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Generation of a Glomerular Filtration Barrier on a Glomerulus-on-a Chip Platform

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Within the kidney, the glomerular filtration barrier - composed by a monolayer of podocytes and a monolayer of glomerular endothelial cells, separated by the glomerular basement membrane- is in charge of the renal ultrafiltration. The direct interaction between these 3 components is essential to the proper maintenance of the renal permselectivity; damage to any of these components affects the others, leading to loss of glomerular filtration barrier functionality, glomerular injury, and proteinuria.

The generation of a functional glomerular filtration barrier in vitro has been for long time challenged by architectural and functional hurdles as well as by sourcing of cells.

In the last decade, the rapid and exciting progress in the field of microfluidic systems has opened new avenues for our ability to bio-engineer renal structures in vitro, including glomeruli-on-a-chip. These new systems hold the promise for new discoveries based on molecular mechanisms of injury in the filtration barrier as well as the possibility to apply those findings for a more personalized therapeutic approach in kidney research.

In this lecture, we will discuss the latest advances in the development of glomeruli-on-a-chip and how these systems can inform us about mechanisms involved in glomerular injury in glomerulonephritis and other renal diseases.