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
  - > 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
  - > 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
• 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
- *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
**IN VIVO CONSTITUTIVE EPO-VG IMPLANTS**

**Concept**

- Pre-implant
- Implant surgery
- Post-implant

- EPO-VG concentration (mIU/ml)
- Hct%

*Proof of concept in small animal model!*

- Days: 1, 5, 7, 9, 13
- Lumen
- Hydrogel
- Neo-tissue
## EPO-VG Development Plan

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<tr>
<th>Timeline:</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
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<tbody>
<tr>
<td>Quarters:</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
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<tr>
<td><strong>IP:</strong></td>
<td></td>
<td>File provisional patent application</td>
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<td><strong>Funding:</strong></td>
<td>Blavatnik Pilot Funding for large animal studies (100K) - Critical inflection point - Proof of concept - Attract investment</td>
<td>Investors, NIH (technology development or SBIR), and/or foundational grants</td>
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<td><strong>Entrepreneurship:</strong></td>
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<td><strong>Bench to Bedside:</strong></td>
<td>Safety and Efficacy Testing: - Preclinical rodent, to large animal pig models (outsourced) - Pharmacokinetics and dynamics in GLP model - CKD anemia models - Toxicity, carcinogenicity testing.</td>
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<td><strong>Exploration:</strong></td>
<td>Design and implementation of EPO variants (titratable, immunoevasive, stem cell-derived) and exploration of other therapeutic targets.</td>
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