



Open PhD Position

PhD Student position (full-time, 4 years) for the research project

„Multinuclear ^{23}Na and ^1H quantitative MRI in brain tumors and metastases“

in the Innsbruck PhD School for Biomedical Sciences at the
Department of Neuroradiology, Medical University of Innsbruck in Austria.

Envisioned qualification of the candidates:

Master or diploma degree in Physics, Biomedical Engineering, Informatics, Mathematics or related fields with an experience in medical image analysis and MRI, advanced programming skills and an interest in basic medicine/neuroscience.

Aim of the project:

Sodium (^{23}Na) is the second most abundant MRI active nucleus and plays an important role in the human brain's metabolism. In several pathologies, such as cancer, a disturbed balance of the intra- and extracellular sodium concentration is present. In brain tumors, an increase was observed in total sodium concentration attributed to a disturbed cellular energy metabolism. Therefore, ^{23}Na -MRI could provide valuable information in addition to ^1H -MRI aiming for a more precise characterization of pathological changes in brain tumors and metastases prior and upon treatment. The aim of this project is to develop a hybrid imaging approach by combining ^{23}Na and ^1H quantitative MRI in a clinical setting with patients with brain tumors or brain metastases. One major focus will be the quantification of the multi-exponential ^{23}Na and ^1H effective transversal relaxation rate R_2 . This should be achieved by adapting existing MRI sequences to assess multi-echo ^{23}Na and ^1H images and by developing an image analysis method to separate slow and fast components of the total R_2 signal decay for both ^{23}Na and ^1H . The different R_2^* components can then further be assigned to different microstructural tissue compartments, such as the intra- and extracellular sodium and water components. By applying the developed approach to the patients will allow to assess pathological differences in multi-compartmental ^{23}Na and ^1H relaxation in different brain tumors. For patients with metastases, this approach will allow the monitoring of treatment-induced microstructural changes. As ^{23}Na and ^1H imaging relies on different MR coils and MR sequences, image registration will be an important aspect. Therefore, this PhD project covers tasks from adapting and testing MR sequences, quantification of MR parameters, classical (non-AI) image analysis and the work in an interdisciplinary patient study.

For further information and the application guidelines see our website

<https://phd-IGDT-ART.i-med.ac.at>

or contact DI Dr. Christoph Birkl (christoph.birkl@i-med.ac.at).