

Nanoparticle Transport and Interactions in the Kidneys

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The kidney is a crucial organ for rapidly eliminating wastes from the body. Over the past 15 years, the kidney elimination pathway has been increasingly leveraged to minimize the accumulation of engineered nanoparticles in the body and to accelerate their clinical translation as novel diagnostic and therapeutic agents. Despite these advancements, the mechanisms of nanoparticle transport and interaction with different kidney compartments remain largely unexplored at a fundamental level, which is critical for their future clinical success. In this talk, I will present several breakthroughs we have achieved in understanding the fundamental physiological principles that govern glomerular filtration, tubular secretion, transformation, and extrusion of engineered nanoparticles in the kidneys. Additionally, I will demonstrate how these newly discovered principles can be applied to address current challenges in disease diagnosis and treatment, offering insights into their potential clinical applications¹⁻⁷.

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