

**Title :** Modeling blood flow and mass transfers within the brain

**Abstract :** Because the brain lacks any substantial energy reserves, the cerebral microvascular system is essential to a large variety of physiological processes in the brain, such as blood delivery and local blood flow regulation as a function of neuronal activity. It provides a unique window to observe the functioning brain using hemodynamically-based functional imaging techniques. It also plays a major role in disease (stroke, neurodegenerative diseases, ...). However, the functional consequences of vascular damage (including acute occlusions or long-term remodeling in ageing or disease) are poorly understood.

In this context, modeling approaches are increasingly important. I will present some of the approaches we develop for studying blood flow and mass transfer at various scales within the brain. Most of them are based on methodologies developed for the study of multiphase or reactive flows in porous media, subsequently enriched to take into account the specific architecture of the microvascular network. This network can indeed be viewed as the superposition of two types of structures: a slow mesh-like porous network (capillary vessels) and fast fractal arborescent structures (arteries and veins), which gives rise to unexpected flow patterns. Finally, I will present some perspectives related to the role of cerebral microcirculation in neurodegenerative diseases.