portrait



### Christophe Mulle was awarded the Desmarest Prize

The Pierre Deniker Foundation's Desmarest Prize aims to fund fundamental research projects in the field of Alzheimer's disease and neurodegenerative disorders. Christophe Mulle was awarded the prize for a project co-directed with Thierry Amédée. The aim of this project is to study the morpho-functional relationships between microglia and synapses in the vicinity of amyloid plaques in an animal model of Alzheimer's disease.



### Valentin Nägerl awarded the Maxime Dahan Prize by the Institut Curie

On 15 December at the Institut Curie, Valentin Nägerl was awarded the Maxime Dahan prize for innovation in methods and instrumentation. The scientist has developed remarkable tools in the field of biological imaging, particularly on a nanometric scale.

## Fullbright, FRM, ...



### Daniel Choquet is a member of the 2023 Fullbright France

Daniel Choquet will spend a 7-month sabbatical in Denver in 2024 in the laboratory of Prof. Mark Dell'Acqua. The pharmacology department at the University of Colorado is already home to many top neurobiologists who are developing original approaches to cell biology. Daniel will be developing new methods and approaches aimed at controlling receptor trafficking and visualisation.



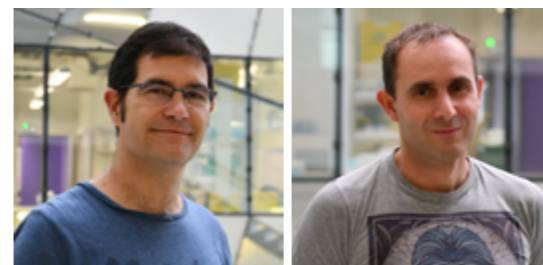
### The team's Giannone is awarded of the FRM Teams Award 2023

The team works on the molecular mechanisms controlling the architecture and dynamics of motile structures, in particular integrin adhesions and actin-dependent protrusions, during cell migration and mechanosensation. Thanks to its innovative research programme in biology with potential applications in healthcare, the team has been selected by the Fondation pour la Recherche Médicale (FRM).

## Agence Nationale de Recherche (ANR)

### Alexandre Favereaux (Team Thoumine) and Daniel Choquet (Team Leader)

**Project: "TiPS"**. This project focuses on molecular and cellular neuroscience, particularly developmental neurobiology. In collaboration with Mónica Fernández Monreal (Bordeaux Imaging Center, BIC).



### Grégory Giannone (Team Leader)

**Project: "CryoNanoLam"**. This project is studying the organisation and nanometric dynamics of the molecular machinery that directs cell migration.

### David Perrais (Team Leader) and Grégory Giannone (Team Leader)

**Project: "RINSE"**. This project is seeking to understand the role of integrins in the structure and activity of synapses and endocytosis zones in neuronal dendrites.



### Olivier Rossier (Team Grégory Giannone) and Mathieu Sainlos (Team Daniel Choquet)

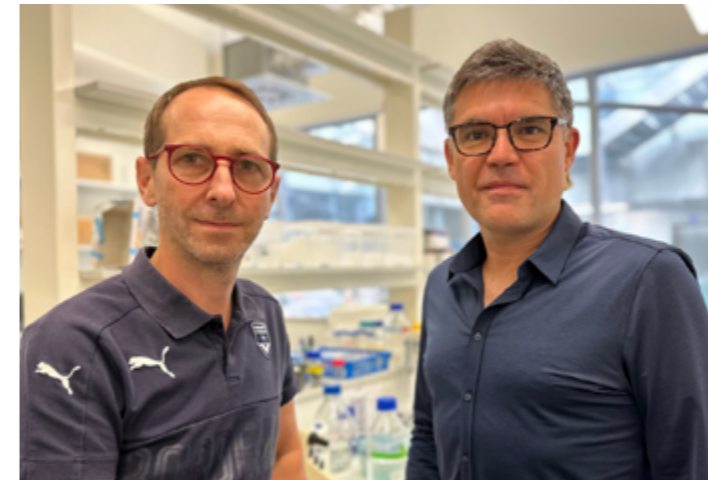
**Project: "EndoGraal"**. This project aims to decipher the interactions between endogenous proteins in macromolecular adhesion complexes.



# TRANSLATIONAL SUCCESSES



Floriane Uyttersprot | Team Laurent Groc



Flash to know more about the project



## Gene therapy a treatment for drug-resistant epilepsy? This is the result of research by Christophe Mulle's team

The team of Christophe Mulle and Valérie Crépel (Inserm) have demonstrated that localized injection of a viral vector targeting GluK2/GluK5 kainate receptors in the hippocampus is a highly promising gene therapy strategy for controlling seizure onset in drug-resistant epilepsy patients. Based on the gene therapy strategy described in the *Annals of Neurology* article, the Dutch company uniQure, which has acquired the start-up Corlieve Therapeutics - of which Valérie Crépel and Christophe Mulle were scientific co-founders - will launch a Phase I/IIa clinical trial in the USA to for the treatment of drug-resistant temporal lobe epilepsy.

This project is based on the hypothesis that GluK2/GluK5-type kainate receptors localized ectopically at aberrant synapses formed by the sprouting of axons from dentate gyrus granule cells, act as detonators in triggering epileptic discharges in the hippocampus. In 2014, an initial study by these researchers demonstrated that the genetic deletion of *grik2*, the gene encoding the GluK2 subunit of the kainate-type glutamate receptors, or pharmacological inhibition of GluK2/GluK5 receptors, led to a reduction in the number of spontaneous and recurrent seizures observed in a mouse model of temporal lobe epilepsy. A patent had been filed indicating GluK2/GluK5 as a potential target for treating temporal lobe epilepsy.

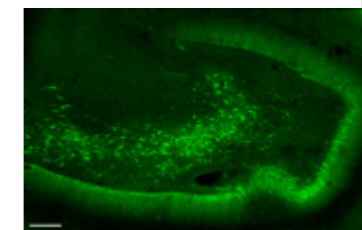
## The PHRC TiM-DepisT project, a national hospital-based clinical research project by Laurent Groc's team

The PHRC TiM-DepisT project is a national hospital-based clinical research project. Its aim is to detect (DepisT) and treat (TiM = immunomodulatory therapy) the presence of autoimmunity in people suffering from psychiatric disorders (psychosis).

Led by Frédéric Villega (CHU Bordeaux/IINS) and involving 9 University Hospitals across France, the project involves psychiatrists, child psychiatrists, neuropaediatricians and researchers. Psychiatrists Marion Leboyer from the Fondamental Foundation, Bruno Auizerate, David Misdrahi, Sébastien Gard and Anouck Amestoy from Bordeaux Charles Perrens CHU, will be working hand in hand with researchers from Laurent Groc's IINS team (Delphine Bouchet, Olivier Nicole, Julien Dupuis, Hélène Gréa) and the Bordeaux CHU immunology department team (Isabelle Pellegrin, Patrick Blanco, Cécile Bordes).

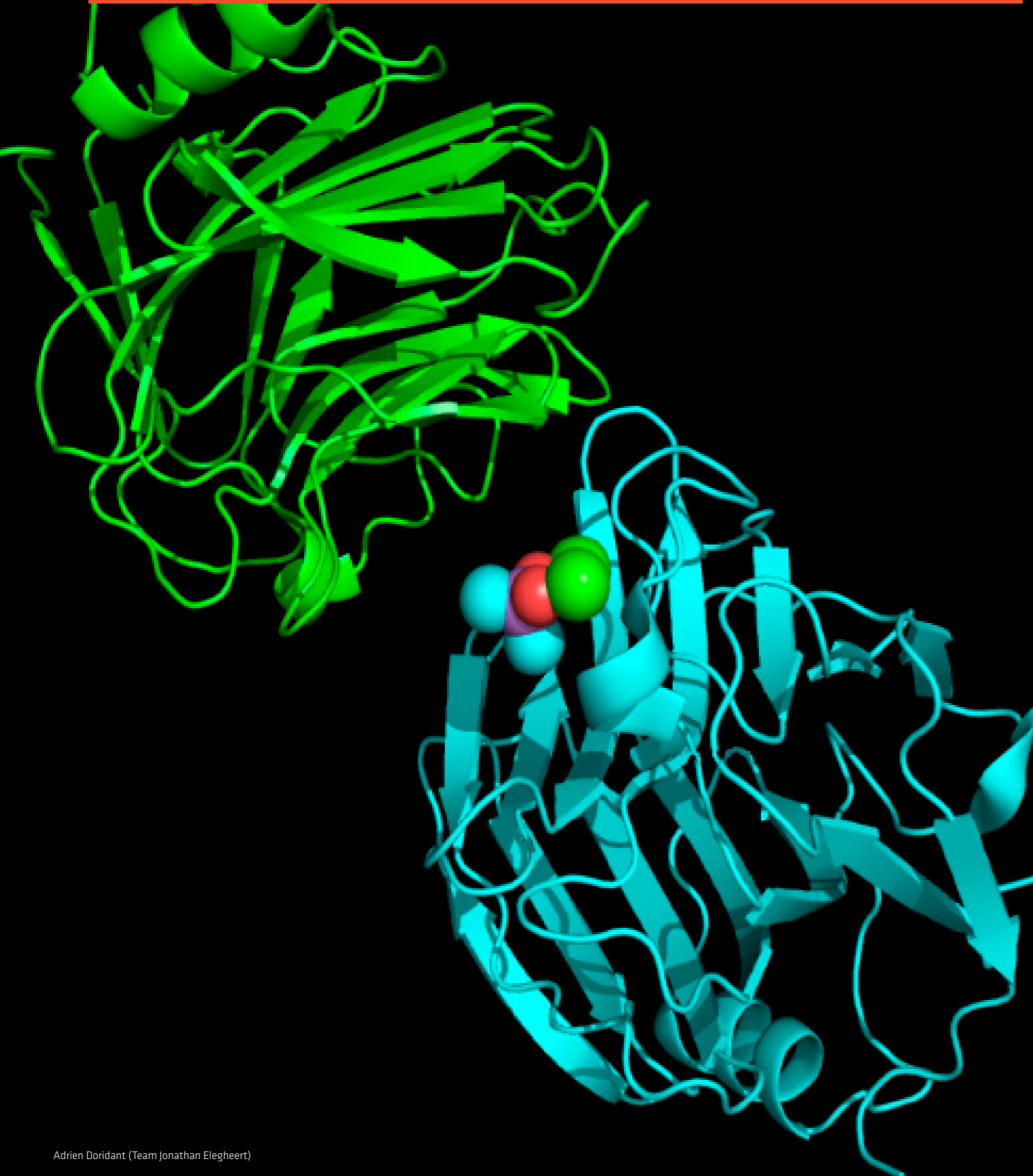


Flash to know more about the project





# TECHNOLOGICAL SUCCESSES



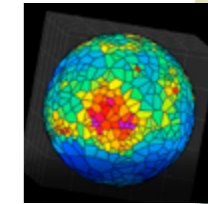
Adrien Doridant (Team Jonathan Elegheert)

## Florian Levet (Team Jean-Baptiste Sibarita) has developed PoCA: a software platform for the visualisation and quantification of cloud data

Point Cloud Analyst (PoCA) is a powerful open-source software platform dedicated to the visualisation and analysis of 2D and 3D point cloud data. PoCA enables the manipulation of large datasets, and integrates a plug-in architecture, a native batch analysis engine and a Python code interpreter, making it easy both to analyse data and to integrate new methods.

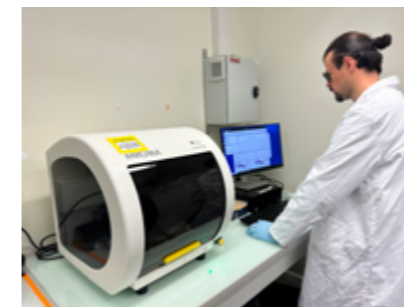


Flash to see the publication



## As part of the Calipso project, Jean-Baptiste Sibarita (Team Leader) presented soSPIM and Jewell

At the CNRS CREATE 2023 Symposium in Singapore, Jean-Baptiste Sibarita presented his new tools: the soSPIM microscope and a prototype imaging instrument and innovative patented JeWell plates. Developed with Virgile Viasnoff, these tools are part of their Calipso project.



## The Elegheert team has acquired a new BLI analysis tool: OctetR8 (Sartorius)

An OctetR8 is a device that measures the interaction between different partners. This acquisition will allow the team to screen for nanobodies and to observe the influence of mutations on the ability of certain proteins to form complexes.

## The Elegheert team took part in the "Single-Domain Antibodies 2023" meeting at the Institut Pasteur, Paris

This meeting was the 3rd congress dedicated to the study of single-domain antibodies. The meeting took place from 18 to 20 September at the Institut Pasteur Conference Centre in Paris. Anushka Nair presented a poster on the production of nanobodies from a DNA library transformed in yeast.





Computational and Systems Neuroscience  
Team Frédéric Gambino



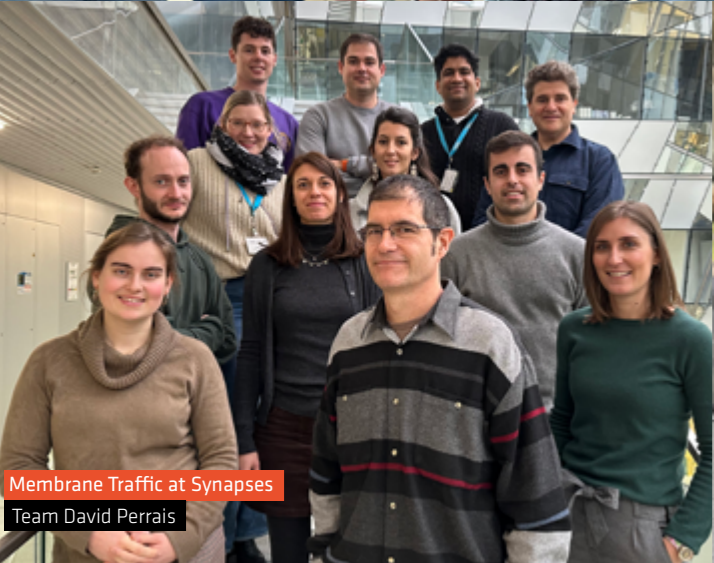
Organizing the cells  
Team Vincent Studer



Cell Adhesion Molecules in Synapse Assembly  
Team Olivier Thoumine



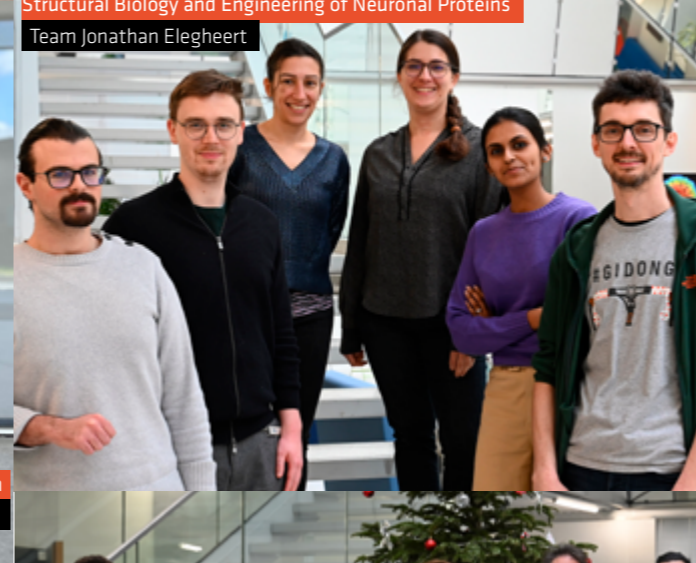
Olfaction and Memory  
Team Lisa Roux



Membrane Traffic at Synapses  
Team David Perrais



Synapse in Cognition  
Team Yann Humeau



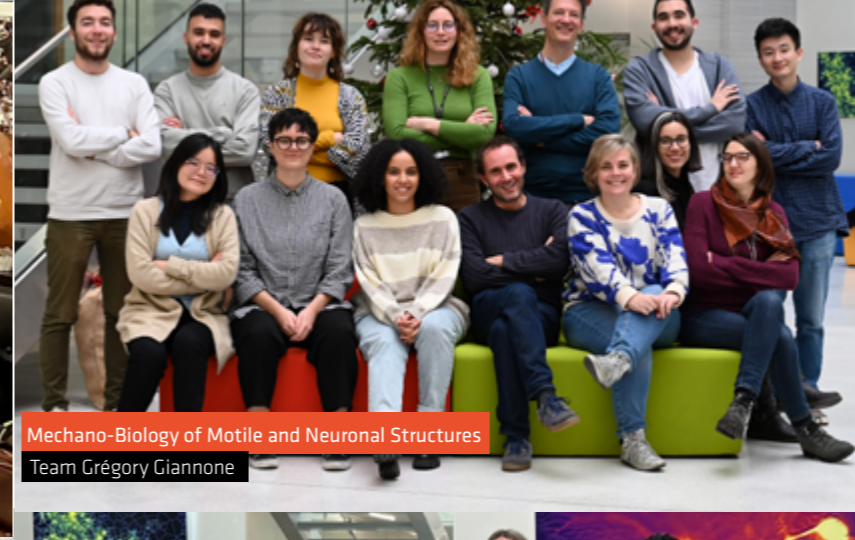
Structural Biology and Engineering of Neuronal Proteins  
Team Jonathan Elegheert



Synapses and Neural Circuits in Behaviour  
Team Christophe Mulle & Mario Carta



Developmental Brain Physiology and Pathology  
Team Laurent Groc



Mechano-Biology of Motile and Neuronal Structures  
Team Grégory Giannone



Synaptic Plasticity and Super-Resolution Microscopy  
Team Valentin Nägerl



Quantitative Imaging of the Cell  
Team Jean-Baptiste Sibarita



Neural Basis of Perception  
Team Naoya Takahashi



Dynamic Organization and Function of Synapses  
Team Daniel Choquet



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Mathieu Letellier (Team Thounine & Monica Hernandez, Montréal (BIC)

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