Propositions

1. Organ-on-a-Chip is a powerful tool to mimic the microarchitecture and functions of living human organs. (*Chapter II*)
2. One of the challenges of organs-on-chips is to fabricate functional microvessels that can be integrated with other systems, can withstand continuous perfusion after cell seeding and run in fully automated manner over extended periods of time. (*Chapter VI*)
3. Bioactive lipid profiles can be readily detected from three-dimensional microvessels-on-a-chip and display a more dynamic, less inflammatory response to tumor necrosis factor α, that resembles more the human situation, compared to classical two-dimensional endothelial cell cultures. (*Chapter V*)
4. Perfusing microvessels with human plasma samples is a valuable tool in searching for drivers of microvascular destabilization in a broad spectrum of systemic diseases including cardiovascular diseases, obesity and its complications, neurodegenerative disease and cancer. (*Chapter VII*)
5. Recently, the development of microfluidic platforms (organ on a chip) that allow co-culture of cells and matrices, combined with the application of perfusion and spatial control over signaling gradients, have been used for physiological studies and drug discovery for many complex organs including liver, heart, gut, lung, and brain. (*Petrosyan A, et al. Nature Communications 2019, 10: 3656*). Although the usefulness of many organs-on-chips have been shown, their friendliness and compatibility is often still at premature stage.
6. To further fine-tune the vessel permeability to match the unique environment in different organs, organ-specific endothelial cells should be used. (*Zhang B, et al. Nature Materials 2016, 15: 669–678*). This approach can be further improved by perfusing blood (fractions) in the organs-on-chips for cells to fully maintain their *in vivo* phenotype and function.
7. Several organ-on-chip models in which endothelial cells are co-cultured with other cells have been developed. These models have been used to test endothelial cell barrier function by directly measuring diffusion or migration of tracers and cells by measuring the transendothelial electrical resistance (TEER) or by performing junction-specific staining. (*Cochrane A, et al. Advanced Drug Delivery Reviews 2019, 140: 68–77*). Besides these approaches, metabolomics can provide a much sensitive and informative read-out for investigating endothelial cell barrier function.
8. To date, pulmonary endothelial cells have been largely overlooked as a therapeutic target in COVID-19, yet emerging evidence suggests that these cells contribute to the initiation and propagation of acute respiratory distress syndrome by altering vessel barrier integrity,

promoting a pro- coagulative state, inducing vascular inflammation (endotheliitis) and mediating inflammatory cell infiltration. (*Teuwen L. A., et al. Nature Reviews Immunology 2020, 20: 389–391*). In fighting the resent pandemic, the microvessels-on-a-chip may allow us to assess the vascular derailment and to unravel the process underlying hyper-inflammation and hyper-coagulation that drive fatal outcomes in COVID-19.

9. "What I cannot create, I do not understand." (*Richard Feynman*)
10. If I can imagine a solution to a problem, then I believe it is possible to solve the problem no matter what people say.
11. "Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less." (*Marie Curie*)