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HUMAN & BIOTECHNOLOGY

Fields of Expertise TU Graz

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In this issue we can report two things: on the one hand we were again successful at receiving awards, on the other hand, this is a very busy period for writing proposals. To go into details, Theresa Rienmüller (Institute of Health Care Engineering) received a Paper Award, Anna Pukaluk and Gerhard Sommer (Institute of Biomechanics) received the Best Collaborative BioTechMed-Graz Paper Award, Michael Wimmer (Institute of Neural Engineering) received an award for his Master's thesis, and Oliver Maier (Institute of Medical Imaging) gained an award for his PhD thesis from the Styrian Brain Research Initiative (Initiative Gehirnforschung Steiermark). Furthermore, on 24 March 2023, Bernd Nidetzky, one of the leaders of our FoE, received an honorary doctorate from Ghent University in Belgium. To mark the occasion, the Faculty of Bioscience Engineering at Ghent University organized a symposium on biotechnology, and we are delighted about its successul outcome. Congratulations to all of the winners – and now a reminder: whenever you want to report successful projects, publications or awards – please let us know.

In fact, each award starts years before with a written proposal. And this is indeed a very important task for all PIs in the FoE. Currently, there is an open call for TU Graz multidisciplinary Lead Projects. In addition, our oldest and largest COMET K2 Center, the Austrian Centre of Industrial Biotechnology ACIB, will apply for a new funding round.

Our contribution to this issue of TU Graz research comes from the field of biomechanics – a traditional area of our FoE. Gerhard Sommer successfully completed his tenure track position. He analyses the biomechanical properties of the aorta system in the context of human health issues, and gives an overview of his research here.

Gerhard Sommer

Exploring the Aorta: Multiscale Aorta Project

Arteries have a remarkable ability to remodel in response to altered hemodynamics, disease progression, and injury. Such remodeling is typically manifested at the macroscopic tissue level, but the underlying mechanisms exist at the micro- and nanoscopic levels, where the extracellular matrix, cells, and molecules interact. This project funded by the Austrian Science Fund (FWF) focused on mechanical characterization and imaging techniques of aortic tissues. In particular, such experimental methods were combined to allow the identification of relationships between the mechanical loading at the macroscale and structural alterations at the micro- and nanoscale in human aortas (Figure 1).

BACKGROUND

In general, efficient diagnosis and treatment of vascular diseases, such as atherosclerosis or the formation of an aneurysm or a dissection in arteries, should be grounded on a thorough understanding of the biomechanical properties of the arterial tissues. Over the past decades, advances in imaging techniques have revealed that biology creates intricate hierarchical structures across multiple scales, where molecular details are exhibited in macroscale mechanical responses. In particular, imaging techniques revealed a complicated network of extracellular matrix constituents (i.e., mainly collagen, elastin, and proteoglycans) in the three arterial layers (i.e., intima, media, and adventitia). In the last years, technological advances have provided us with an increased understanding at the macroscopic (tissue) level, the microscopic (fiber) level, and the nanoscopic (fibril and molecule) level. However, there has been little attempt to combine the different material characterization methods across these length scales.