**Micro-technologies and big data analysis for engineering human tissues in vitro**

Human tissues are difficult to access for biomedical research and therapeutics development, especially from healthy donors. On the other hand, mimicking tissues in vitro has several advantages: accessibility to measurements, control and perturbation of environmental conditions, dissection of mechanisms, just to mention a few. However, biological systems are complex, due to the high interconnectivity between tens of thousands of molecular players, and the presence of phenomena occurring at temporal and spatial scales spanning several orders of magnitude. Multiple types of expertise are required to face this open challenge and also engineers are playing a significant role in this field.

Stem cells are an important starting point for developing tissues in vitro. Their ability to differentiate and produce different cell types represents their great potential, but also their difficulty to control. The molecular signals that drive their changes need to be understood and controlled to develop robust systems. Recent years have seen great progress in stem cell differentiation in vitro with the transition from 2D to 3D. The so-called organoids are clusters of cells that self-organize in 3D and are able to better mimic the tissue structure. They hold potential not only as in vitro models of tissues, but also for clinical applications of regenerative medicine.

Within this context, recent technological advances strongly improved controllability and measurement accessibility of biological systems. Micro-technologies make possible to control and perturb the environment surrounding the biological system with a resolution of microns. High-throughput measurements produce data describing the system at the molecular level with sub-cellular resolution. The problem shifted from identifying the molecule of interest to data mining by bioinformatics tools for its selection among thousands of candidates.

Overall, the field developing in vitro human tissues has seen great advances in recent years and is supporting basic science and biomedical research applications for the near future.