Faculty: Medical Faculty

Institute: Hertie Institute for Clinical Brain Research (HIH)

Supervising Professor: Prof. Dr. Esther Kuehn

About the Supervisor: Prof. Dr. Esther Kuehn heads the Translational Imaging of Cortical Microstructure lab at the Hertie Institute for Clinical Brain Research (HIH) at the Medical Faculty Tübingen. She has a background in neurobiology (MSc), did her PhD in cognitive neuroscience, and focuses in her research on the analysis of ultra-high field (7 and 9.4 Tesla) human MRI neuroimaging data to better understand age- and disease-related changes in the human cortex. She focuses on the sensorimotor system as this undergoes profound changes in the course of human development, and is affected in many neurological, neurodegenerative, and mental disorders. Her lab combines novel MRI analyses tools and methods with digital health tools such as Apps and data gloves to characterize the human phenotype in multiple dimensions at once. She aims at training an interdiscplinary team not only in research methods and translation, but also strives to educate the next generation of scientists to work in a cross-disciplinary team, integrating knowledge across different disciplines, characterized by mutual respect and an interactive working environment.

Project title: **Uncovering the microstructure of an aging human cortex**

Topic Description:

Cortical degeneration is a hallmark characteristic of human aging as well as of a range of neurological and mental disorders. So far, studies mostly extracted cortical thickness (or averaged signals across cortical depth) to indicate cortical degeneration. In a recent study (Liu et al. 2025 Nat Neuroscience), however, we evidenced that cortical degeneration with aging is layer-specific. Specifially, we showed that age-related cortical thinning is driven by deep layer thinning, but that other layers expand in size. This warrants a redefinition of the models that we have on cortical aging, and cortical degeneration more broadly. In this project, already acquired structural and functional 7 Tesla Magnetic Resonance Imaging (7T-MRI) data of younger and older adults will be used to probe layer-specific degeneration in an extended area of the cortex. This project has the potential to fundamentally change how we analyze and interpret cortical degeneration in the future. It also allows the student to learn novel methods of ultra-high field data modeling developed by my lab. The student will be integrated into a young, international and vibrant research team concerning with translational imaging of the cortex, i.e, to use insights on cortical architecture in health and disease to aid disease diagnosis, stratification, tracking, and treatment.

Intended Degree: Dr. rer. nat.

Type of the PhD Study: Human neuroimaging, Full-time (complete doctoral studies at the University of Tübingen)

Required Degrees and Qualifications:

Master of Science in Cognitive Neuroscience, Psychology, Neurobiology or related field

Experience with structural or functional MRI data analyses

Excellent Master Thesis (ideally completed with published manuscript)

Language Requirements: English (very good)

Notes: One PhD student and one Postdoc from my lab are from China and will offer the prospective student an excellent and supported integration into the lab