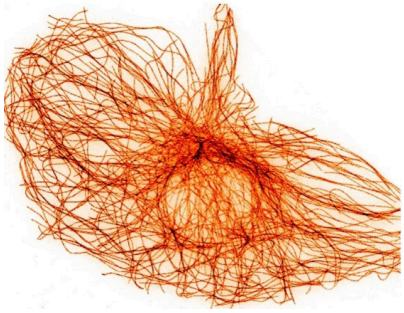
Created in March 2013 within the Institut de Biologie et de Médecine Moléculaires (IBMM) by Prof. Benoît Vanhollebeke and joined in May 2020 by Prof. Maud Martin, the Laboratory of Neurovascular Signaling specialises in vascular biology and has around twenty members. Its numerous grants (WELBIO, ERC, Walloon Region) demonstrate the relevance of its work. Here we present the work of Prof. Martin, one of the laboratory's two PIs.

Prof. Martin not only works in the Laboratory of Neurovascular Signaling: she is also the academic head for the Free University of Brussels (ULB) of the Center for Microscopy and Molecular Imaging (CMMI), an imaging platform run by the University of Mons (UMONS) and the ULB. An obvious choice for this researcher who makes extensive use of imaging in her research. Her area of expertise? The intracellular regulation of the endothelial cells that form our blood vessels. More specifically, she is studying the role of the cytoskeleton and its microtubules in this regulatory process. To do this, she uses cell models in 3D gels – a compromise between simple cell models and more complex in vivo environment. She also uses an animal model, the zebrafish, and advanced fluorescence microscopy, including super-resolution techniques. While this fundamental research focuses on the role of microtubules in normal physiology, it should eventually extend to more pathological perspectives with the study of the disruption of these mechanisms.

Prof. Maud Martin, PI at the the Laboratory of Neurovascular Signaling

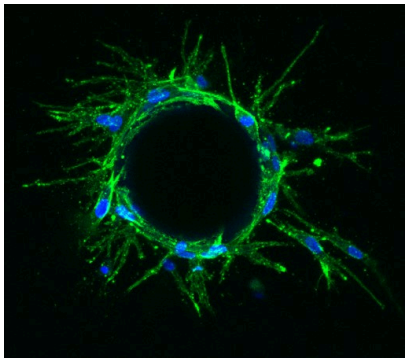


Network of microtubules in an endothelial cell

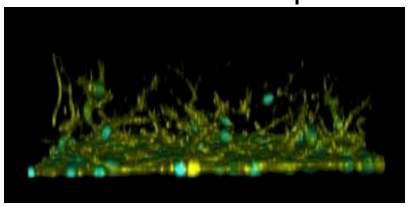
Initially, the team of Prof. Martin carried out a large number of screenings, on the lookout for microtubule regulators during the angiogenesis process. Candidates are now being validated and studied in detail. These include proteins associated with the actin cytoskeleton, which could serve as a link to establish a dialogue between these two

types of cytoskeleton. Prof. Martin is also studying post-translationally modified microtubules in order to assess their impact on a given physiological context. She discovered that these modifications affect angiogenesis, but still needs to understand how. Hence the use of innovative models such as micropatterning, which imposes specific geometries on the cells. The combination of multiple experimental approaches is a hallmark of Prof. Martin's research.

This aspect of Prof. Martin's research is being carried out in collaboration with the University of Mons (Prof. Sylvain Gabriele) and the KU Leuven (Prof. Hans Van Oosterwyck). Another project involves Prof. Agnès Noël (ULiège) and focuses on lymphangiogenesis, in which microtubules are also involved. In parallel, the CMMI is taking part in a project funded by the ERDF (European Regional Development Fund). The aim is to acquire state-of-the-art equipment but also to coordinate the activities of all the imaging platforms in Wallonia.



Endothelial cells sprouting from a bead in 3D



3D reconstruction of a sprouting assay

For Prof. Martin, angiogenesis remains an important research challenge, as disruption of this process is implicated in numerous pathologies. It is notably associated with the development and spread of tumours. It is therefore crucial to find new therapeutic targets to complement the already existing ones, mostly centered on signalling pathways. Potential targets can potentially be found within the angiogenic cells and allow targeted correction of their aberrant behaviour. Increased and sustained support for fundamental research is therefore essential to achieve this. Another major challenge for Prof. Martin is to bridge the gap between cellular research, based on simplified

models, and more physiological studies where understanding of the cellular level is hardly reachable. This gap could well be bridged soon by the exponential growth in imaging technology. And there are exciting prospects ahead.

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