2-year Post-Doctoral Position available at ICube laboratory, Strasbourg, France
Starting January 2024
Biophysical modeling of age-related dielectric properties changes in the brain.

Rationale

The structure and composition of tissues determine the nature and extent of their interaction with electromagnetic fields and the resulting dielectric properties (permittivity and conductivity). Normal aging and its effects on tissue composition and cell structure can cause local changes in the dielectric properties of biological tissues. In a study on brain tissue from pigs, it was found that the dielectric properties of gray matter do not change with age, while statistically significant variations were observed for the dielectric properties of white matter [Gabriel & Peyman, 2018]. The differences correlate with the biological observation of increased myelination and decreased water content as a function of age.

MR Electrical Property Tomography (MR-EPT) allows for the mapping of dielectric properties using MRI pulse sequences [Leijsen *et al*., 2021; Katscher & van den Berg, 2017; Zhang *et al*.. 2014]. Simultaneous assessment of brain microstructure and composition using quantitative MRI (qMRI) techniques (*e.g*. relaxometry, diffusion and magnetization transfer mapping) could help us understand how these parameters affect dielectric properties.

Objectives

The proposed project aims to better understand the relationship between tissue and cell changes and dielectric properties in the human brain during normal aging. From May 2023 we will acquire MR-EPT and qMRI data from 120 healthy subjects (6-12, 20-40 and 70+ year old). Our objective is to elaborate a comprehensive theoretical model encompassing all relevant biophysical parameters to describe the electrical conductivity in the white matter. Validation of the model will be performed using physical and numerical phantoms. The candidate will be responsible for conducting numerical simulations, data acquisition, analysis, and communication of results.

Qualifications

We are looking for a motivated candidate with a PhD in MR physics, biomedical engineering, or related topic. Good writing and communication skills in English are required.

Environment

The project is a collaborative work (https://electra.univ-lorraine.fr/) between the ICube Laboratory (https://icube.unistra.fr/en/) and the Diagnosis and Interventional Adaptive Imaging team – IADI (https://www.iadi.fr/en). The successful candidate will work in the IMIS team of ICube composed of senior scientists, postdoctoral fellows, and PhD students. The IMIS team focuses its research on imaging methods development, particularly MRI, to noninvasively study brain structural and functional brain communication. The team has direct access to research-dedicated equipment, a 3T whole-body MRI scanner (Magnetom Vida, Siemens),

Applications should be sent to Paulo Loureiro de Sousa (ploureiro@unistra.fr) and Julien Lamy (lamy@unistra.fr) and include an outline of the research experience and interests, a curriculum vitae and contact information for references.