

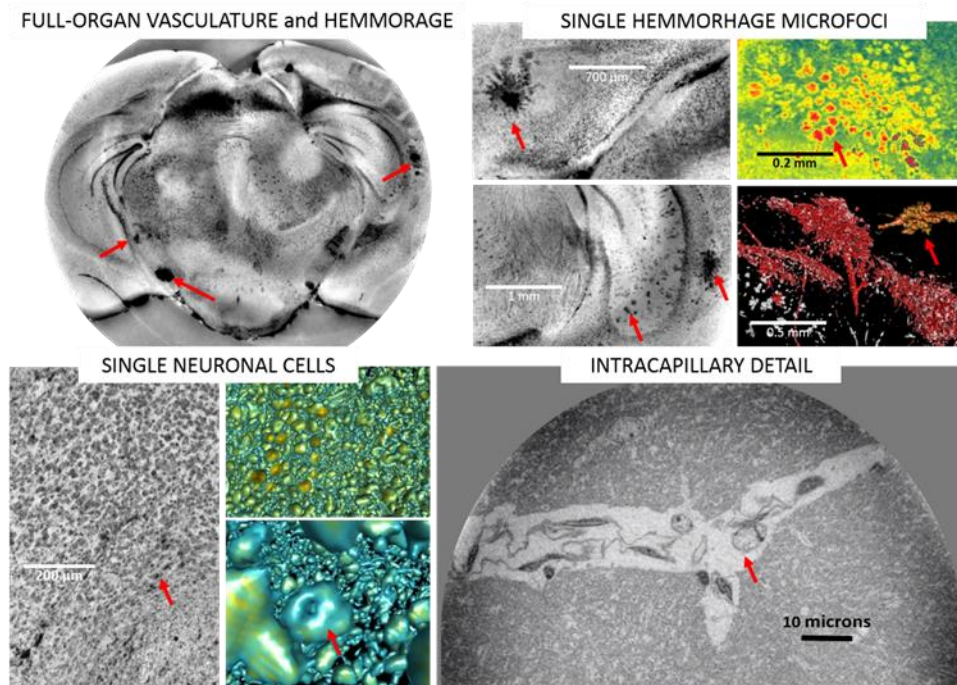
**MASTER THESIS PROJEC in the Prof. COAN's GROUP - Brilliant X-Rays for Medical Diagnostics**

Our group at the LMU Chair of Medical Physics in Garching (LS Parodi) is working on biomedical applications of X-ray phase contrast CT, and is looking for a highly motivated **MASTER STUDENT** to work with us.

**Project Title:** "Characterization by micro-CT and nano-holotomography of brain blood vessel remodeling in an experimental animal model of hypertension".

**Scientific Case:** Hypertension is the most prevalent risk factor for stroke, and cardiovascular complications in hypertensive patients are related to endothelial damage or dysfunctional angiogenesis. Many genes are involved in angiogenesis and, in particular, the angiogenic factor Dickkopf-3 (Dkk-3) plays an important role in embriogenesis and tumor development, and could represent a suitable candidate as a drug target in stroke. We have found that the *dkk-3* gene maps within a chromosomal region linked to the stroke-prone phenotype in "stroke-prone" spontaneously hypertensive rat (SHRsp). The study aims to evaluate by means of X-ray phase-contrast micro-CT and nano-holotomography the role of Dkk-3 expression and hypertension-mediated vascular remodeling in two animal models of hypertension: i) spontaneously hypertensive rats subjected to cerebral Dkk-3 lentiviral silencing, and ii) Dkk-3 knockout mice subjected to subcutaneous chronic delivery of angiotensin II.

**X-ray Phase-Contrast CT experiments:** Two phase-contrast micro-CT experiments and one nano-holotomography experiment (see Figure) showed the possibility to successfully analyze vascular remodeling and visualize both single cells and capillary detail: the occurrence of localized hemorrhages down to single micrometric foci can be distinguished from healthy vasculature.



Moreover, single neuronal cells perfused by pathological vasculature can be extracted, and their potential neurodegeneration evaluated. Nano-holotomography confirmed the possibility of visualizing cerebral intra-capillary detail.

**Overall Project Objectives:** This experimental work is expected to impact our understanding of the location and morphology of micro- and nano-foci of hemorrhage. The full project aims to evaluate the role of the angiogenic glycoprotein Dkk-3 in vascular remodeling and stroke susceptibility in animal models of hypertension. These data may shed new light in the pathophysiology of cerebrovascular disorders favoring the identification of new targets for drug development for the treatment of hypertension.

**Specific Thesis Work Objectives:** You will perform an in-depth quantification of the role of the angiogenic glycoprotein Dkk-3 in vascular remodeling. You will learn to reconstruct and explore the acquired phase-contrast CT datasets and extract meaningful structural parameters (e.g. capillary and hemorrhage focal sizes, locations and interactions), as well as full-sample vascular trees. You will learn to critically evaluate your analytic methods, and explore new ways to use imaging datasets creatively. Your quantitative analysis work on the development of hemorrhage micro-foci will play a central role within this project, and will be instrumental to the successful publication of our results.

**Candidate:** Previous knowledge in Python and/or Matlab could be an asset (but it is not mandatory), and the candidate should be interested in developing new analysis tools for image quantification.

**Travel:** The candidate will be given the opportunity to travel to the European Synchrotron in Grenoble, FRANCE to **participate in upcoming experiments of our group**.

**Start date:** May 2018 onwards

Please get in contact with us if you are interested in knowing more - we would be happy to hear from you!

**Contacts:**

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