

UNDERSTANDING THE BRAIN, CURING DISEASE

NEUROSCIENCE RESEARCH IN LEUVEN, BELGIUM

WE ARE THE VIB-KU LEUVEN

Our Center's annual Science Day 2023

CENTER FOR BRAIN & DISEASE RESEARCH

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Understanding how our nervous system drives our senses, thoughts and behavior and how it loses these abilities in disease—is the goal we set ourselves at the Center for Brain & Disease Research, and our teams are making immense progress taking multidisciplinary approaches to unlocking the secrets of the brain. But the journey doesn't stop at generating knowledge. **Our objective is to make lasting scientific contributions with societal impact**.

Embedded within both VIB and at KU Leuven university we are creating one of the most exciting locations worldwide to pursue original ideas and train new generations of scientists. At any level of our organization, we have designed our state-of-the-art facilities and community initiatives to foster collaboration and interaction. Creativity and ideas spark where different backgrounds meet and unlocking the secrets of the brain will require the brightest minds from all continents.

We embrace diversity because it empowers our work. We aim to build a vibrant and interactive neuroscience community, locally and globally. We take pride in excellent communication at all levels, and in our enthusiasm, openness, collaboration, inclusion and diversity. **We are the Center for Brain & Disease Research!**

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LEUVEN, BELGIUM

We are based in the city of Leuven in Belgium. Leuven consistently tops international rankings as the most innovative city and university in Europe.



DISCOVER OUR

OUT SCIENCE FIVE THEMES SPAN OUR RESEARCH QUESTIONS

Background Image: Tubb5 labeling with endogenous tagging in the cortex. In green you see tubulin from cortical excitatory neurons, in pink is a fluorescent protein used for injection marker, and in blue is a DAPI staining. Image by Blanca Lorente Echeverría and Dan Dascenco (Joris De Wit Lab).

Neuronal and Neurodegenerative Disease

Neuronal and neurodegenerative disorders affect millions of people worldwide. For most of these diseases there are no cures. We are working hard to understand the mechanistic basis of these diseases with the ultimate aim of developing therapies. We have uncovered exciting new avenues in the context of Alzheimer's disease, Parkinson's disease and ALS, and together with the translational team of VIB, they are pursuing these targets further.

Brain Development & Repair

Developmental processes define neuronal and glial subtypes, but how neuron number and brain size are controlled is not known. Our researchers are looking for human-specific developmental processes and aim to understand how the brain is shaped, from the fundamentals of cell type-specific developmental processes to delineating the code of neuronal wiring and synapse formation.

Synapses, Connections and Behavior

The computational processes of the nervous system that direct behavior are only possible because of trillions of synaptic connections in the brain. Our researchers elucidate how these connections are established, and unravel the underlying mechanisms of synaptic specificity, stability, plasticity and function. We exploit our knowledge of brain wiring to create induced human neuronal circuits to study how neuronal computation is affected in human disease.

Toxic Protein Assemblies

The biophysical properties of some proteins allow them to sometimes separate in droplets in the cytoplasm or aggregate in an insoluble mass. These features are relevant because pathological studies in human patients show protein aggregates in many neurodegenerative diseases. We study how these protein assemblies can form, their functional consequences and what their therapeutic challenges are.

The Brain at Single-Cell Resolution

The brain is the most complex organ in our body and we are only now starting to discover the full diversity of cell types that exist in the brain. Our researchers are now pursuing questions that address the cellular changes during disease, ageing and behavior. We also work on the next generation of technologies to measure cellular function at much higher resolution and to maintain spatial information of the location of the cells in the brain.

STEIN **AERTS**

LABORATORY OF COMPUTATIONAL BIOLOGY

We are interested in decoding the genomic regulatory code and understanding how genomic regulatory programs drive dynamic changes in cellular states, both in normal and disease processes. Stein Aerts is also Director of VIB.AI: the VIB Center for Computational Biology and AI.



LUCÍA CHÁVEZ-GUTIÉRREZ LABORATORY OF PROTEOLYTIC MECHANISMS

We want to generate a quantitative understanding of the molecular mechanisms underlying Alzheimer's disease pathogenicity, more specifically the biochemical function of the molecules involved in familial Alzheimer's disease.



WIM ANNAERT

LABORATORY FOR MEMBRANE TRAFFICKING

Our laboratory is focused on understanding the molecular biology of membrane transport in a disease-related context covering Alzheimer's and Lewy Body diseases.





SANDRINE DA CRUZ LABORATORY OF NEURODEGENERATIVE DISORDERS AND NEUROPHYSIOLOGY

We study the role of local axonal translation in neurodegeneration in amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD). We develop new therapeutic targets to treat neuromuscular disorders including ALS.

our **LABS**

THE SCIENTISTS BEHIND THE SCIENCE



Julian Diender, Research Technician in the Laboratory of Interneuron Developmental Dynamics

BART DE STROOPER LABORATORY FOR THE RESEARCH OF NEURODEGENERATIVE DISEASES

We study the basic mechanisms causing Alzheimer's disease, particularly the complex cellular phase of Alzheimer's using singlecell, genome-wide transcription profiling with spatial and temporal resolution.



SHA LIU

LABORATORY OF SLEEP AND SYNAPTIC PLASTICITY

The goal of our lab is to understand the synaptic and circuit mechanisms underlying sleep and its function in the brain.





JORIS DE WIT LABORATORY OF SYNAPSE BIOLOGY

Our lab aims to unravel the molecular mechanisms that control neuronal connectivity in developing circuits, and determine how perturbations in this process affect cognitive function.



ESTHER KLINGLER LABORATORY OF EMOTIONAL NEURON CIRCUIT DEVELOPMENT

We study how emotions emerge during development, what controls the diversity of emotional circuits, and to which extent this relies on intrinsic factors or on past experience.



LUDO VAN DEN BOSCH

ALS.

We focus on the mechanisms of acute and chronic axonal and neuronal degeneration and regeneration. We contribute to the development of new therapeutic strategies for neurodegenerative disorders, including

FREDERIC **ROUSSEAU** & JOOST **SCHYMKOWITZ**

SWITCH LAB

We study the mechanisms of protein folding and misfolding, particularly how protein aggregation affects the interactome by suppressing native interactions and introducing novel aggregation-specific interactions.





LYNETTE LIM LABORATORY OF INTERNEURON DEVELOPMENTAL DYNAMICS

We study the metabolic and transcriptomic programmes that shape neuronal diversity and circuit assembly in the developing mammalian cortex.



PIERRE VANDERHAEGHEN STEM CELL AND DEVELOPMENTAL NEUROBIOLOGY LABORATORY

We aim to understand the molecular and cellular mechanisms underlying the development and evolution of the cerebral cortex, from stem cells to neuronal circuits, from mouse to human, in health and disease.



PATRIK VERSTREKEN I ABORATORY OF NEURONAL COMMUNICATION

The earliest stages of neurodegenerative diseases are characterized by synaptic problems. We probe into the diverse molecular mechanisms at the basis of neuronal degeneration and synaptic dysfunction, and how we can reverse this.

THOMAS **VOETS** LABORATORY OF ION CHANNEL RESEARCH

We focus on TRP channels, which includes 27 human members. There is a striking diversity in the stimuli that can regulate the gating of the TRP channels, which include physical stimuli such as temperature and voltage, as well as various endogenous and exogenous chemical ligands.





Ilse Lambeau, VIB and KU Leuven Liaison

our **SUPPORT**

Aligning Science Across Parkinson's

CHAN

ZUCKERBER INITIATIVE

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INTERNATIONAL GRANTS

Muscular Dystrophy Association

Cure

FUND

Alzheimer's

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BrightFocus™ Foundation

alzheimer's $\ref{eq:started}$

association

OUR TECHNOLOGY WE PROVIDE ACCESS TO THE

Neuroscience is a quickly evolving field, driven by the development of new technologies and the advances in complex data analysis.

Advanced Microscopy

We have access to numerous confocal microscopes and super-resolution systems, slide scanners, high content screening, and 3D whole organ imaging (e.g. light sheet microscopes) as well as transmission and scanning electron microscopes, light and electron microscopy-combined systems and block face scanning electron microscopy solutions.

Single Cell

We offer a wide and growing range of applications for single cell research, including single-cell transcriptomics, epigenomics, and proteomics. We work closely with the VIB Nucleomics Core and KU Leuven Genomics Core, and with connections within the Bioinformatics Interest Group at KU Leuven and the High Performance Computing node at the Flemish Super Computer Center.

Flow Cytometry

This unit provides access to a broad portfolio of flow cytometer analyzers, FACS cell sorters, and multiplexing devices. The staff is available to help users with the design, acquisition, and analysis of their experiments. The core actively scouts for emerging technologies and applications.

Animal Models

We provide rodent facilities and knowhow, offering an expanding toolbox of behavioural assays, genome engineering, reproductive techniques, and more. In addition, the Liu Laboratory has an in-house fly workshop to study sleep behaviour, while the Van Den Bosch Laboratory hosts an aquatic facility to generate zebrafish models for researching ALS.

Electrophysiology

We help researchers within the center with cutting-edge electrophysiology systems and expert knowledge to support ongoing research projects with refined research contributions. Researchers have access to several patch and field recording rigs with uncaging capacity as well as multi-electrode array systems and multiphoton microscopy.

BEST TECH AND EXPERTISE

At our Center, we follow this evolution closely and realize the importance of easy access to the newest technologies and the importance of technology development.

Genomics & Nucleomics

Through both our host institutes, VIB and KU Leuven, there is access to nextgeneration sequencing technologies and analysis. There are personalized expert services available for expression analysis, RNA and DNA sequencing, including both short (Illumina) and long read sequencing (Pacific Biosciences and Oxford Nanopore) technologies.

Human Models

State-of-the-art cell culture facilities on each floor of our Center allow us to culture and manipulate animal and human iPS cells. Our histology labs has several vibratomes and microtomes. Several labs are developing novel models of human brain function, for example the Verstreken lab's Brain on Chip and Vanderhaeghen's human-mouse chimeras.

Biophysics

The biophysics platform helps researchers in the Center by providing biophysical and structural insight into biological phenomena that are driven by protein folding, aggregation and interactions. Our equipment enables the latest in biophysics and protein analysis.

Mass Spectrometry

These facilities possess unique expertise in tracer-based metabolomics, which can deliver crucial insights into the activity of metabolic pathways. Using high resolution mass spectrometry, metabolomics (including spatial metabolomics), proteomics and lipidomics, the fate of labeled isotopes can be tracked throughout the metabolic network.

Neuroengineering

In our dedicated workshop, the neuroengineering unit designs, creates and builds optical, electrical and mechanical instruments in collaboration with the research labs and expertise centers in support of experimental neuroscience research. This unit is run in collaboration with NeuroElectronics Research Flanders (NERF).



STARTUPS

Our Center's research was at the basis of the foundation of several new Belgian and international biotech start-ups. Some are operating in stealth mode, and several are growing fast.

FLYING TECHNICIANS

Dedicated research associates at our

Center provide expert hands-on help to

build strong data packages facilitating transfer to the private sector or drug

screening.



BUSINESS DEVELOPMENT

The Business Development team looks for partnerships to achieve academia-toindustry transition for innovations, and to translate scientific findings into products for patients.



DISCOVERY SCIENCES

The VIB Discovery Sciences team initiatives and guides the transformation of scientific insights into projects that could deliver novel therapeutics.

OUT IMPACT

DRIVING A CHANGE FOR PATIENTS AND SOCIETY

The field of neurological diseases is a major frontier of biomedical innovation. It is our goal to be a key player and to actively engage in translational research, based on a solid mechanistic understanding of fundamental and disease processes. As a publicly funded and basic science driven research center, we are committed to making a societal impact.



DRUG SCREENING

Our researchers work with well-staffed expert facilities - the VIB Screening Core and KU Leuven Center for Drug Design & Discovery (CD3) - to translate our basic biological findings into novel pharmaceutical interventions.



PATENT PORTFOLIO

Dedicated patent analysts and writers work in close collaboration with our researchers and the business development team to protect our innovations.

SCIENTIFIC SUPPORT ASSOCIATION

The Scientific Support Association (SSA) is run by and for technicians. We aim to stimulate the exchange of know-how between labs and increase communication between the scientific support staff, including all lab managers and all lab technicians, and the rest of our Center.

PHD ASSOCIATION

The PhD Association was born to create the ideal space for PhD students to support each other and to make their journey as smooth as possible. The PhDA aims to foster interaction, collaborations and a sense of community at our Center! We also want to provide resources for career and personal development and to represent the PhD students at executive level.

POSTDOC ASSOCIATION

Our research Center has a very engaged postdoc network, which aims to foster a sense of community and to provide resources for career and personal development. At the institutional level, the VIB Postdoc Committee (PDC) represents all postdocs and staff scientists at VIB and organizes networking and career development events.

INCLUSION & DIVERSITY COMMITTEE

Scientific accomplishments often originate at the interface of several disciplines, illustrating that creativity sparks where diverse backgrounds come together. Our local Inclusion & Diversity (I&D) Committee works in collaboration with other VIB and KU Leuven based diversity working groups to organize various initiatives to raise awareness of and advocate for an inclusive and welcoming working environment.

OUR COMMUNITY CREATING A STIMULATING & INCLUSIVE ENVIRONMENT

Community is an integral word for us. We are investing in our people, and our research thrives because of the excellence of our staff and students.

ECO TEAM

Our Center's Eco Team acts as a sustainability think-tank that explores ideas and initiatives to make our work place more sustainable through a bottom-up approach. The Eco Team consists of people throughout each layer of our organization, with representatives from as many of our labs as possible. They form a point of contact between our Center and policy makers at the university and institutional level.

Background image: Mural designed for our Center's lobby by Júlia Mota Albuquerque as part of the Inclusion & Diversity Committee's Diversity in Science campaign.



Our Center equips alumni with the expertise, tools and confidence to progress on to exciting career opportunities in the most top-notch research institutions all across the world. To keep in touch with our community, we have set up an Alumni Network and a LinkedIn Alumni Group to stay up-to-date with how our alumni are.

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LEUVEN BRAIN INSTITUTE & MISSION LUCIDITY

We are part of the Leuven Brain Institute, which groups the >1000 Leuven-based neuroscientists under one umbrella. We also work closely with Mission Lucidity, which drives innovation in the development of neurotechnologies for neurodegenerative diseases, bringing engineers, medical doctors and biologists together around specific projects.

NERF (Neuroscience Electronic Research Flanders)

NERF combines systems neuroscience and neuroengineering to understand and restore nervous system function. We regularly cross paths with our Leuven-based neighbour and fellow VIB Center, whether it be at a Group Leader retreat, a PhD progress seminar, or in the lab.

COLLABORATIVE RESEARCH INITIATIVES

Our strength is a bottom-up approach: ideas are incubated in our research labs, but the best ideas may benefit from leveraging expertise and knowhow from different groups. We therefore initiated a Collaborative Science Program both within our Center and across the 3 VIB Neuroscience centers.

OUR NETWORK Collaborative science And translation

The current pace of science is surpassing the capacity of individual labs. We are convinced that if we work together, we can tackle the most important questions in neuroscience and neuronal disease. We have invested in bringing groups together around common goals and ideas.

CLINICAL COLLABORATIONS AT UZ LEUVEN

We have invested in increased collaborations with numerous clinicians, pathologists, and surgeons for expertise across several domains. Group leaders at our Center regularly work with medical professionals at UZ Leuven - based at the same Gasthuisberg campus as our Center - for maximum insight and impact.

imec (INSTITUTE FOR MICROELECTRONICS)

Our Center is located close to imec, a world leader in silico technologies with an emerging life sciences department. Several of our researchers have started to collaborate with the engineers at imec to develop novel transformative technologies, enabling and tackle new research questions.

OTHER VIB CENTERS

We are continuously working on numerous collaborative projects with other VIB Centers across Belgium with overlapping research interests: the Center for Structural Biology in Brussels, the Center for Inflammation Research in Ghent, and the Center for Molecular Neurology in Antwerp.

INTERNATIONAL PARTNERSHIPS

In addition to our strong local partnerships, we also benefit from ever-growing collaborations across the globe. As such, we enjoy regularly inviting and hosting international guests for lectures, workshops, or as members of our Scientific Advisory Boards.



EVENTS

Our calendar is full of activities to bring our scientific community together. We have weekly progress seminars for PhD students, and regularly host top neuroscience experts to give lectures. Through our host institutions, we have plenty of training opportunities throughout the year. We also organize external conferences and symposia, in addition to monthly Happy Hours and an annual Science Day for the entire Center.



DOING A PHD

At our Center, PhD students have the best of both worlds: with access to training, resources and facilities through both host institutions VIB and KU Leuven. Each year, new PhDs enjoy the PhD Symposium and receive a Welcome Package to kick-start their experience. The PhD Association organizes social events throughout the year, and the PhD-led journal "The Optimist" shares nuggets of wisdom every quarter.



LIFE IN LEUVEN

Our Center is based in the city of Leuven in Belgium, the heart of Europe. Leuven consistently tops international rankings as the most innovative city and university in Europe. KU Leuven university boasts over 600 years of history: the university was founded in 1425, and is one of the oldest in Europe. Last, but not least, Leuven is home to the world-famous Stella Artois beer!



OUT DAY-TO-DAY What life and work Look like at our center

We believe it is important to generate a friendly atmosphere where colleagues feel welcomed and supported. We build our community by encouraging interactions, and strengthen our scientific excellence by organizing regular opportunities for our researchers to learn and network.

VACANCIES

Curious about a career at the VIB-KU Leuven Center for Brain & Disease Research? We regularly have available job positions posted on our website, and are open to spontaneous applications as well. We look forward to hearing from you!





EVGENIA SALTA FORMER POSTDOC AT DE STROOPER LAB

VIB is research heaven. I am eternally grateful for all the opportunities I was provided with to get trained, learn, collaborate and grow as a scientist. Apart from being at the forefront of research, having direct access to cutting-edge technologies and being surrounded by amazing colleagues, supporting teams and facilities, have all been instrumental for my career.

Evgenia is now PI at the Netherlands Institute of Neuroscience in Amsterdam



IKUO SUZUKI FORMER POSTDOC VANDERHAEGHEN LAB

It was fantastic: I could spend all my time on my own research! The seminars are great and I also enjoyed being part of collaborative projects involving multiple labs in the Center. I was absolutely satisfied of the science at the Center. In addition, I really enjoyed the cultural diversity in Belgium as a foreigner. I do miss Belgium, Leuven, and the Center.

Ikuo is now Associate Professor at the University of Tokyo

OUT LEGACY Don't take it from us.

Our former PhDs, postdocs, and group leaders spread their wings to positions in prestigious scientific institutions in all corners of the world. We have compiled a few testimonies which give insight into their time at the Center.

CLAUDIA BAGNI FORMER GROUP LEADER (2007-2016)

My time at KU Leuven and VIB in one sentence: it is all about great and fun science! As Chair of a Department, I have been largely inspired by my time in Leuven. Among the many aspects I remember with pleasure and that inspired my work here: the driving force of the PhD students and their initiatives, the departmental retreats and the outstanding seminar series.

Claudia is now DFN Department Director at the University of Lausanne



BASSEM HASSAN FORMER GROUP LEADER (2001-2016)

My time at VIB was special in so many ways. I started my career as a PI there when VIB was a young unknown institute and I was an inexperienced PI. By the time I left, VIB had become a world class center of research. From day one at VIB I was involved in changing things. That early involvement in leadership and strategy is very helpful for me today as the Scientific Director.

Bassem is now Director at Institut du Cerveau-ICM in Paris





MARIA SZARUGA-BRACKE FORMER PHD CHÁVEZ-GUTIÉRREZ LAB

This is where I became a scientist. It gave me the chance to grow under the mentorship of inspiring scientists that continue to support me. The years I spent at VIB were full of cutting-edge research and working with amazing people - both I still miss! I advertise VIB and Belgium to every researcher I meet that is searching for a new scientific hub.

Maria is now a Postdoc at the MRC Laboratory of Molecular Biology in Cambridge, UK



- in linkedin.com/showcase/CenterBrainDiseaseResearch
- f facebook.com/CenterforBrainandDiseaseResearch
- twitter.com/CBD_VIB
- instagram.com/cbd.research/
- wib.be/cbd

Credits

Editing: Bethan Burnside

Photography: Ine Dehandschutter & Luc Hilderson

Cover: Amyloid plaques and glial cells in 7-month-old AppNL-G-F mouse brain. Large image of half a mouse brain showing amyloid plaques and glial cells in a 7-month-old AppNL-G-F mouse. Plaques are double stained with an amyloid dye (X34, blue) and an Aβ-antibody (82E1, green); microglia are stained for Iba1 (red), and astrocytes for GFAP (cyan). Image by Nóra Baligács (De Strooper Lab).