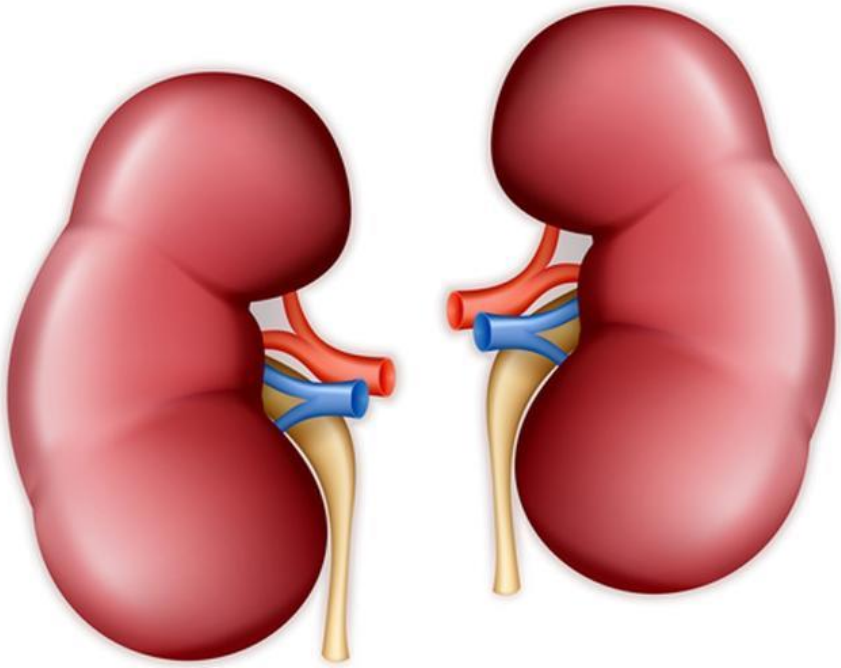
From patient to researcher: Transforming kidney disease treatment

Gary W. Liu
NSF Graduate Research Fellow
Department of Bioengineering,
University of Washington
May 19, 2016

The impact of kidney disease

- Diagnosed with kidney disease at 5
- Disease flares



A pile of pills…

Prednisone
up to 4× tablets/day

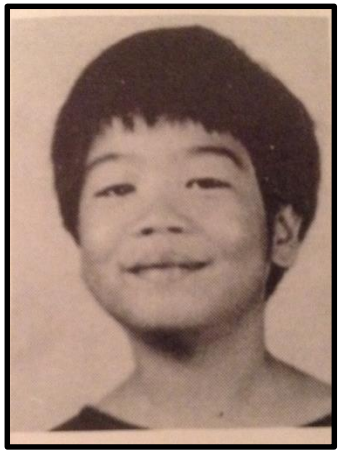
Cyclosporine/Gengraf
2× tablets/day

Simvastatin
2× tablets/day

Lasix
up to 2× tablets/day

up to **10 pills** a day

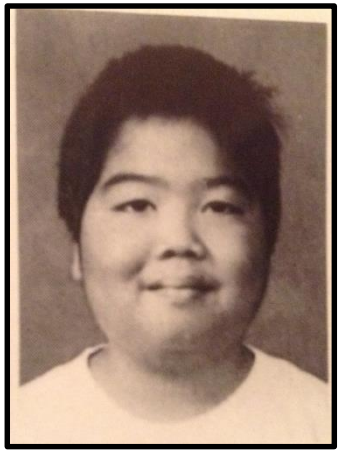
…and a list of side effects



1997–1998
Age 6-7

4 years later

- still had disease flares
- side effects: obesity, high blood pressure



2001
Age 10

The (pill) that broke the camel's back

Actonel

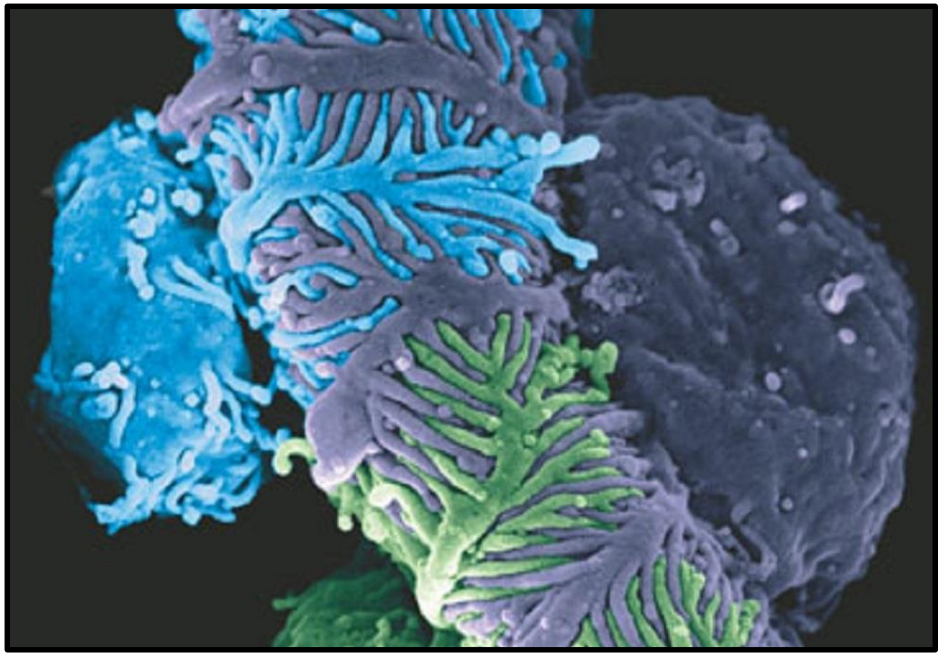
1× tablet/month

The (pill) that broke the camel's back

Actonel

1× tablet/month

Podocytes are important kidney cells



podocytes!

Podocyte roles:

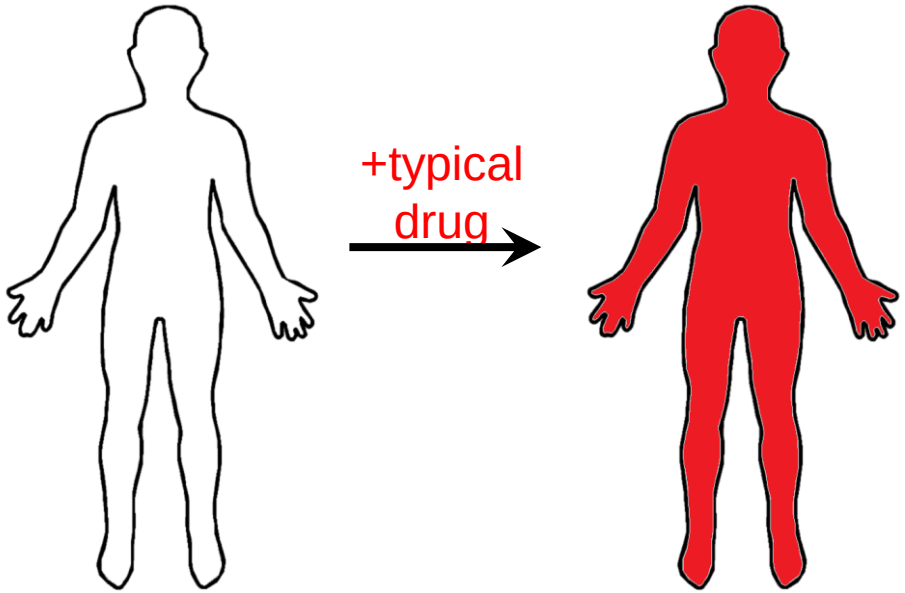
- filtration
- structural support

Podocytes are **injured** in kidney disease…

…so we need to **protect** and **regenerate** these cells!

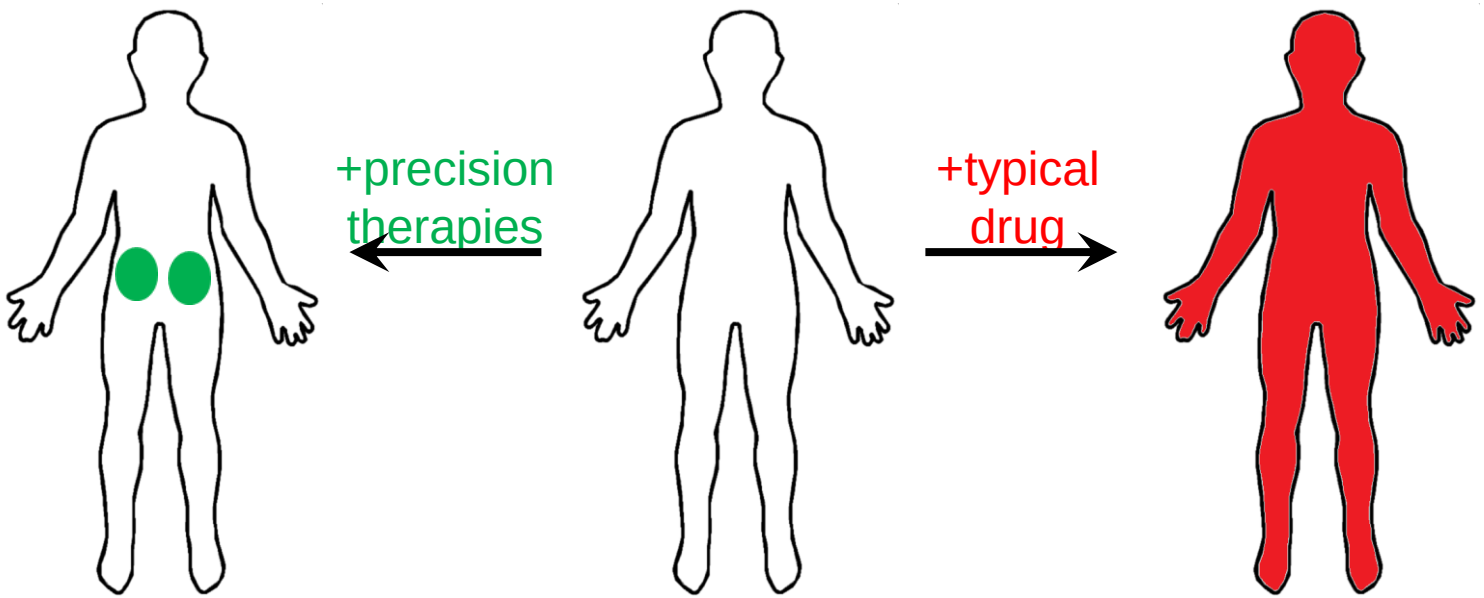
Goal: transform kidney disease treatment

Precision therapies for podocytes



Goal: transform kidney disease treatment

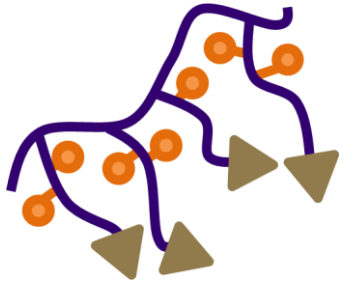
Precision therapies for podocytes



Engineering precision therapies to podocytes

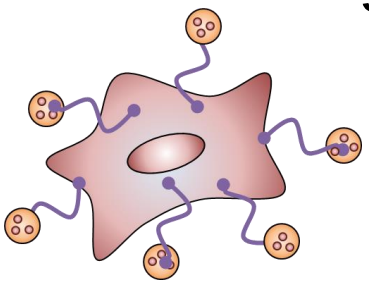
Precision drug delivery to podocytes

Engineered, targeted materials for precision drug delivery



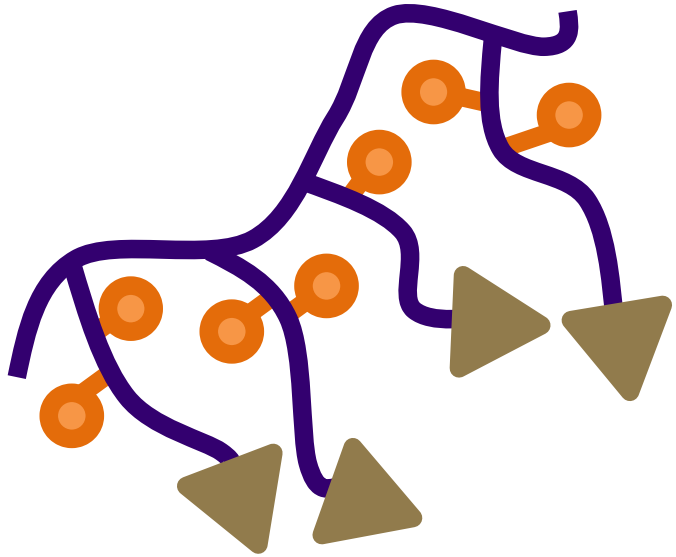
Regenerate podocytes that are lost

Engineered progenitor cells to regenerate podocytes



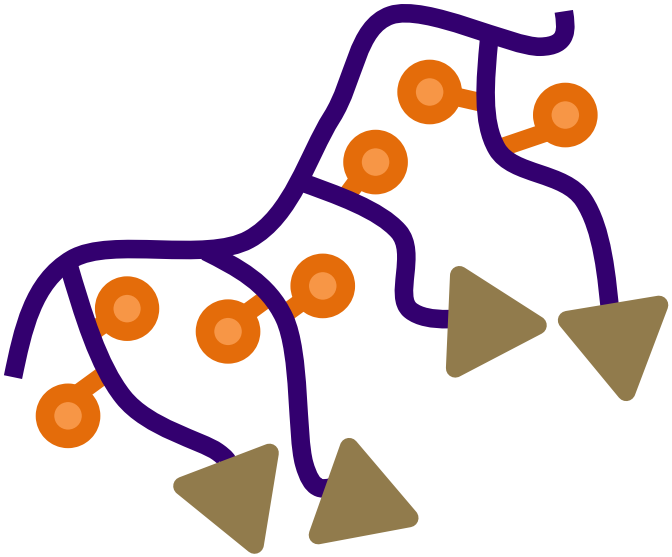
Precision drug delivery to podocytes

1. Homing polymers
2. Targeting molecule
3. Drug



Precision drug delivery to podocytes

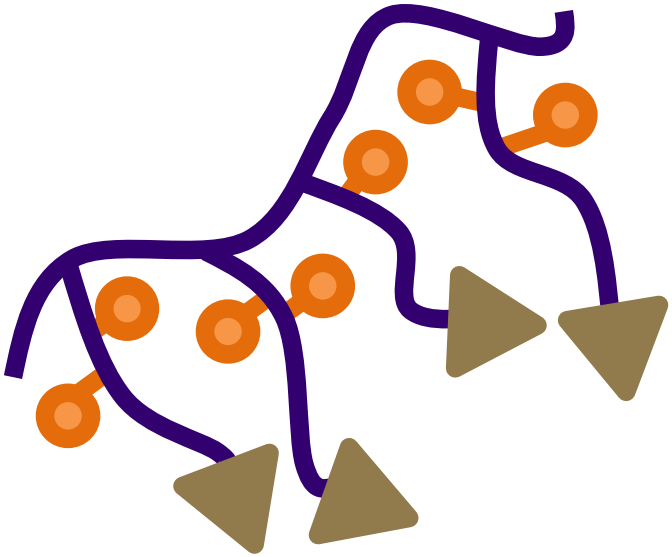
In blood



× no drug release

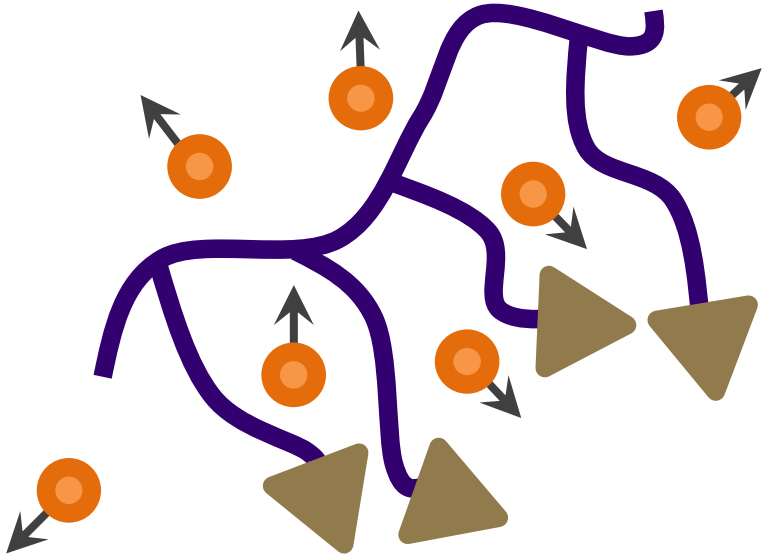
Precision drug delivery to podocytes

In blood



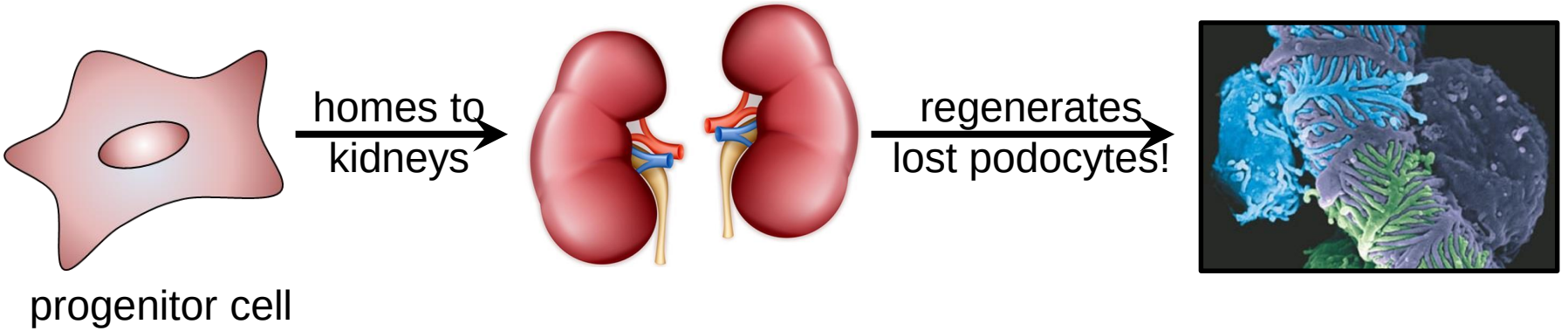
× no drug release

Inside podocytes



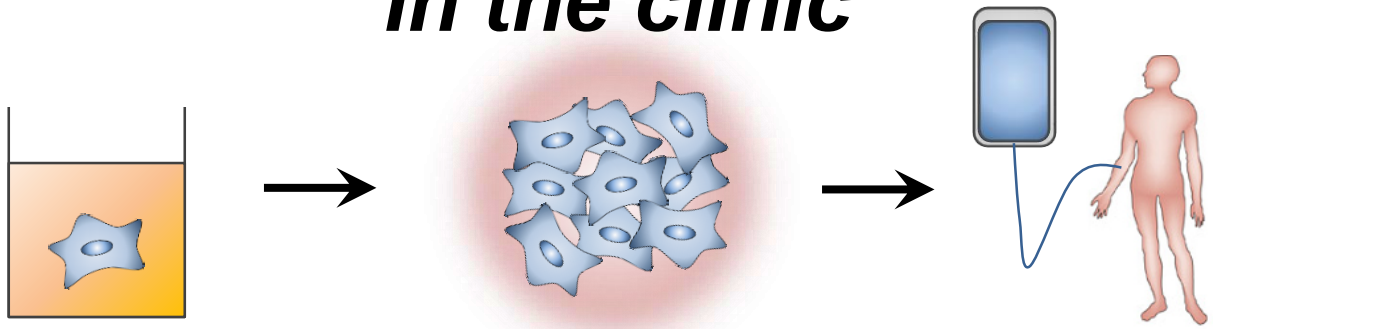
✓ drug release

Regenerate podocytes that are lost



Regenerate podocytes that are lost

In the clinic



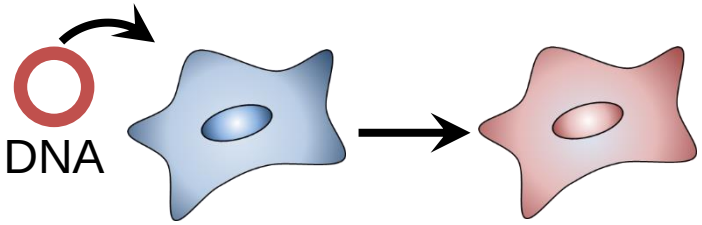
collect urine from patient

collect and grow progenitor cells

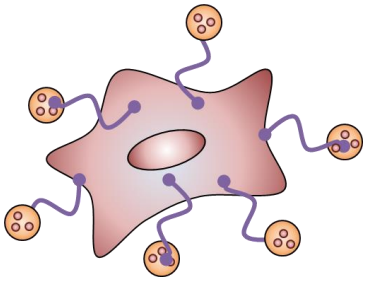
infuse cells into patient

Regenerate podocytes that are lost

In the lab



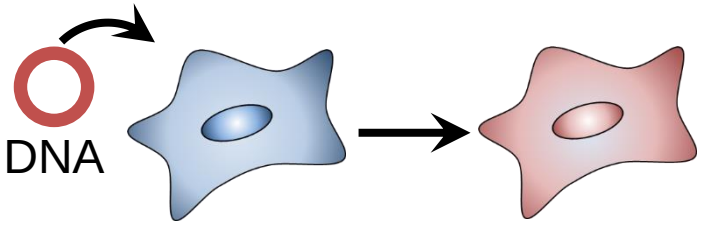
genetic engineering



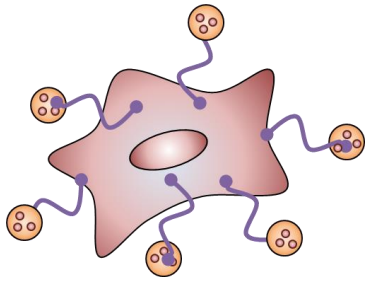
attach survival “backpacks”

Regenerate podocytes that are lost

In the lab

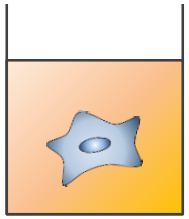


genetic engineering

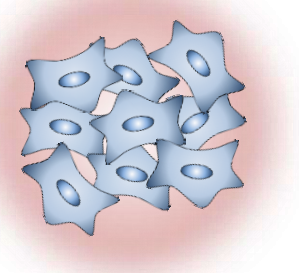


attach survival “backpacks”

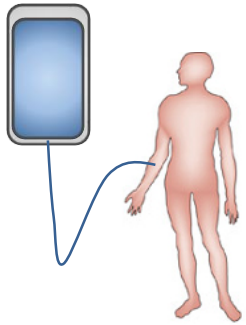
In the clinic



collect urine from patient



collect and grow progenitor cells



infuse **engineered** cells into patient

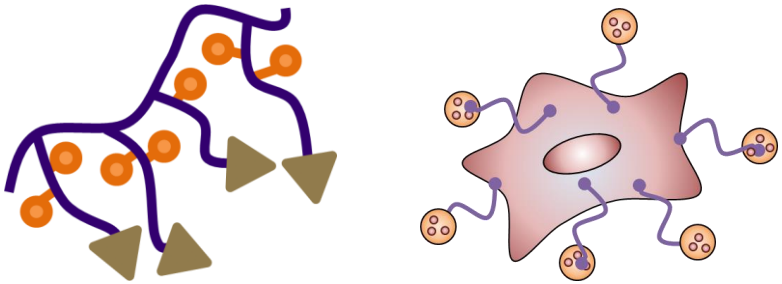
Goal: transform kidney disease treatment

Current treatments

× many side effects

× frequent disease flares

Precision treatments



✓ less side effects

✓ treat injured podocytes

Thank you!

Gary W. Liu
Department of Bioengineering
Email: garywliu@uw.edu
LinkedIn: linkedin.com/in/garywliu

Gary Liu is a third-year graduate student working towards a Ph.D. in Bioengineering. He received a B.S. in Biomedical Engineering from The University of Texas at Austin, and was awarded an NSF Graduate Research Fellowship to support his graduate studies. As a kidney disease patient for the past 20 years, Gary seeks to engineer new therapies and technologies to treat kidney disease.