

An Implantable (Bio)Artificial Kidney

Update on The Kidney Project

Shuvo Roy, PhD

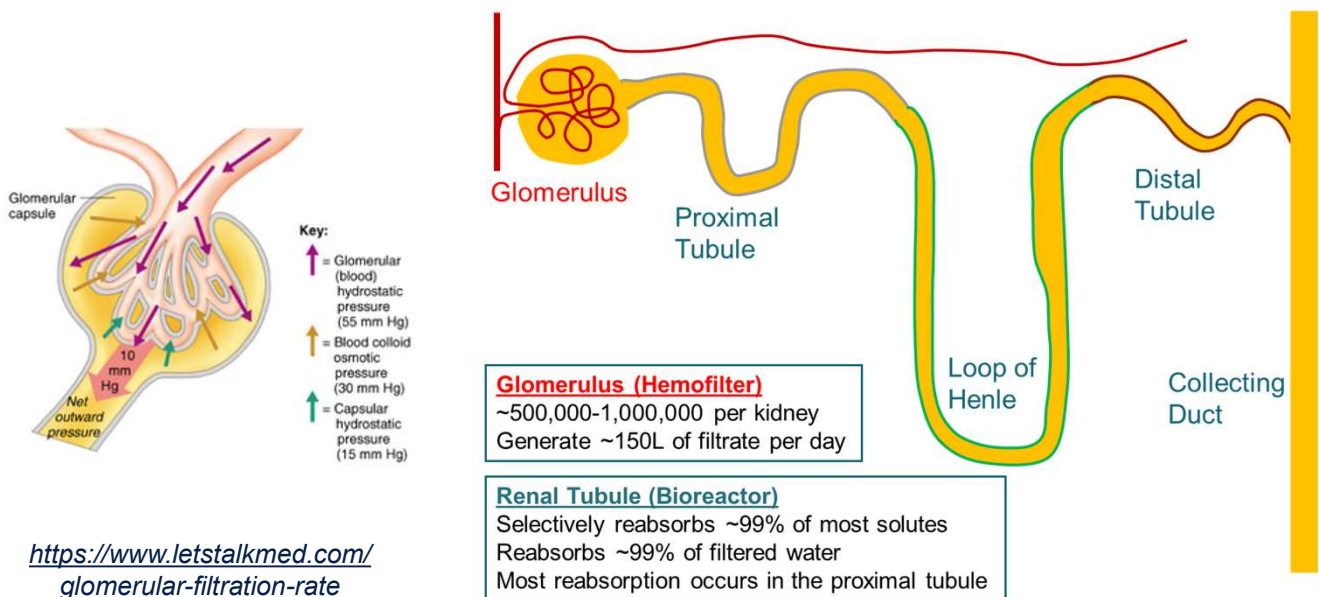
Department of Bioengineering &
Therapeutic Sciences
Schools of Pharmacy and Medicine
University of California, San Francisco

Bay Area Association of Kidney Patients (BAAKP)
New Frontiers in Kidney Transplants
Webinar
July 27, 2025

Disclosure: Silicon Kidney

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Filtration and Reabsorption in the Kidney



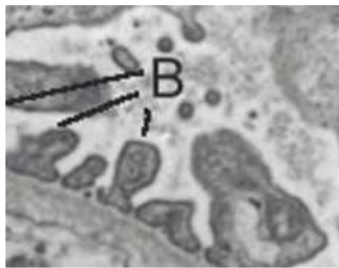
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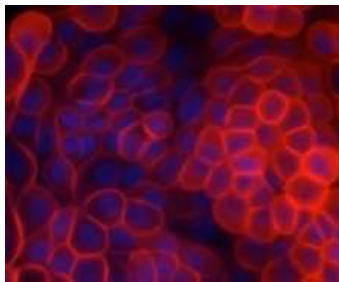
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Biohybrid Strategy to Recapitulate Kidney Architecture



Hemofilter
GLOMERULUS

BUILD
what we cannot
GROW PRECISELY



Bioreactor
TUBULE

GROW
what we cannot
BUILD PRECISELY

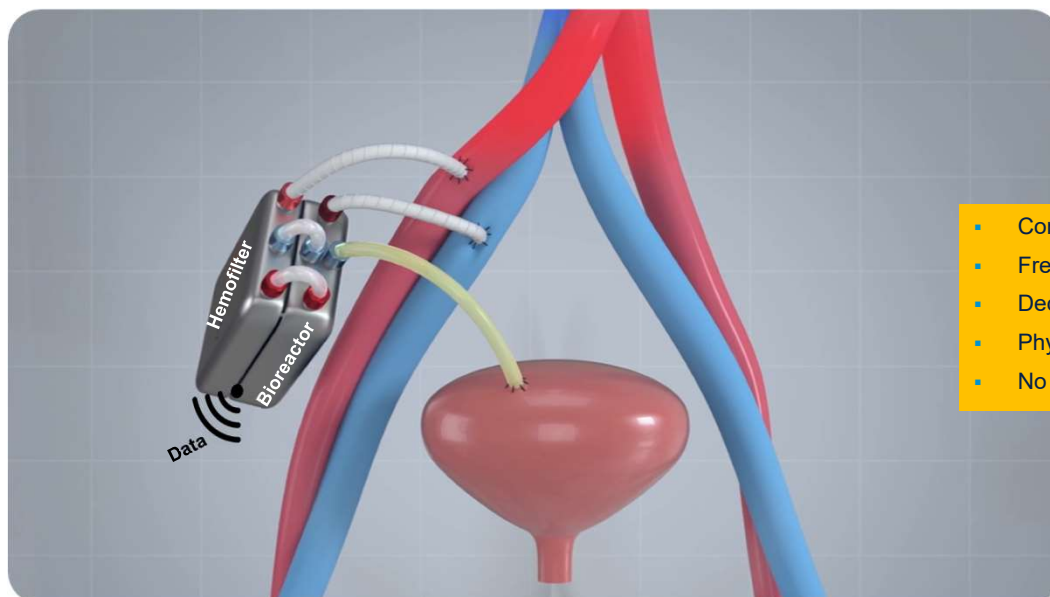
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Our Goal - Implantable Bioartificial Kidney (iBAK)



- Continuous treatment
- Freedom of mobility
- Decreased infection risk
- Physiological therapy
- No immunosuppression

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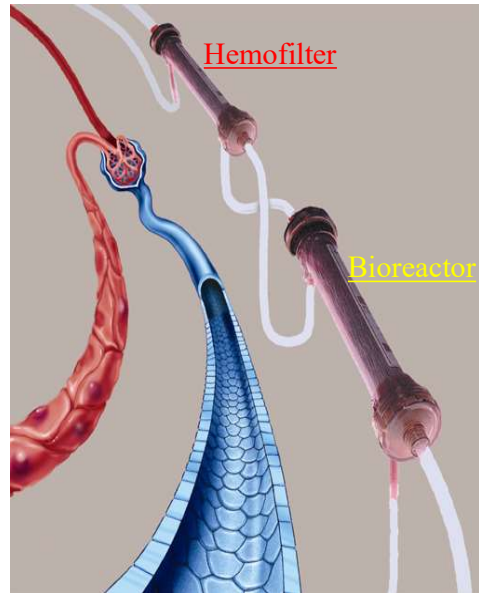
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Hybrid Demonstration of Renal Cell Therapy



H. David Humes, MD
University of Michigan, USA



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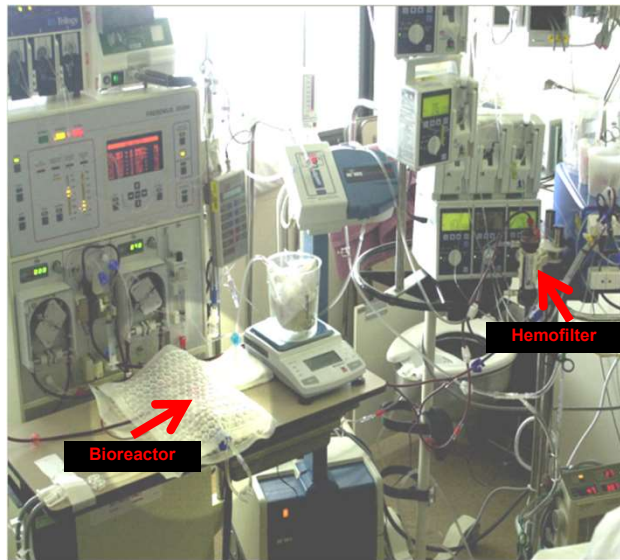
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Renal Assist Device (RAD)

- 50% mortality reduction
- Cell therapy benefit



Tumlin J et al. Efficacy and Safety of Renal Tubule Cell Therapy for Acute Renal Failure. JASN 2008 19: 923

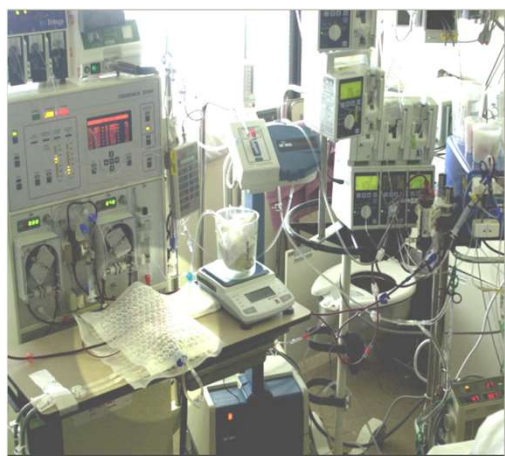
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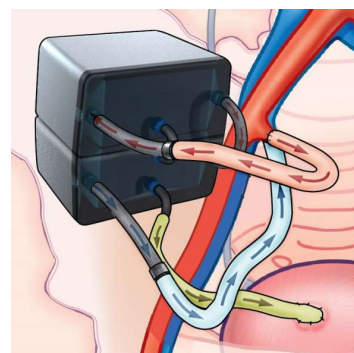
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Our Roadmap – Engineering Approach



The Kidney Project



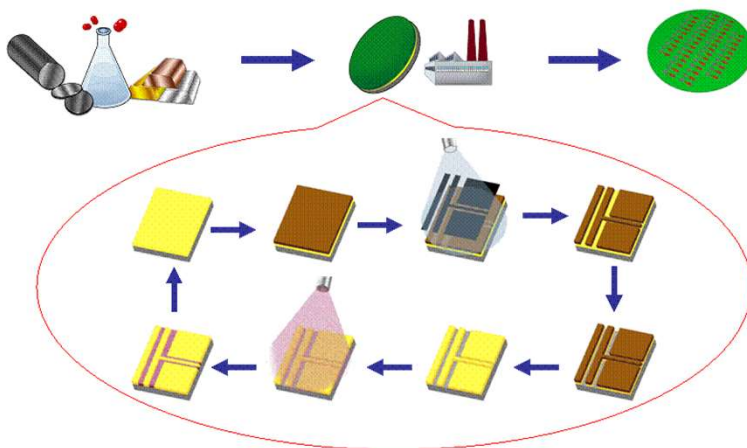
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Semiconductor Nanotechnology



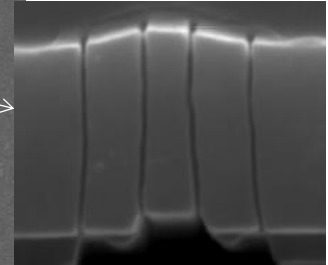
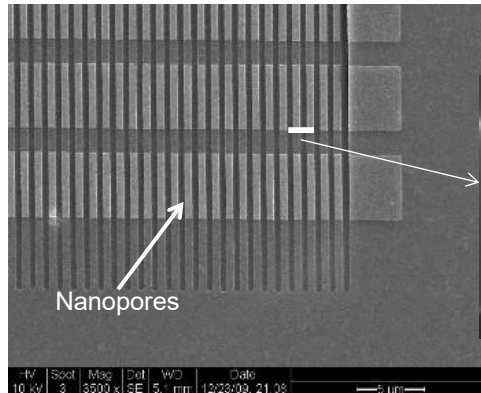
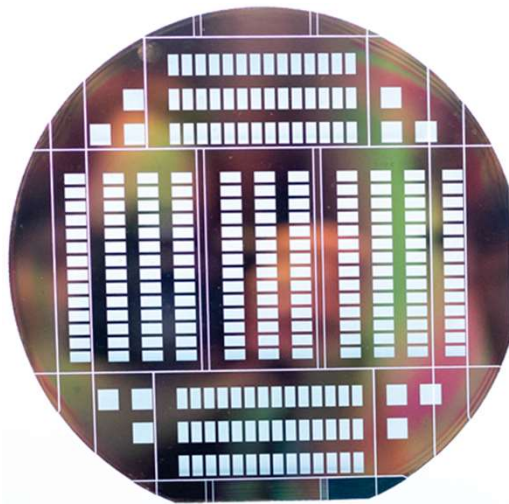
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Silicon Nanopore Membranes (SNM)



- High Molecular Selectivity
- Low Fluidic Resistance
- Batch Manufacturing

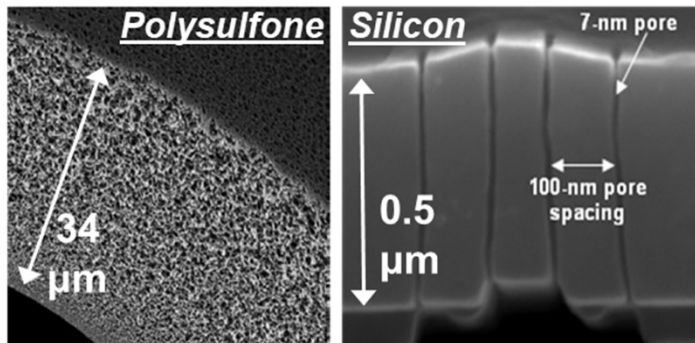
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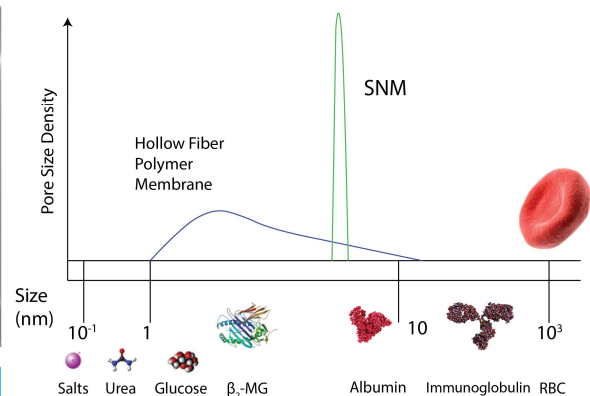
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SNM vs Hollow Fiber Membrane



	SNM	Polysulfone (Optiflux F160NR)
Hydraulic Permeability (ml/hr/mmHg/m ²)	200-600	10-30



No Pumps

Improved Clearance

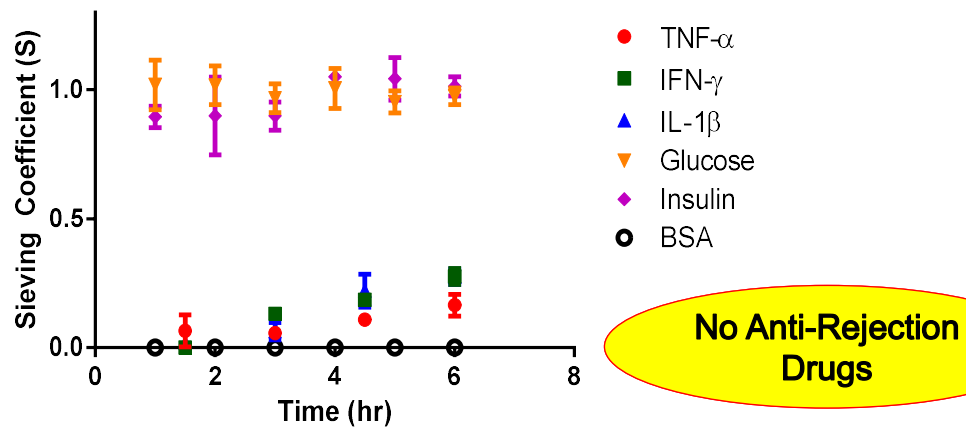
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SNM Selectivity



- 80% reduction in cytokine passage
- 100% passage of glucose and insulin
- No passage of albumin or antibodies

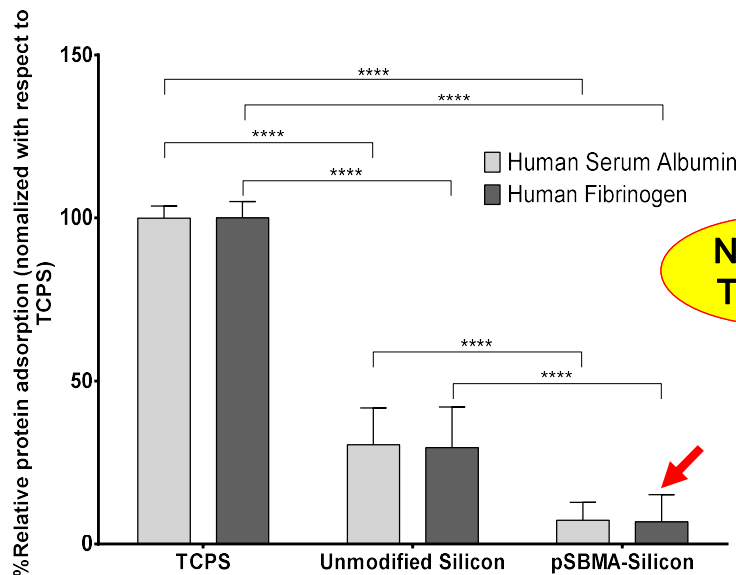
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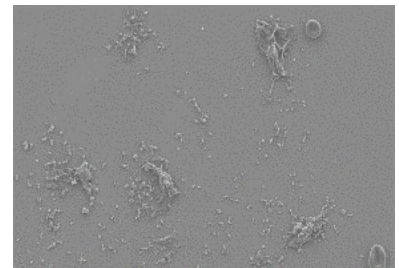
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Biocompatible Coatings



Unmodified Silicon



pSBMA-Silicon



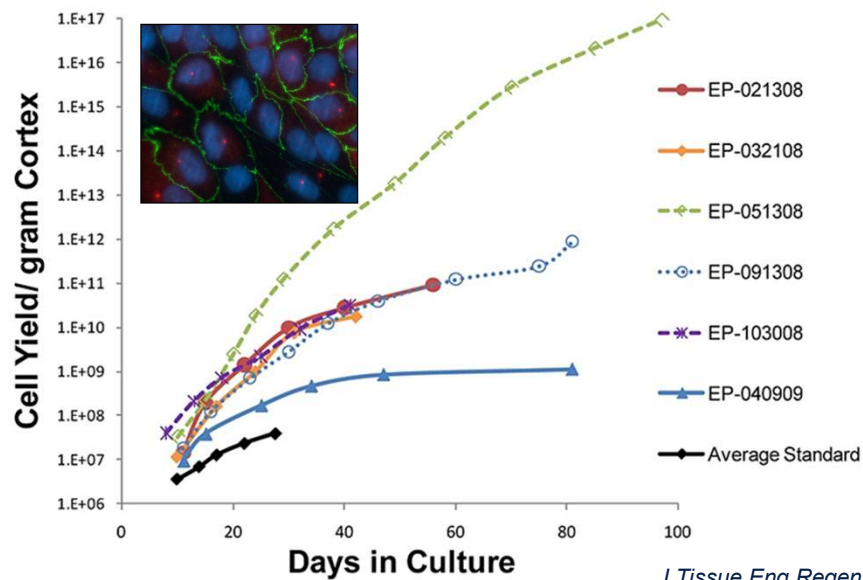
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Human Renal Tubule Cell (HRTC) Sourcing



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Integrated Device Prototype

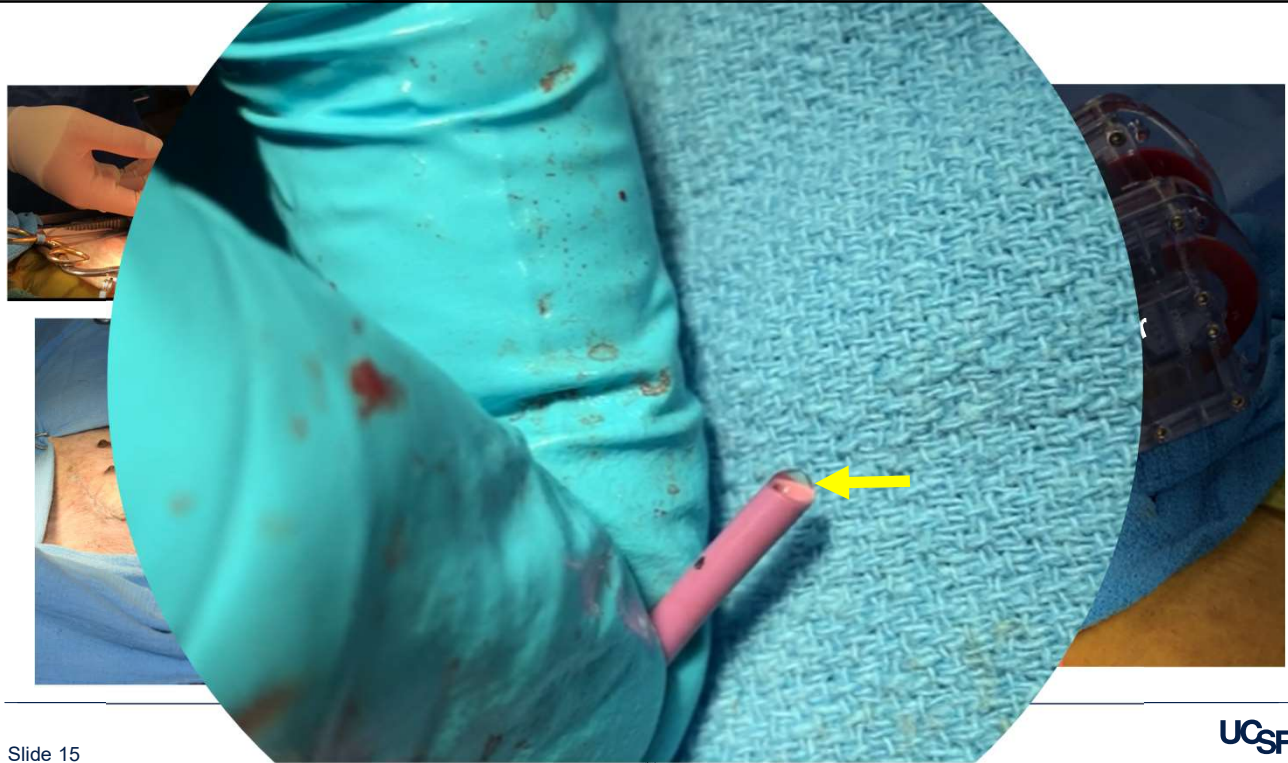


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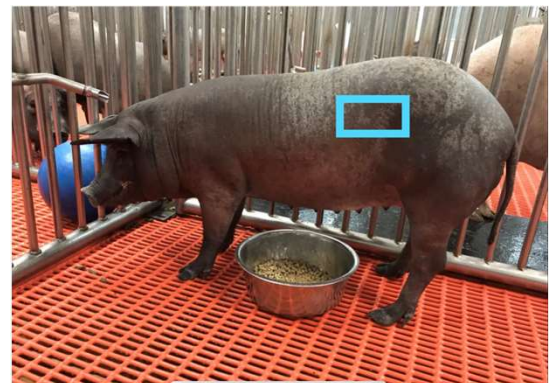
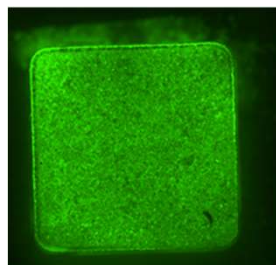
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Device Performance

- 3-day duration with 5 nm SNM and LLC-PK1 cells
- Hemofilter output: 4 ul/min
- Bioreactor reabsorption: 93%
- Cell viability: 95%



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Pathway to Patients

- Scale up devices for clinical capacity
- Conduct first-in-human testing
- Recruit investors/industry for manufacturing
- Commercialize and distribute to patients



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Overcoming the Barriers

- Prototype Development and Testing
- Regulatory and Reimbursement
- Manufacturing and Distribution
- Patient Education and Clinical Adoption

Need Your Help!

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Tell Your Physician – Input Needed!

Tell Doctor to scan QR code to take survey:



Or use they can use the link to go to the survey:

<https://KidneyTherapies6.sawtoothsoftware.com/login.html>

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Acknowledgements



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The Kidney Project Team

<http://kidney.ucsf.edu>

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