Systems microscopy of neurodegeneration at multiple scales

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Abstract

The Antwerp Centre for Advanced Microscopy (ACAM) provides high-end microscopy service to image samples at the meso-, micro- and nanometer scale (www.acam-uantwerpen.be). One of our spearpoints is systems microscopy with which we provide information on the spatiotemporal behaviour of cells and molecules in response to targeted perturbations with high throughput (Figure 1). One of our key research domains is neurodegeneration. We have established a set of quantitative image-based assays among others for profiling morphofunctional connectivity of primary and iPSC-derived neuronal cultures[1–3]. This allows us to stage the maturity of neuronal cultures and assess the impact of pharmacological modulators in a standardized manner. Currently, we are extending our pipelines to more complex, physiologically relevant biological specimen such as mixed neuronal cultures and cerebral organoids[4]. Given the opacity of the latter, we build on a tissue clearing and light sheet microscopy approach that we have optimized for whole mouse brain[5,6]. We used this approach to monitor the spatiotemporal spreading of tau pathology throughout the brain of a seeded transgenic mouse model. Thus, our systems microscopy expertise enables quantitative investigation of neurodegeneration from the cellular to the organ level and is accessible to European users via the Flanders Bioimaging Euro-BioImaging node.

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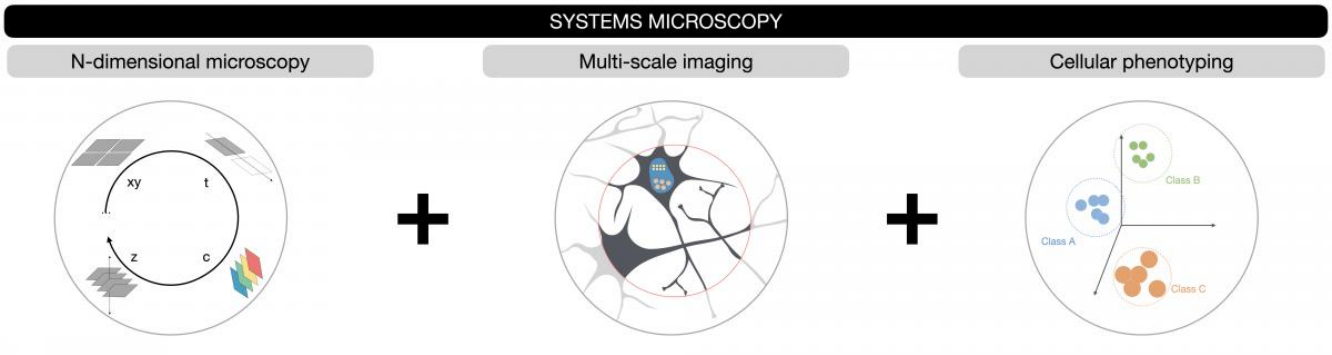

Figure 1: Systems microscopy is based on high-throughput n-dimensional acquisitions that enable the phenotypic profiling of cells based on the spatiotemporal information that is obtained at multiple scales.

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