

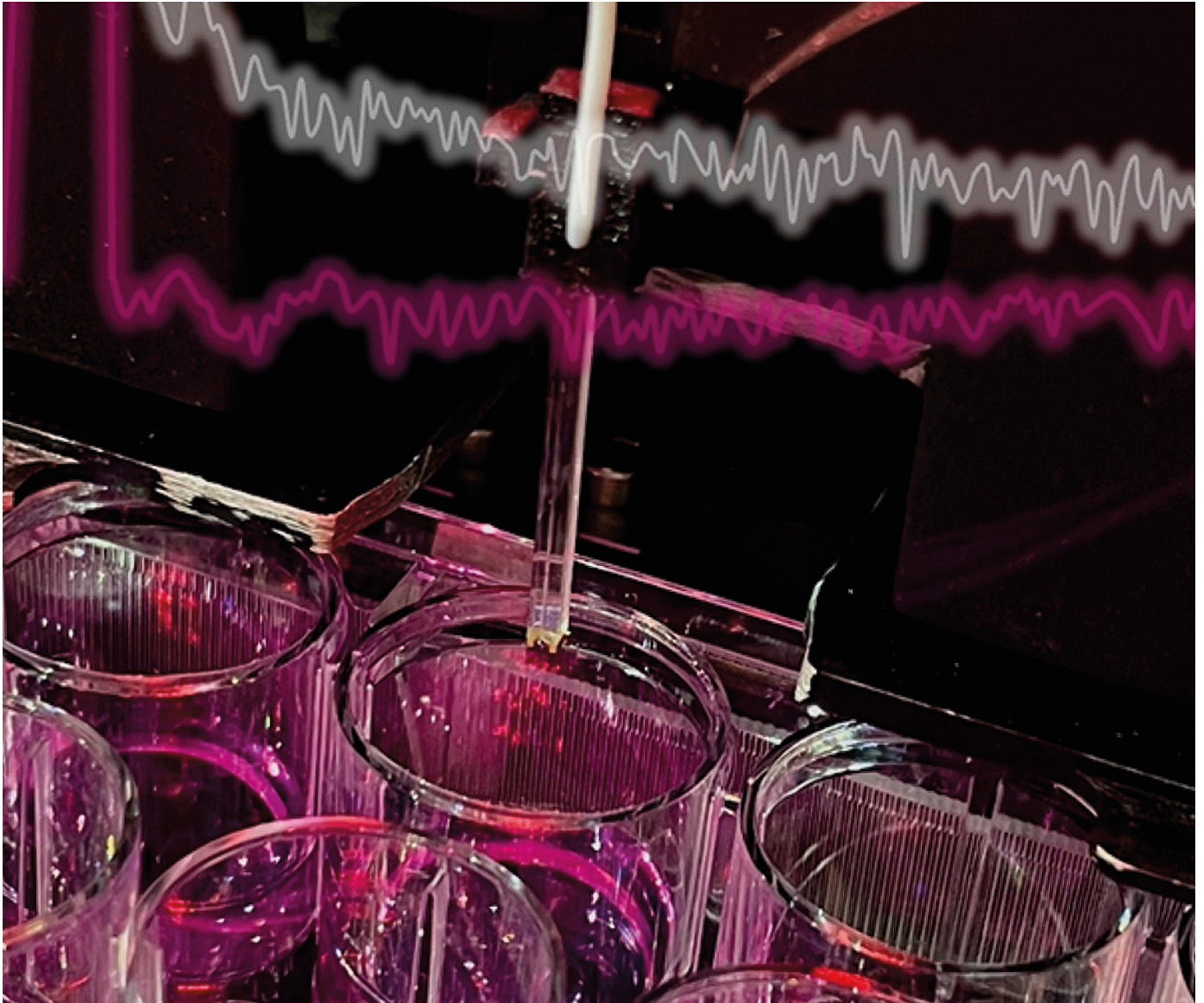
Controlled Environments, Controlled Results: Unveiling Vascular Cell Dynamics

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At the Cardiovascular Research Institute Maastricht (CARIM) and Maastricht University Medical Centre (MUMC+)

PhD candidate Pepijn Saraber and Dr.ir. Koen Reesink, Associate Professor at the Cardiovascular Research Institute Maastricht (CARIM) and Maastricht University Medical Centre (MUMC+), are engaged in the multidisciplinary public-private partnership project CELLSYSTEMICS. The study seeks to explain the regulatory mechanisms governing vascular tissue integrity during disease development. Optics11 Life, as an industry partner, contributes its expertise in high-resolution indentation- and stretch-based measurement using Pavone.

The research by CELLSYSTEMICS delves deep into the mechanobiology of vascular smooth muscle cells at various levels of interaction: intra-cellular, inter-cellular, and cell-matrix. *“We use the Pavone because of its ability to measure locally and specifically individual cells while also enabling measurements at macro-scale facilitated by the probe size we use,”* explains Saraber. He adds, *“What is very interesting is doing a matrix scan of a patient’s tissue sample. The heterogeneity across the tissue is pretty much uncharted territory in studying the mechanobiology underlying aortic aneurysm formation and dissection.”*



^ Next-generation dynamic cell stiffness measurements on the Pavone platform using multisine broadband excitation (spectral response illustrated).

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According to Dr. Reesink, actual progress in creating advances in mechanobiology relies on genuine collaboration. *“We are creating a technology platform to advance mechanical characterization and stimulation aspects of mechanobiology; the real partnership with Optics11 Life is key because managing product IP, prototyping, expert support, quality control, and so on, is beyond the academic primary process,”* he emphasizes. This collaboration extends further, combining Optics11 Life’s Pavone platform with the *Line REscan NL5* high-framerate confocal microscopy functionality. *“The scientific benefit is that coherent co-registration of, e.g., fluorescently labeled protein expression and stiffness of the cell-under-test is now possible. Using such approaches, we should be better able to disentangle the complex regulatory functions of smooth muscle cells.”* Saraber and Dr. Reesink passionately claim, *“... with Dr. Dilan Öztürk of the Control Systems Group at partner TU/e, Optics11 Life is piloting next-generation Pavone indentation protocols to study smooth muscle cell dynamics even more in-depth.”*

Saraber emphasizes the significance of Pavone's environmental control module for long-term experiments. *"If I did not have the environmental control module, the conditions I would be measuring at the start of my experiment would not remain comparable at the last stage. Differences in temperature, oxygen concentration, and humidity will complicate or limit the interpretation of the data,"* shares Saraber. He continues, *"Frankly, I would also face dying cells. Because we run comprehensive and thus lengthy tests to answer our research questions, tight control of environmental variables is crucial."*

Looking ahead, CELLSYSTEMICS researchers envision *cellular system dynamics* as a biomarker to improve the management of vascular disease. *"The concept is that a patient's immanent cellular behavior could predict pathology,"* affirms Dr. Reesink.

ACKNOWLEDGMENTS

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► www.health-holland.com/project/2022/2022/how-get-cells-talking

CELLSYSTEMICS partners are the Depts. Biomedical Engineering, Biochemistry, and Cardiothoracic Surgery | MUMC+; Control Systems Group, Dept. Electrical Engineering | TU/e; Optics11Life; Confocal.nl; HCM Medical; BioSPX; STEMCELL Technologies; Contactgroup Marfan Netherlands.

