

MARCH 17, 2022

Growing human heart tissue in the laboratory - ERC Consolidator Grant for Laura De Laporte and the "HEARTBEAT" project

The Belgian scientist Prof. Dr.-Ing. Laura De Laporte from the DWI - Leibniz Institute for Interactive Materials and RWTH Aachen University has been awarded one of the most highly endowed research grants of the European Research Council (ERC): an ERC Consolidator Grant. This will fund the expansion of her research at the DWI in Aachen over five years with a budget of two million euros. In her research project "HEARTBEAT", De Laporte and her team aim to grow vascularized, structured and beating human heart tissue in the laboratory. In doing so, she wants to break with traditional methods of producing 3D biomaterials: Her approach is to use interactive rod-shaped polymers - called microgels - to produce gels for growing cell structures similar to heart tissue. The spatially controllable arrangement of the microgel network serves as a scaffold and also determines the orientation of growth.

In the first step of the project, different types of microgels will be automatically assembled into large-pored, actuable and movable three-dimensional constructs that can be aligned in a desired orientation. In the subsequent step, the microgels forming the construct will now be mixed with (stem) cells to form a hydrogel. The resulting structures allow the cells to proliferate and also serve as a spatial orientation aid for cell growth. Due to their magnetic responsiveness, ensured by incorporated magnetic nanoparticles, the microgels can be aligned as required by applying a magnetic field. In addition, the microgels are designed in such a way that they can be selectively degraded under UV irradiation if necessary, for example to ensure sufficient space for the constantly growing cell tissue.

"This project is a major step towards complex and interactive materials, as we know them from nature and thus also from the human body," explains De Laporte. Indeed, until now it has not been possible to create functional and personalized tissues including the biological structures and mature blood vessels. The main reason for this limitation is that current materials cannot replicate the complexity and dynamics of the natural cellular environment. "HEARTBEAT's unique bio-inspired 3D constructs – characterized by their macroporous and aligned structure – will resemble the complex biological architecture. At the same time, the actuation of the microgels mimics the heartbeat," describes De Laporte. The project aims to unravel how material properties, architectures, and the actuation of the microgels affect the formation and vascularization of human cardiac tissue, and how the construct needs to adapt to the growing tissue over time to provide the proper extracellular environment. Being able to grow functional human mini-tissue in a high-throughput, automated manner will provide a platform for drug testing and studying diseases, reducing the need for animal studies and better representing the human body, also with the possibility to grow patient-specific tissues.

About Laura De Laporte

Laura De Laporte studied chemical engineering at Ghent University (Belgium). She received her PhD from Northwestern University (Evanston, USA) in the group of Prof. Lonnie Shea, where she developed guided implants for nerve regeneration. At EPFL (Lausanne, Switzerland), she researched regenerative hydrogels in the group of Prof. Jeffrey Hubbell. From 2013 to 2018, Laura De Laporte led a junior research group at DWI – Leibniz Institute for Interactive Materials in Aachen and was awarded a Starting Grant from the European Research Council in 2015. In October 2017, she completed her habilitation at the Department of Chemistry of RWTH Aachen University and since December 2020 she is an associate professor in this department with the teaching and research area Advanced Materials for Biomedicine with additional affiliation to the University Hospital RWTH Aachen. In 2018, she was one of five excellent female researchers who have received funding from the Leibniz Programme for female Professors.

MARCH 17, 2022

About the ERC Consolidator Grant

ERC Consolidator Grants are considered one of the most prestigious funding instruments in Europe. They intend to support researchers in establishing their own research team or program, according to the ERC. To receive them, scientists have to demonstrate the groundbreaking character, ambition, and feasibility of their scientific proposal. Laura De Laporte, professor in the teaching and research area Advanced Materials for Biomedicine, will receive €3 million in funding from the ERC over five years.

Images

- Image 1:
Laura De Laporte (right) inspects the microfluidic device together with her PhD student Yonca Kittel (left).
Reference: DWI - Leibniz Institute for Interactive Materials
- Image 2:
Receives two million euros from EU funding for her research: Laura De Laporte.
Reference: Peter Winandy
- Image 3:
Laura De Laporte receives ERC Consolidator Grant.