University of Antwerp
Bio-Imaging Lab
Dept. Biomedical Sciences

Lab head:
Prof. Dr. Marleen Verhoye

Prof. Dr. Daniele Bertoglio

Em. Prof. Dr. Annemie Van der Linden

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Researchers network

Non-invasive, in-vivo brain research
Magnetic Resonance Imaging in Small Animals

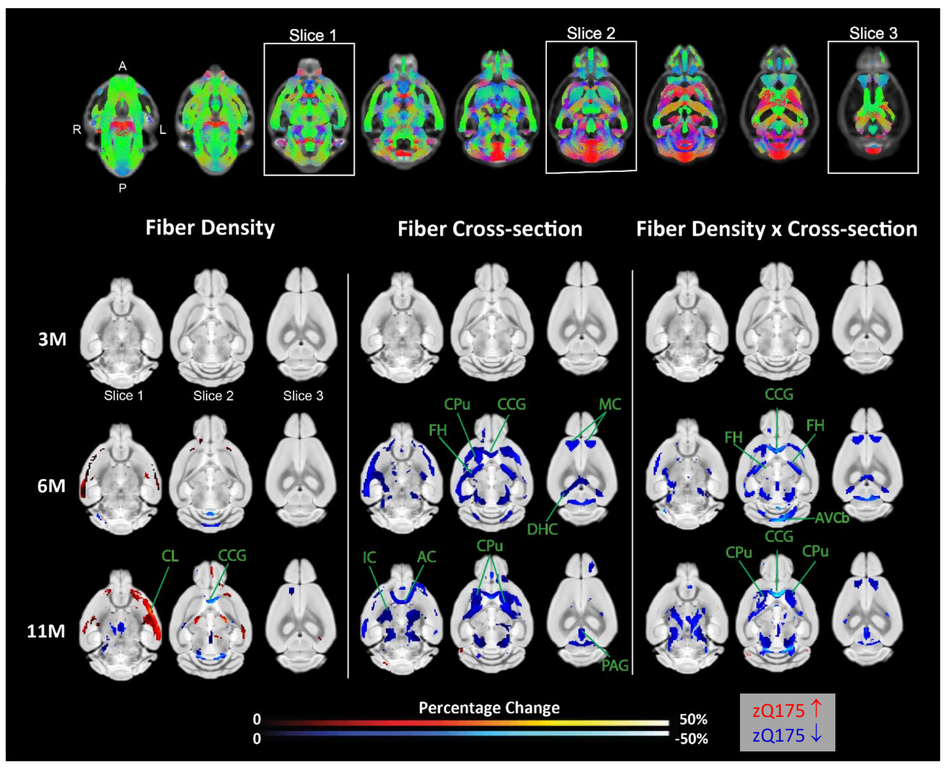
Searching for translational/early non-invasive MRI markers to monitor and predict the progress of neurological diseases and therapies

Huntington's Disease (HD)

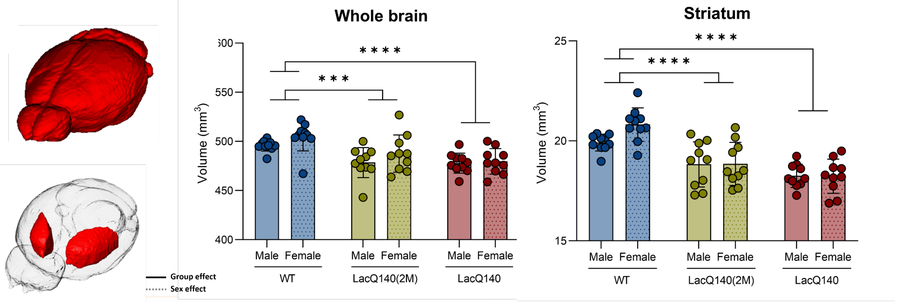
Post-doc:
Dr. Mohit Adhikari
PhD students:
Joëlle van Rijswijk,
Marion Decrop,
Andrea Estevez Velez

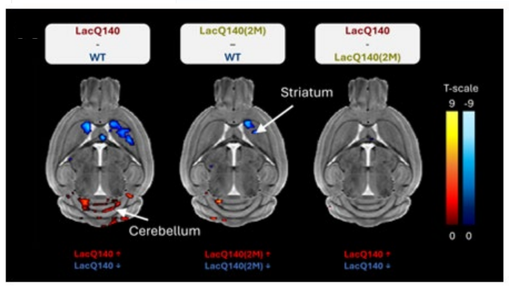
Different MRI-derived parameters have shown to be relevant **Biomarkers** in mouse models for **HD**. Current studies aim to test their sensitivity in **evaluating treatment effects in HD animal models.**

The generation of **Tractograms** allows the visualization of **structural connectivity. Fixel Based Analysis on diffusion MRI data** can be used to evaluate **structural integrity** on a voxel-based level. The different metrics (Fiber Density; Fiber cross-section) can be compared at different states of pathology progression in the same animal over time.



Using high resolution anatomical scans, detailed **volumetric analysis** can be performed on regions where changes are expected.

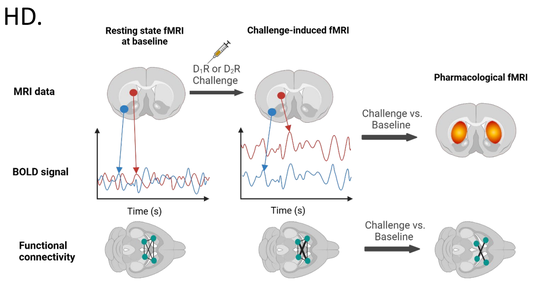




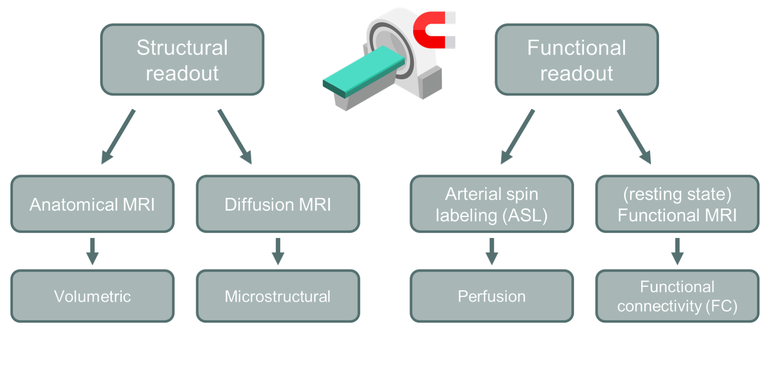
Data-driven **Tensor Based Morphometry** compares **local changes in relative volume** due to pathology progression.

HD is characterized by selective neurodegeneration of medium-size spiny neurons in the basal ganglia. We use a **multidisciplinary approach** to study the integrity of the direct and indirect pathways in basal ganglia.

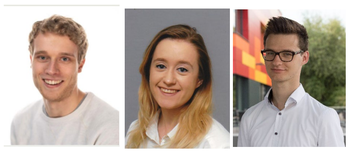
We perform **pharmacological MRI** (phMRI) to investigate the **pharmacological response** of both the direct and indirect pathways of the dopamine system in animal models of HD.



To improve understanding of the neuronal and molecular substrates of the observed deficits, the imaging is complemented by electrophysiology (in collaboration with ENU).

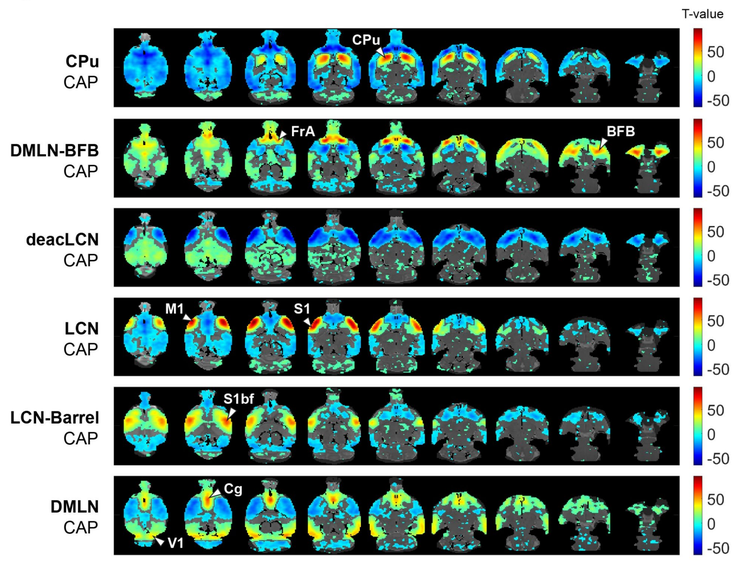


Alzheimer's Disease (AD)

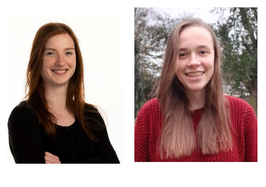


PhD students:
Sam De Waegenaere,
Judith Van Rooij,
Jannis Koesling

Functional imaging detects **early changes in synaptic and network functioning** in **AD**. **Whole-brain activity patterns,** presented below as **CAPs (Co-activation patterns)** are altered in transgenic (TG), compared to wildtype (WT) animals.



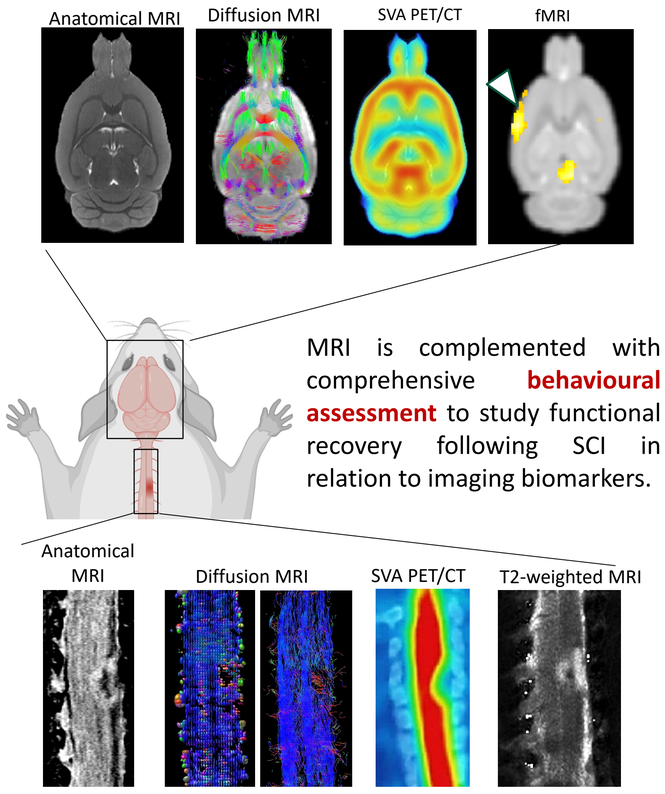
Spinal Cord Injury (SCI)



PhD students:
Claudia Schrauwen,
Lori Berckmans

Diffusion-weighted imaging (dMRI) and **T2-mapping** can be used to assess **axonal integrity** and **inflammation of the spinal cord** occurring with SCI. **Functional MRI** (fMRI) is used to study how SCI **affects brain activity and functional connectivity.**

Positron emission tomography (PET) imaging targeting **synaptic vesicle glycoprotein 2A** (SV2A), a pre-synaptic protein regulating neurotransmitter release, is a powerful tool to quantify **synaptic density** (in collaboration with MICA).

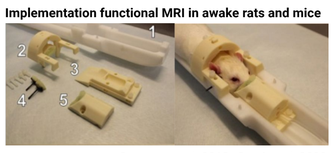


MRI is complemented with comprehensive **behavioural assessment** to study functional recovery following SCI in relation to imaging biomarkers.

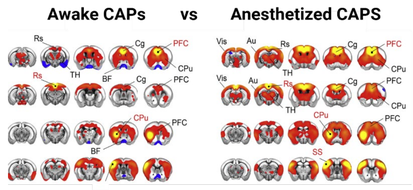
Awake Imaging and Neuro-Modulation

Post-doc:
Dr. Monica van den Berg

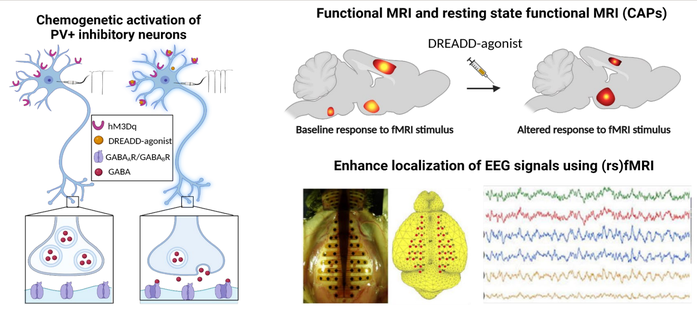
Implementation functional MRI in awake rats and mice



Stenroos et al. 2018; Gozzi et al. 2022



Awake imaging in rats and mice is being implemented to improve biological interpretation of (functional) MRI findings in neurological disorders and to enhance translation of results to patients.



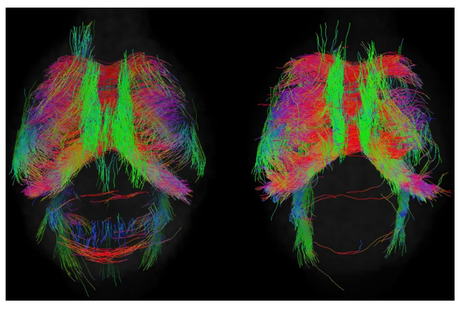
Cell-type specific **neuromodulation** with **chemogenetics** (DREADDs) is used to model **disrupted network activity** as found in neurodegenerative and neuropsychiatric disorders.
Moreover, multimodal imaging is utilized as a readout by combining MRI with electrophysiology/EEG.

Technical Team

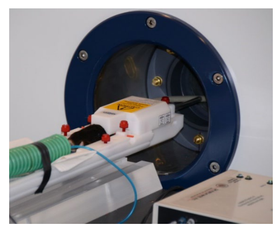
Infrastructure

Beyond anatomical MRI: develop new MRI methods & implement state-of-the-art MRI methods

Johan van Audekerke (Engineer),
Dr. Ignace Van Spilbeeck,
Britt D'hauw



Original (left) and 3x accelerated (right) **tractography** from mouse brain, using **Compressed Sensing** and **HARDI**



Equipment:
- two 7 T and a 9.4 T MRI systems
- 4.7 T Benchtop MRI system
- *In vivo* bioluminescence
- Fluorescence camera

Core Facility manager
Bio-Imaging Lab, MICA
Dr. Elisabeth Jonckers

University of Antwerp,
Bio-Imaging Lab
Universiteitsplein 1,
B-2610 Wilrijk, Belgium
Tel : +32-3-265.27.75
bio-imaginglab@uantwerpen.be
www.uantwerpen.be/bio-imaging-lab

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