

ERYTHROPOIETIN SECRETING  
VASCULAR GRAFTS – **EPO-VG**

**SOLVING ANEMIA IN END-  
STAGE RENAL DISEASE**

William G. Chang MD, PhD  
Assistant Professor of Medicine  
Section of Nephrology  
Yale University

Laura E. Niklason MD, PhD  
Professor of Anesthesiology  
& Biomedical Engineering  
Yale University

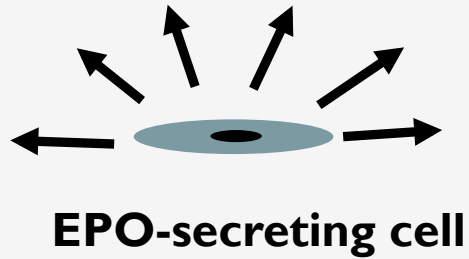
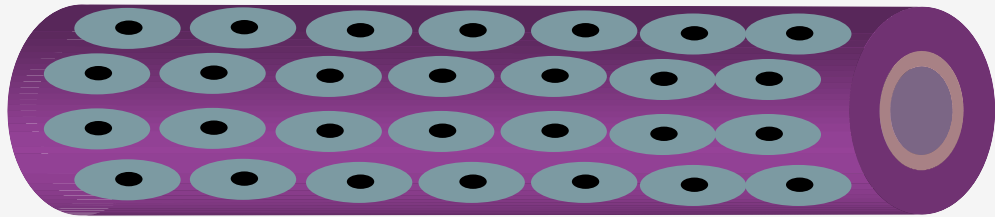
## OUR EPO-VG TEAM

- William G. Chang MD, PhD (Assistant Professor of Medicine) [w.chang@yale.edu](mailto:w.chang@yale.edu)
  - > 10 yrs of experience in clinical nephrology
  - Research focused on vascular and kidney tissue engineering
- Laura E. Niklason MD, PhD (Professor of Anesthesiology & Biomedical Engineering) – [laura.niklason@yale.edu](mailto:laura.niklason@yale.edu)
  - > 20 years of experience in vascular and lung tissue engineering
  - Co-founder of Humacyte – human acellular vessel biotechnology company
- Edward Han MSE – Graduate Student
- Maria Figetakis – Postgrad Research Associate
- Hong Qian PhD – Associate Research Scientist
- Bo Jiang MD – Postdoctoral Research Associate

# BACKGROUND

- In the US, **30 million people** have CKD and **600,000** have ESRD
- Medicare costs for ESRD alone exceed **\$35 billions** annually
- **Anemia** is the most common sequela of kidney disease – kidneys are the major source of the hormone ERYTHROPOIETIN (**EPO**) necessary for maintaining red blood cell levels.
- 78% of hemodialysis patients require regular doses of recombinant EPO to maintain blood levels. *(The market!)*
- ~100,000 new ESRD patients per year in US.
- Standard of care bolus EPO treatments leads to fluctuating blood levels associated with worse cardiovascular outcomes.
- ~ **\$1 billion dollars** spent annually on EPO injections *(the competition!)*
- ***We believe that there is a smarter way to deliver EPO!***

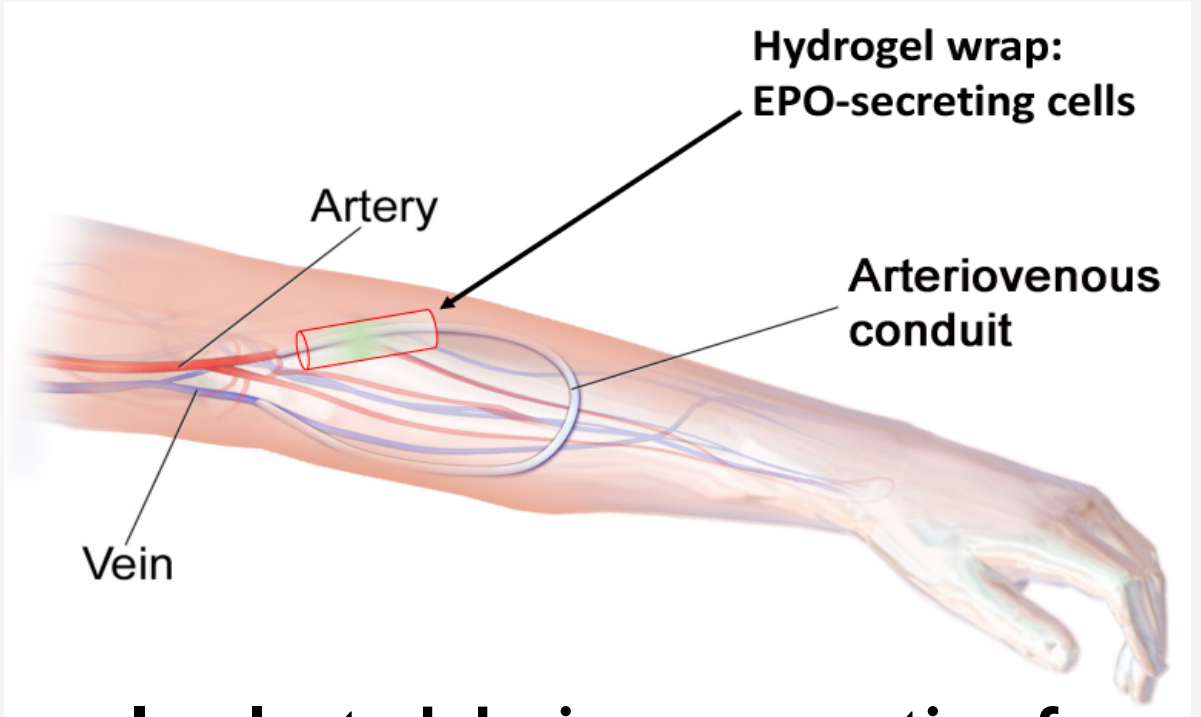
# EPO-VG CONCEPT



**Vascular wrap containing EPO-cells**

**Used on any vascular conduit**

**Immediate access to vessel**

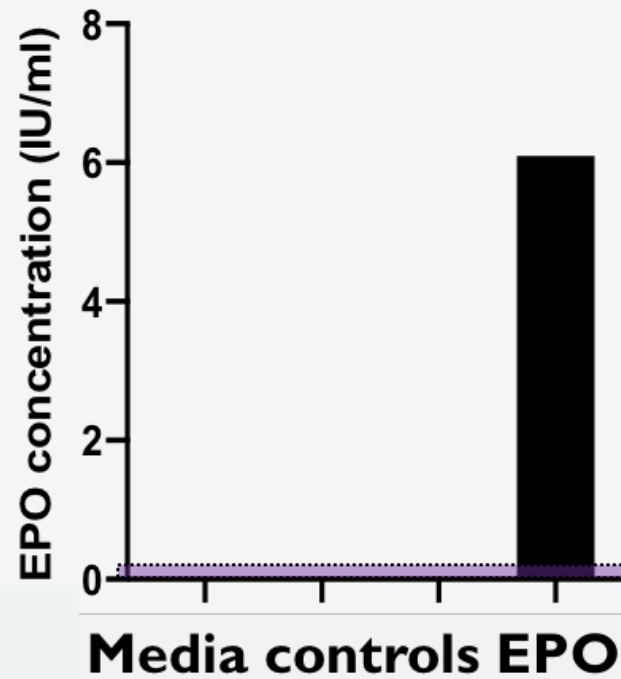


**Implanted during preparation for hemodialysis**

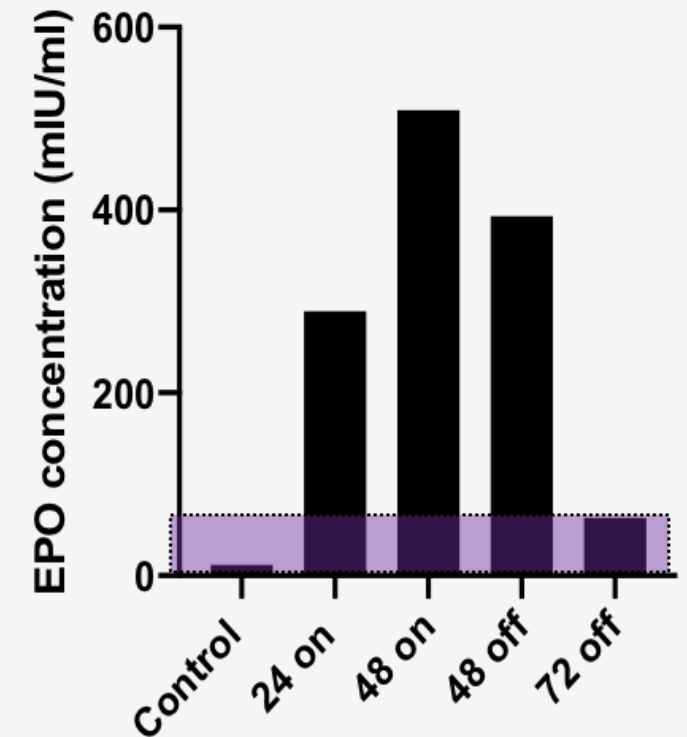
# EPO-CELLS

- *In vitro* EPO-Cells secrete large amounts of EPO!
- The reference range for human serum levels of EPO is 3.7-36 mIU/ml
- **We estimate that we will need 1.5 mL volume of cells**

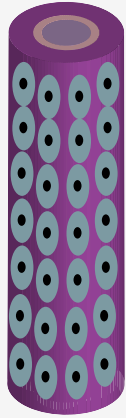
Constitutive EPO-cells



Drug-inducible

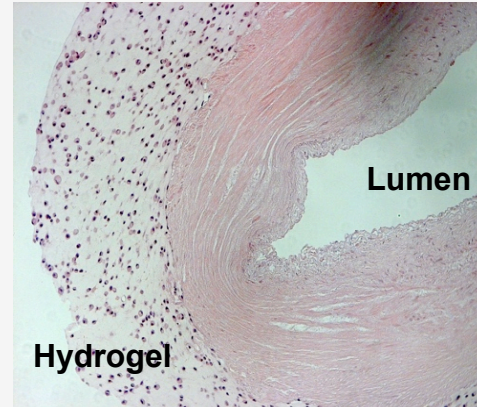


# IN VIVO CONSTITUTIVE EPO-VG IMPLANTS



EPO-VG  
Concept

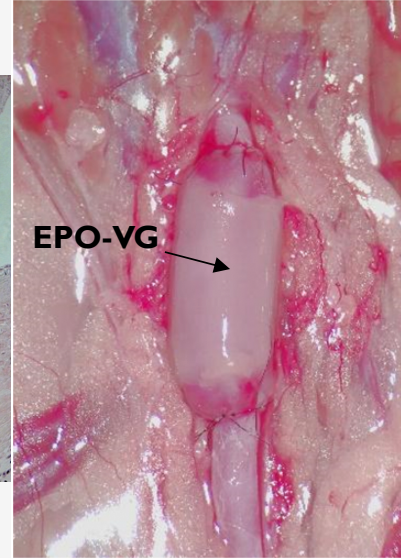
Pre-implant



Lumen

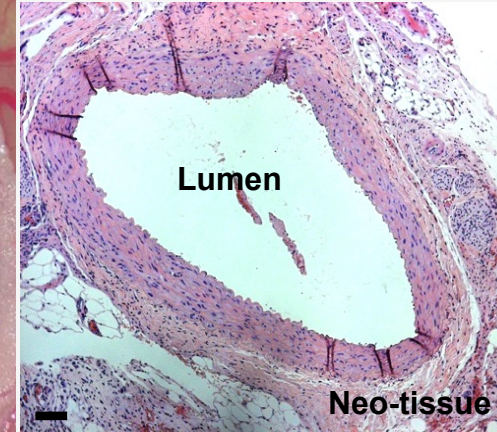
Hydrogel

Implant surgery



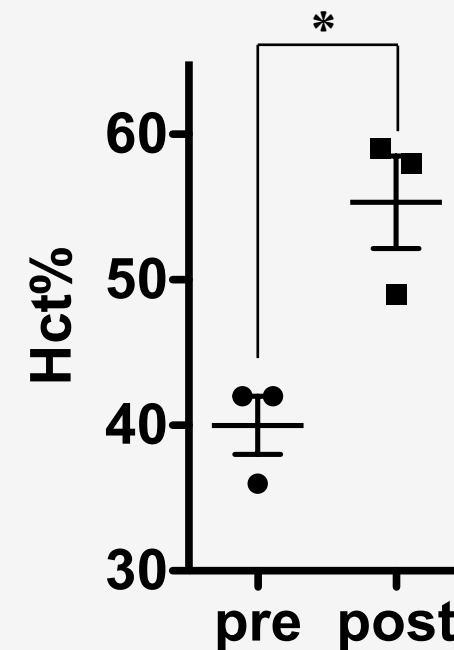
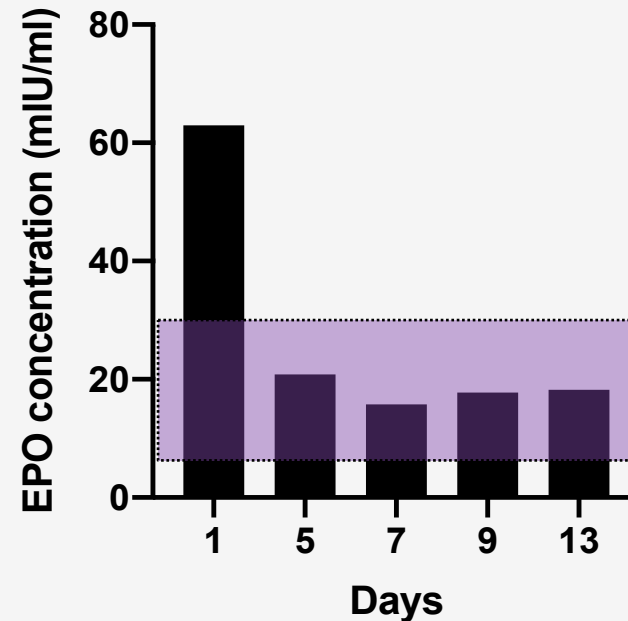
EPO-VG

Post-implant



Lumen

Neo-tissue



**Proof of  
concept in  
small  
animal  
model!**

# EPO-VG DEVELOPMENT PLAN

Timeline:	2020				2021				2022			
Quarters:	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>IP:</b>	File provisional patent application											
<b>Funding:</b>					<b>Blavatnik Pilot Funding</b> for large animal studies (100K) <ul style="list-style-type: none"> <li>- Critical inflection point</li> <li>- Proof of concept</li> <li>- Attract investment</li> </ul>				Investors, NIH (technology development or SBIR), and/or foundational grants			
<b>Entrepreneurship:</b>									Connecticut based Start-up			
<b>Bench to Bedside:</b>	<b>Safety and Efficacy Testing:</b> <ul style="list-style-type: none"> <li>- Preclinical rodent, to large animal pig models (outsourced)</li> <li>- Pharmacokinetics and dynamics in GLP model</li> <li>- CKD anemia models</li> <li>- Toxicity, carcinogenicity testing.</li> </ul>										Phase I Clinical Trial	
<b>Exploration:</b>	Design and implementation of EPO variants (titratable, immunoevasive, stem cell-derived) and exploration of other therapeutic targets.											