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Promoting Sustainable Kidney Health: The Asia-Pacific and Beyond

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Stem cell-derived human kidney tissue for drug development and tissue engineering

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Chronic kidney disease represents a major global burden of disease with no advances in treatment options for decades. Kidney disease is not restricted to adults but also present in 1 in 15000 children due to inherited mutations. A major challenge to the development of new therapies for kidney disease has been the challenge of accurate models of human kidney disease. For almost a decade, it has been possible to pattern human pluripotent stem cells to kidney organoids. These 3D microtissues accurately model the developing kidney including patterning and segmenting nephrons and surrounding stroma. Using transcriptional profiling, proteomics, lineage tracing and reporter iPSC, it has been possible to show the accuracy and congruence of these models with the human fetal kidney. It has also been possible to recapitulate features of human renal disease in vitro, including using patient-derived and gene edited stem cell lines. While these represent remarkable achievements, there remain challenges to utility, including missing cellular components, off target patterning and quality control, maturation of nephron structures and scale up of tissues. This lecture will focus on the application of these human microtissues to the development of new therapies, including both the development of treatments for inherited kidney disease and the engineering of transplantable human tissue.

Keywords: stem cell-derived human kidney tissue, kidney organoids, 3d microtissues, transcriptional profiling, chronic kidney disease