

## Doctoral Candidate 15 - Quantifying neurofluid pathways through AI-accelerated long T1/T2-range MRI

<b>Host Institution</b>	Oslo University Hospital, Norway
<b>PhD enrolment</b>	University of Oslo, Norway
<b>Primary Supervisor</b>	Prof. Dr. Kyrre Emblem, Department of Physics and Computational Radiology
<b>Subject area</b>	MRI sequences for measuring neurofluids

### About this doctoral project and your tasks

You will develop AI-accelerated MRI sequences to characterize **neurofluids** that are thought to play a key role in brain waste clearance. The MRI sequences aim to **accurately capture ultralong T1/T2 relaxation times in fluids**, far exceeding the otherwise seen moderate ranges in brain tissue. To enable high-resolution sharp imaging with an optimized point-spread function, you will develop a quantitative Recurrent Inference Machine (RIM), a neural network with a forward model incorporating T2-decay during long read-out trains. You will develop 3D Look-Locker and mixed spin-echo inversion-recovery sequences for brain parenchyma mapping and strong T2 CSF-specific weighting. You will be in the unique position to measure the T1- and T2-distribution throughout CSF in the brain, aiming to **characterize the brain waste clearance pathways**.

#### Your tasks will include:

- Forward modelling of the MRI data acquisition with magnetic relaxation.
- Training a physics informed neural network on simulated data based on the forward model.
- Deploy a dedicated relaxation map estimation pipeline for real data analysis.
- Apply the model on patient data to investigate brain waste clearance.
- Compare results with the current technique using compressed SENSE.
- Identification and implementation of potential improvements in estimation efficiency by utilizing assumption of parsimonious decay models.

### Foreseen secondments

For this project, we foresee secondments to:

- Prof. dr. Matthan Caan (3 months) at **Amsterdam UMC** (The Netherlands)
- Prof. dr. Julia Schnabel (3 months) at **Helmholtz München** (Germany)
- Dr. Ole Gunnar Johansen (2 months) at **Nordic Imaging Lab** (Norway)

### About the host institution and research group

Oslo University hospital (OUS) is Scandinavia's largest hospital serving 2.7 million people (~50% of Norway). The **Department of Physics and Computational Radiology** at OUS has a total of 70 physicists and researchers working in clinic and research within MRI, X-ray, Nuclear Medicine, Computational Radiology and Artificial Intelligence.

The hospital treats seldom diseases from the whole of Norway and has gained **unique experience on studying CSF-disturbances of different causes**. This expertise on CSF dynamics has facilitated studies on brain clearance based on intrathecal contrast administration in patient, a technique only performed in a few hospitals worldwide.

### About the offer

- The selected candidate will be employed by Oslo University Hospital for **36 months** on the MSCA-DN project.
- Doctoral candidates are offered a **competitive remuneration** based on the MSCA allowances and the regulations of the host institution. You will receive a gross yearly salary according to the standard wages for doctoral candidates in Norway (min. 554.000 NOK).
- **Expected start date:** between April and September 2025. We encourage last-year master students who will graduate by this time to already apply.

More information is available in the [general information document](#) for IQ-BRAIN positions.

### Specific profile and requirements

- Your profile aligns with the [general requirements and eligibility criteria](#) of the IQ-BRAIN project.
- You have a master's degree in **physics, computer science, mathematics, engineering, or related field** (or will have by the time of your appointment).
- Background in **scientific computing and/or magnetic resonance imaging (MRI)** is appreciated.

### More information

For additional information about the research project, contact:

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