Andries van der Meer

Dr. Andries D. van der Meer is a Tenure Track Assistant Professor at the Faculty of Science and Technology of the University of Twente, The Netherlands. He is the leader of the Organs-on-Chips research theme in the Applied Stem Cell Technologies group of the Bioengineering Technologies cluster, supervising six Ph.D. candidates and coordinating multiple national and European research projects on the development and application of organ-on-chip technology.

Before joining the University of Twente in 2015, Dr. Van der Meer worked as a Senior Research Fellow at Harvard Medical School and the Wyss Institute for Biologically Inspired Engineering of Harvard University, Cambridge, MA, USA. He actively developed organ-on-chip models of the blood-brain barrier and the alveolus for the Defense Advanced Research Projects Agency (DARPA) Microphysiological Systems program and coordinated a collaborative project between the Wyss Institute organ-on-chip start-up company Emulate, Inc. and Janssen Pharmaceuticals. Before joining Harvard University, he was a Post-Doctoral Fellow at Prof. Albert van den Berg's BIOS/Lab-on-a-Chip group of the University of Twente, The Netherlands. During that time, he also served as an Assistant Coordinator for the project 'Beyond Borders: Organs-on-Chips' of the Dutch Royal Academy (KNAW). This project led to the founding of the Dutch Human Organ and Disease Model Technologies (hDMT) Organ-on-Chip consortium, for which Dr. Van der Meer is currently his university's representative.

Dr. Van der Meer obtained his Ph.D. in Biomedical Engineering from the University of Twente, The Netherlands in 2010, and received his M.Sc. degree in Medical Biology from the University of Groningen, The Netherlands in 2005.

BLOOD VESSELS IN ORGANS-ON-CHIPS

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Introduction

Organs-on-chips are uniquely different from other cell culture models in that they are based on controlled microenvironment engineering. Therefore, they can capture progressively more complex physiological functions without relying on uncontrolled and unpredictable cellular self-organization [1]. The controlled nature of organs-on-chips also allows the systematic 'personalization' of various aspects of the model, so that it truly becomes a reflection of ourselves and may be applied in targeted drug development and precision medicine (Figure 1) [2,3]. In this talk, I will explain how we

are applying this concept of systematic personalization as we engineer blood vessels for integration in organs-on-chips.

Results and Discussion

For the engineering of blood vessels in organs-on-chips, there are a number of key aspects that can be controlled and personalized: blood and vascular tissue, vessel geometry, and properties of the flow. For example, we have used blood from patients on anti-platelet medication and have detected differences in thrombosis at arterial flow rates in vessels-on-chips. Moreover, we have used CT angiography imaging data to engineer controlled 3D vessel-on-chip geometries, and have used these to study the local risk of thrombosis. Finally, we are moving away from using primary cell material and have been focusing on engineering vessels-on-chips based on human pluripotent stem cell-derived tissues.

Conclusion

The power of personalizing organ-on-chip systems and their integrated blood vessels is only beginning to be demonstrated. By staying close to the design philosophy of controlled microenvironment engineering, it will be possible to further improve the personalized and functional complexity of these systems in the coming years.

References

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