

Research Project

Name of Institution and department:

Geneva University Hospitals (HUG), Diagnostic Department, Neuroradiology Division,

Diagnostic Neuroradiology Unit

Link to website: www.hug.ch

City and Country of Institution: Geneva, Switzerland

RESEARCH GROUP

Brief description of the research group and of its mission:

The "Quantitative and Computational Neuroimaging Laboratory", led by Prof. Felix T. Kurz, aims to develop and validate new MRI and CT imaging techniques, combined with advanced quantitative analysis methods. By integrating these innovations, the goal is to establish robust and reproducible biomarkers that enable a deeper understanding of neurological disorders and optimize clinical decision-making within the framework of precision medicine.

TITLE OF PROPOSED RESEARCH PROJECT

Phosphorus and Proton MR Spectroscopy at 7 Tesla for Metabolic Characterization of Epilepsy and Neurodegeneration

OBJECTIVES

- Acquire and analyze ^{31}P MR spectroscopy data at 7T in patients with focal epilepsy and neurodegenerative disease, using a phosphorus magnetization transfer MR fingerprinting (MT- ^{31}P -MRF) protocol to map creatine kinase reaction rates (k_{CK}) and energy metabolite concentrations (PCr, ATP, Pi, intracellular pH).
- Complement ^{31}P acquisitions with ^1H MR spectroscopy at 7T to provide a comprehensive metabolic profile integrating neurochemical markers (glutamate, GABA, NAA, myo-inositol) with energy metabolism data, in epileptic foci and regions of interest in neurodegenerative conditions.
- Evaluate the clinical added value of 7T metabolic MR spectroscopy as a complementary localizing tool in the presurgical workup of MRI-negative focal epilepsy, and as a biomarker in neurodegeneration, with the aim of contributing to peer-reviewed publications and international conference presentations.

APPLICANT'S DUTIES

- Participate in the acquisition of ^{31}P and ^1H MR spectroscopy sessions at 7T, including quality control of spectroscopic data in close collaboration with the research team and MR technologists.

- Perform quantitative analysis of spectroscopic datasets and contribute to the integration of metabolic findings with clinical and conventional imaging data in the epilepsy and neurodegeneration patient cohorts.
- Contribute to the preparation of scientific manuscripts and presentations for international radiology and neuroscience conferences, under the supervision of the project leader.

APPLICANT'S BENEFITS

- Participation on scientific outcomes of the project i.e. presentations to congresses or publications of papers
- Access to state-of-the-art 7 Tesla MRI infrastructure, with direct exposure to how ultra-high-field MR technology is integrated into a clinical neuroradiology setting, including patient workflow, protocol design, and translational applications.
- Observation of clinical activity within the Diagnostic Neuroradiology Unit, with the opportunity to attend multidisciplinary staffs and tumor boards according to the participant's areas of interest.

- Project Leader: Dr. Ioana Hutuca
- Members: Ioana Hutuca, Federico Ojeda, Aikaterini Fitsiori, Daniele Botta, Corrado Santarosa, Kevin Battistini, HUG, Geneva, Switzerland; in collaboration with Dr. Lijing Xin, Centre d'Imagerie Biomédicale (CIBM), EPFL, Lausanne, Switzerland