The Potential for Tissue Engineered Vessels to Change the Future for Dialysis Patients

Juliana L Blum, PhD

May 22, 2019

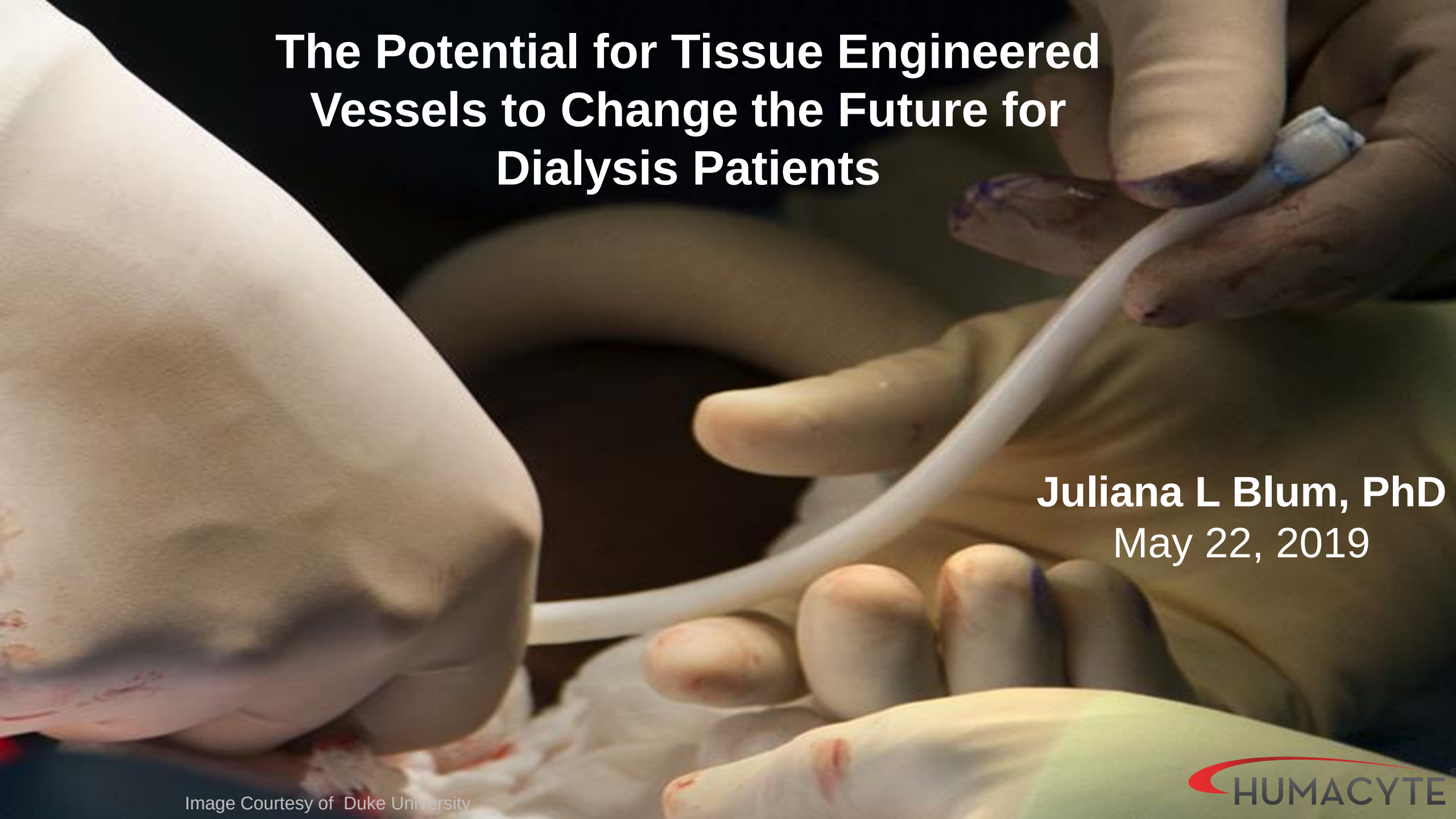

Image Courtesy of Duke University

HUMACYTE

Our Vision

We are the global leader in engineering regenerative medicine products to improve and save patient lives.

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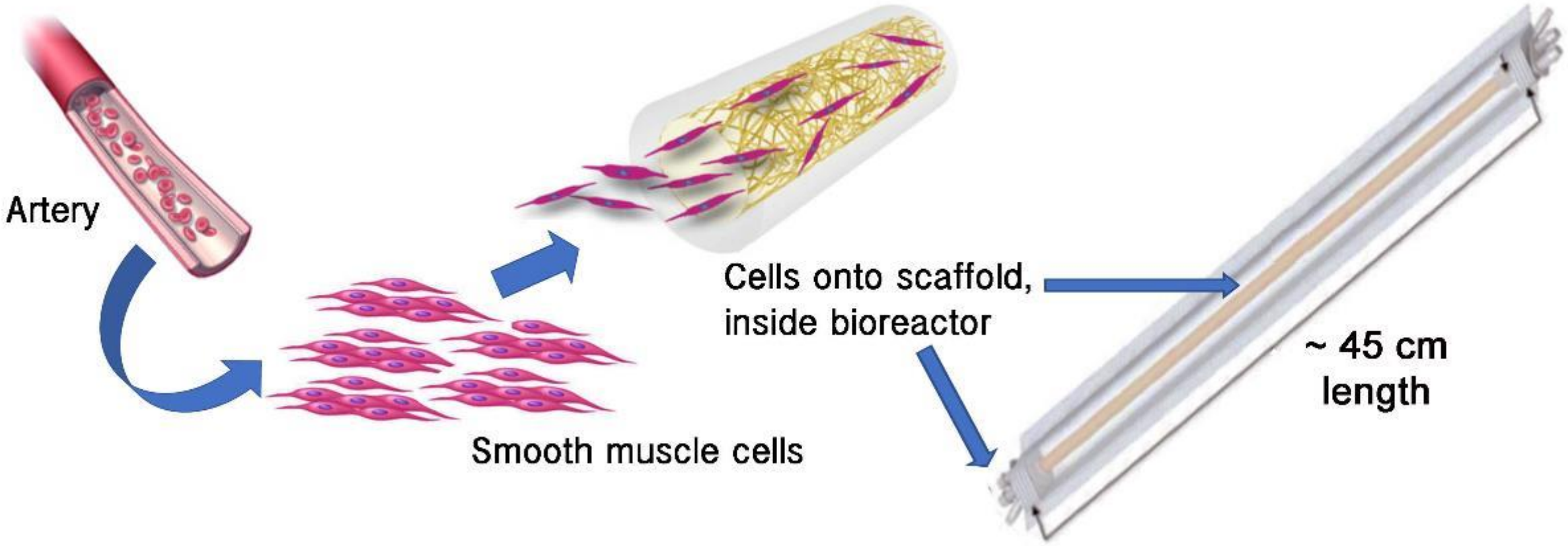
We are committed to bringing first-in-class regenerative medicine products to the marketplace that will improve and extend the lives of patients worldwide and transform the practice of medicine.

Humacyte's Technology Platform – Seeding Cells On Scaffold



Human Acellular Vessels: Production begins with isolation of millions of vascular smooth muscle cells from donated human tissue. Cells are then seeded onto a biodegradable scaffold within the bioreactor container to initiate vessel growth.

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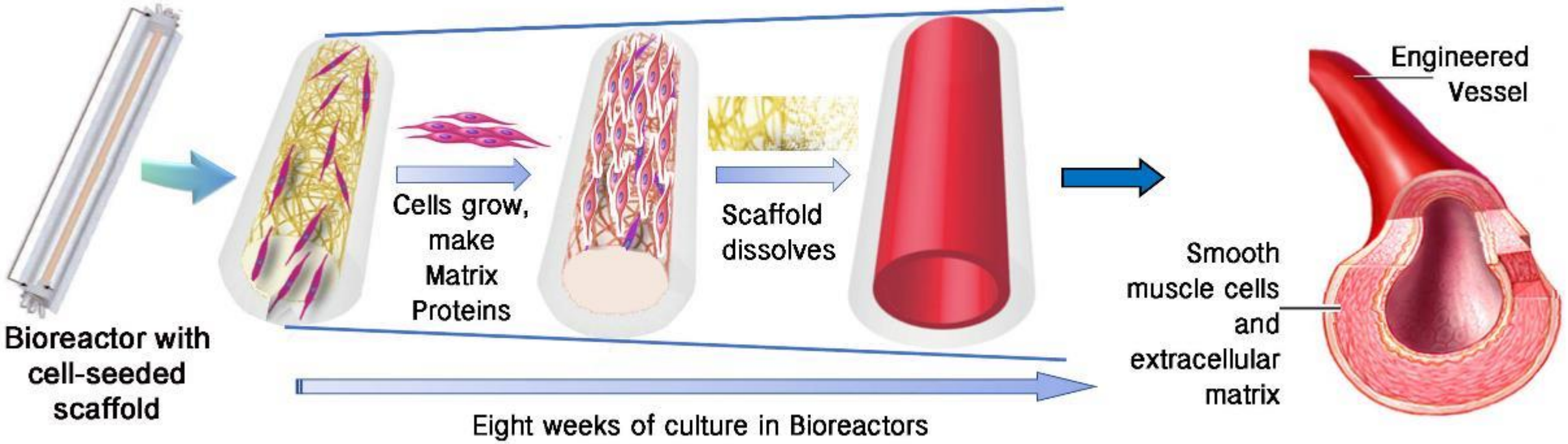
Humacyte's Technology Platform – Vessel Formation



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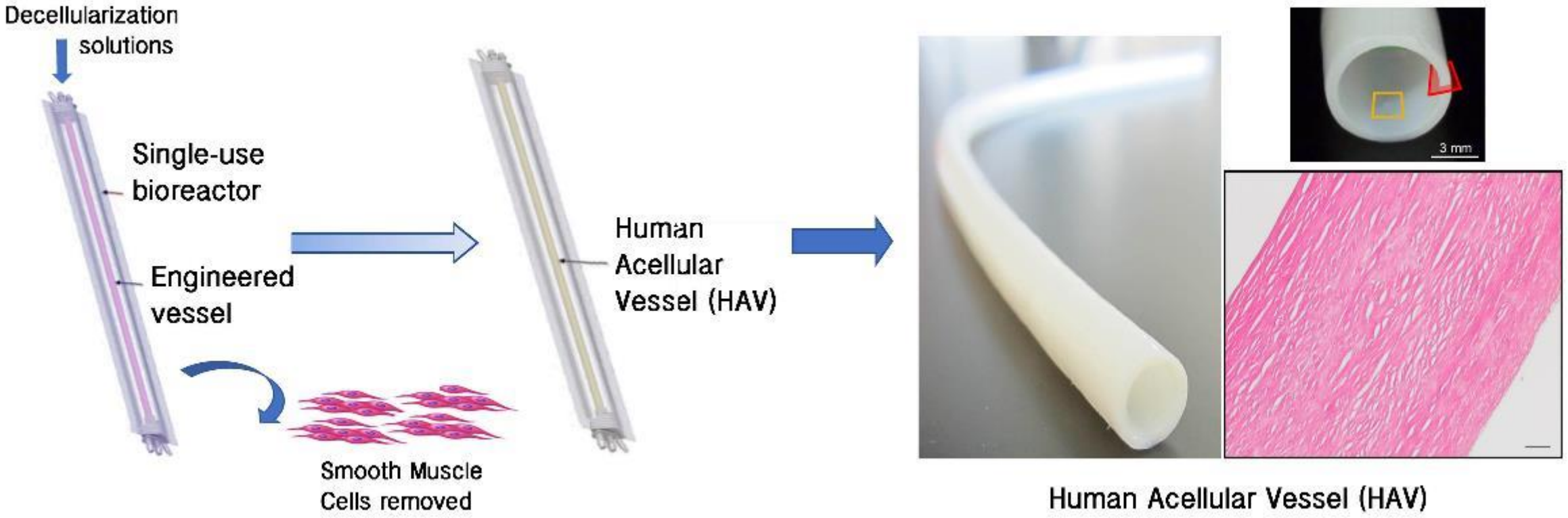
Humacyte's Technology Platform – Decellularization



The engineered vessels are decellularized to remove the smooth muscle cells leaving behind a Human Acellular Vessel (HAV) comprised of extracellular matrix proteins.

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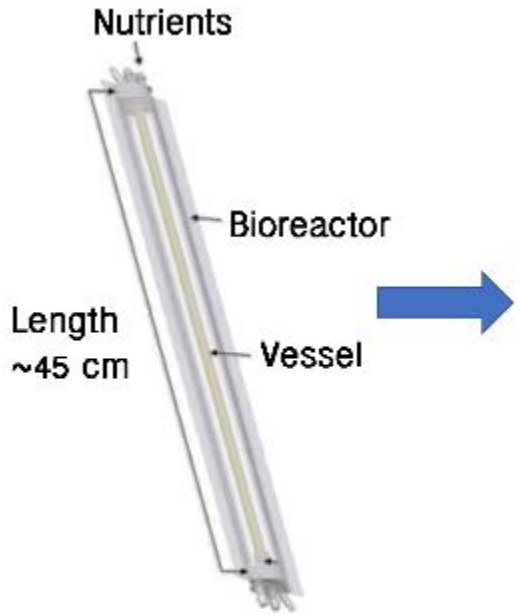
Commercial Scale Proprietary Manufacturing Technology

Each Bioreactor contains a single Vessel. Bioreactors are connected together to create a batch of 200 Vessels within a fully Automated Production System.



Single Bioreactor

10 Bioreactors/Vessels

200 Bioreactors/Vessels
Fully Scaled Automation

Vessel manufacturing is designed as a core competency. Current capacity is 8,000 HAVs/year. Capacity in current facility expected to increase to 33,000 HAVs/year by 2023.

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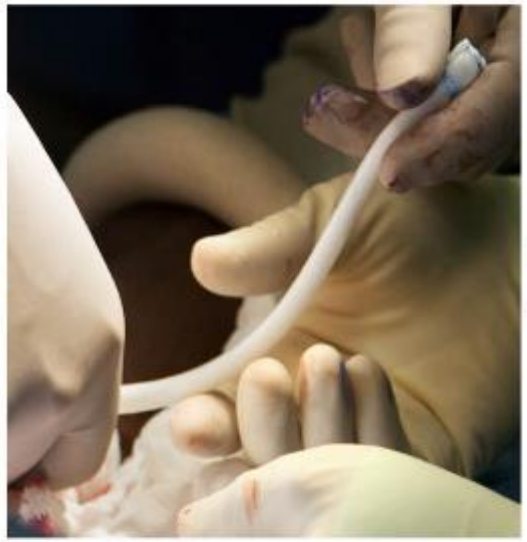
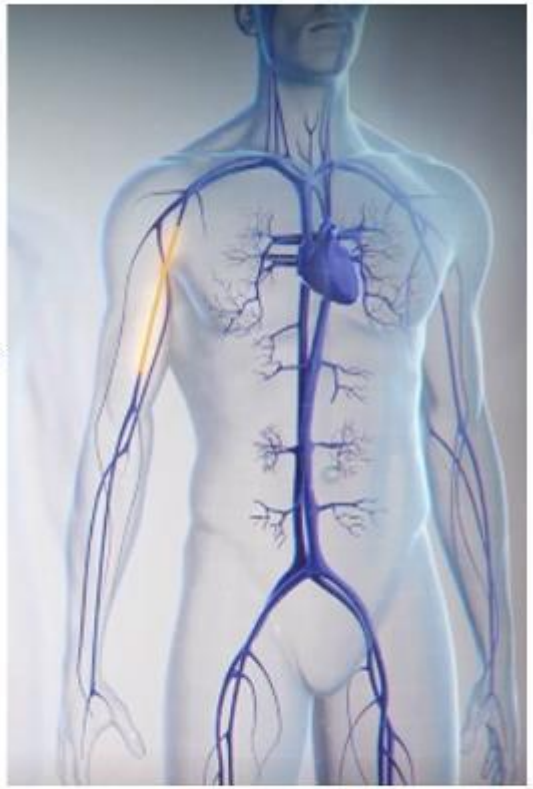
Humacyte's Technology Platform – "Off-the-Shelf" Human Tissues





HAV removed from packaging

HAV Implanted

HAVs are shipped to hospitals for use in operating rooms. During surgery, the HAV is removed from its packaging and then implanted into the patient.

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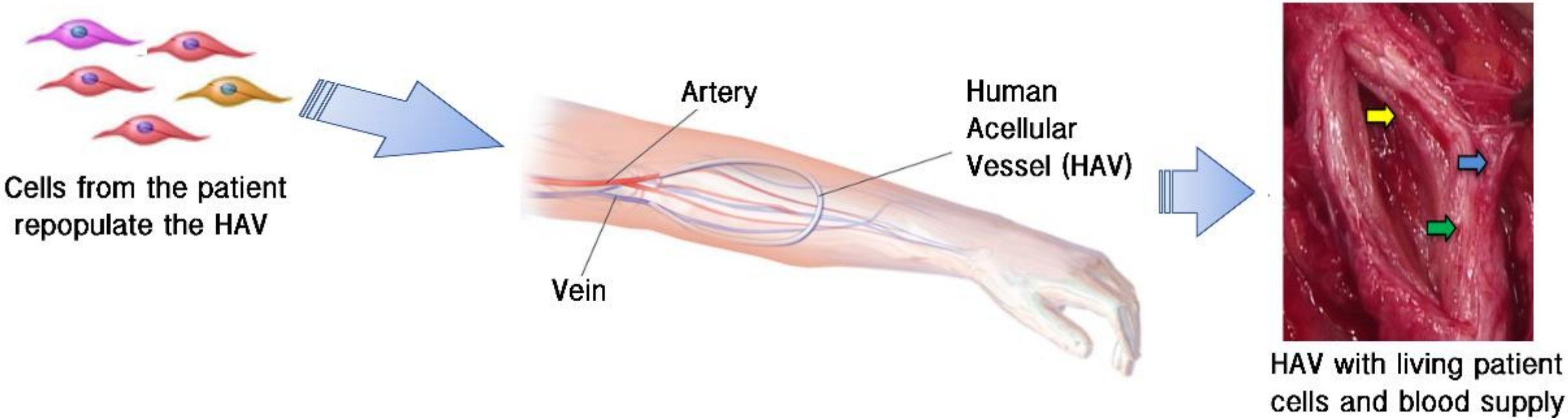
Humacyte's Technology – Patient Cells May Repopulate the HAV



After implantation, cells from the patient gradually repopulate the HAV, producing a tissue that has living cells and its own blood supply.

In this way, the acellular HAV may become a living tissue in the patient.

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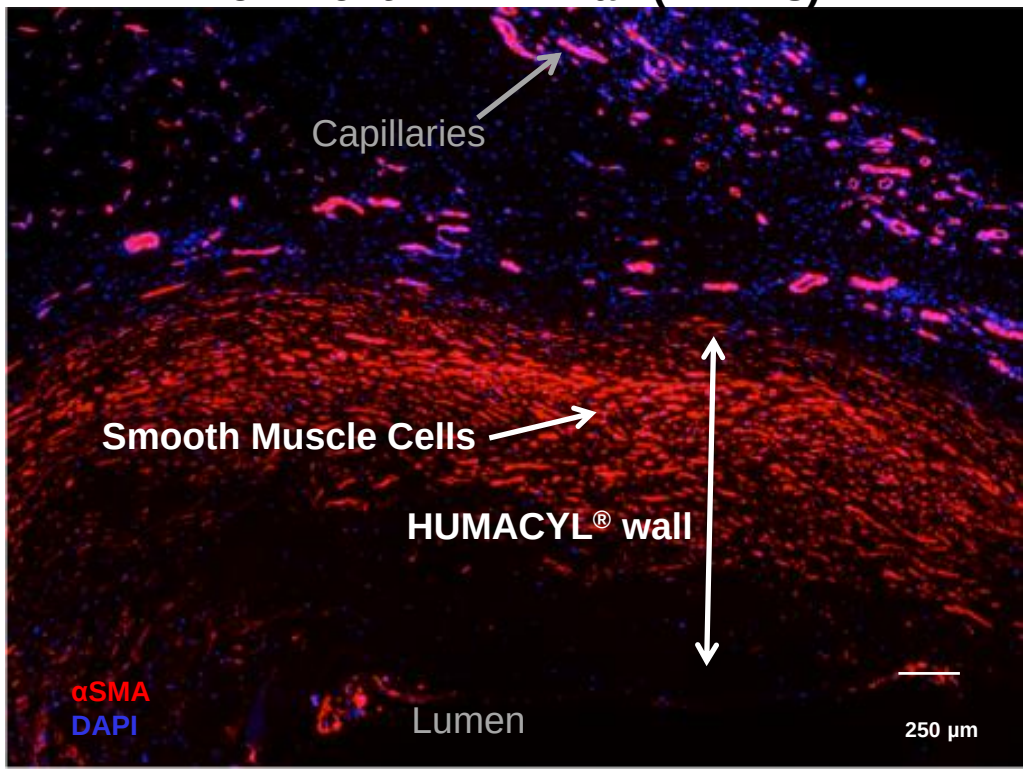
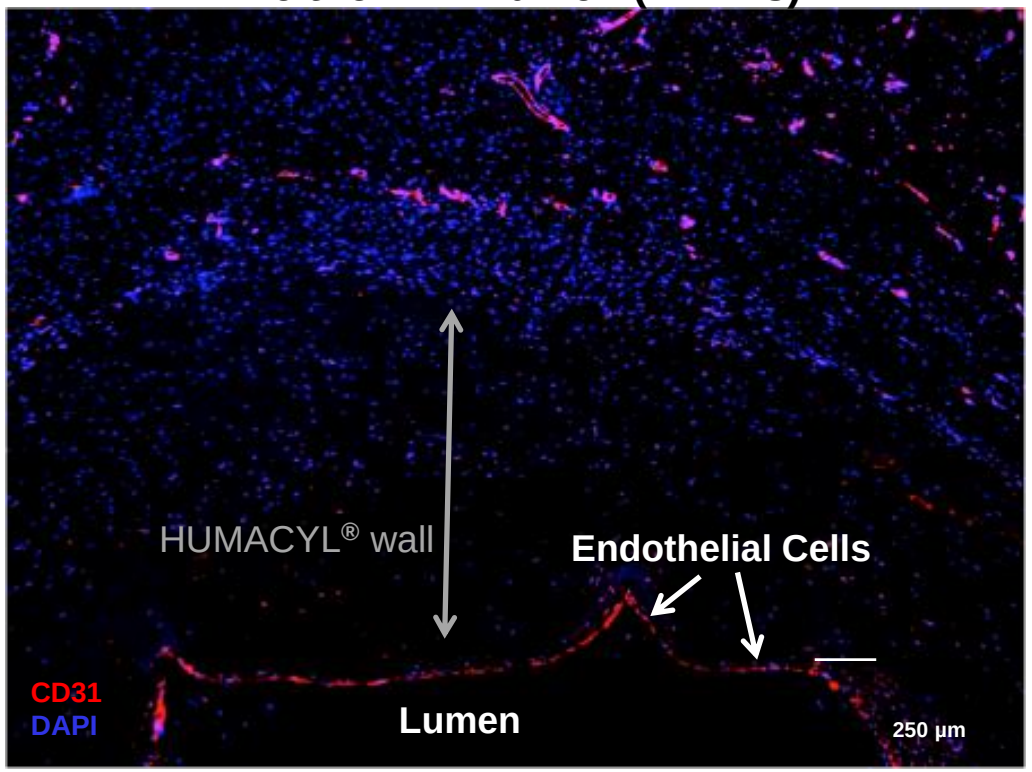
Evidence of Remodeling – Patient Cells May Repopulate the HAV

Smooth Muscle Cells (Red)
Prominent in HAV Wall (44 wks)[3]



Endothelial Cells (Red)
Line the HAV Lumen (44 wks)[3]



Clinical data[1,2] suggests HAVs become living blood vessels; HAVs repopulate with the patient's own cells.

[1] Samples were assessed at 16, 18, 22, 27, 37, 44, 55, 97, 100, 121, and 200 weeks.
[2] No evidence of chronic inflammation
[3] Explant from 01-001-V003, 44 weeks after implantation.

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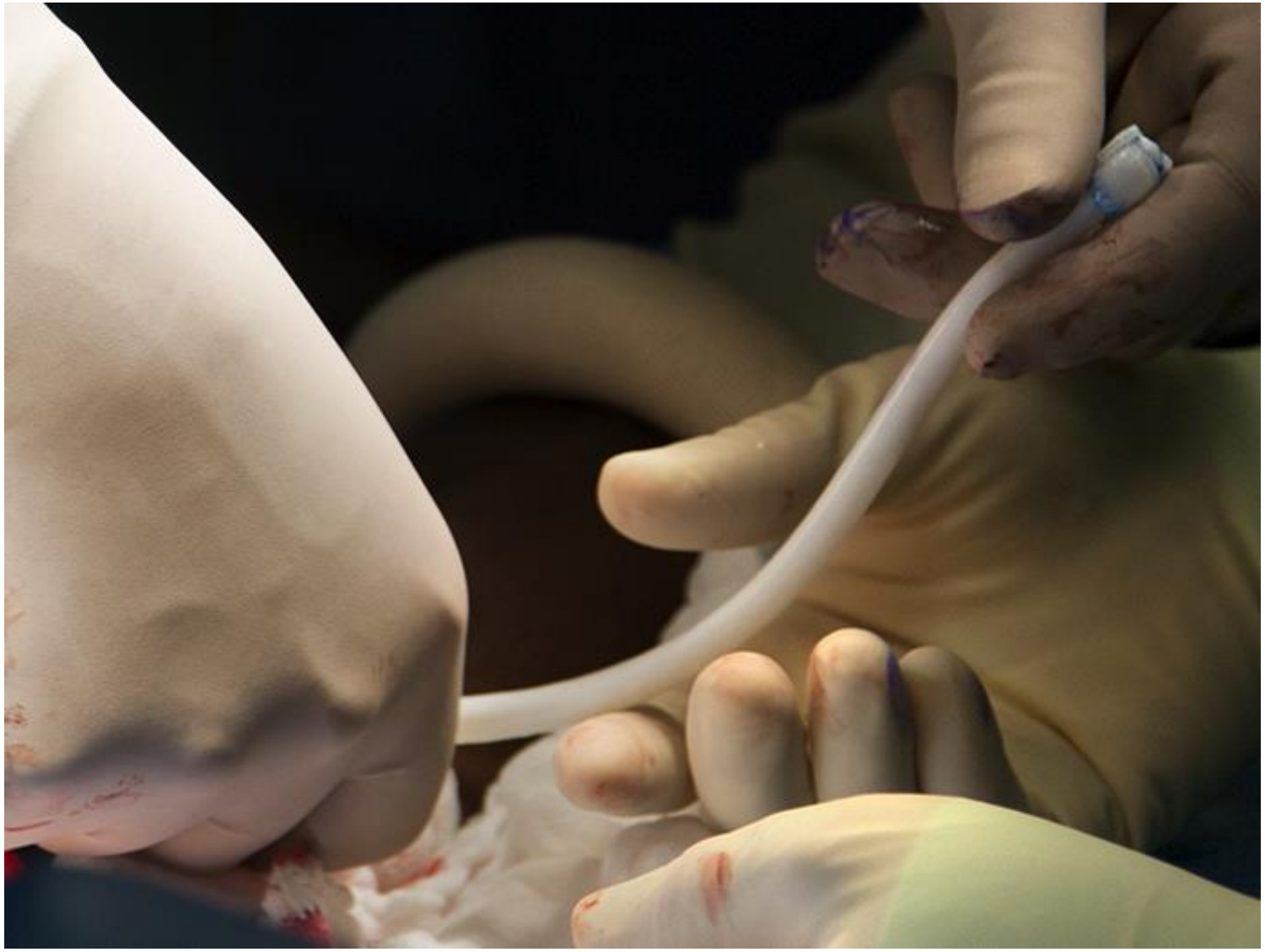
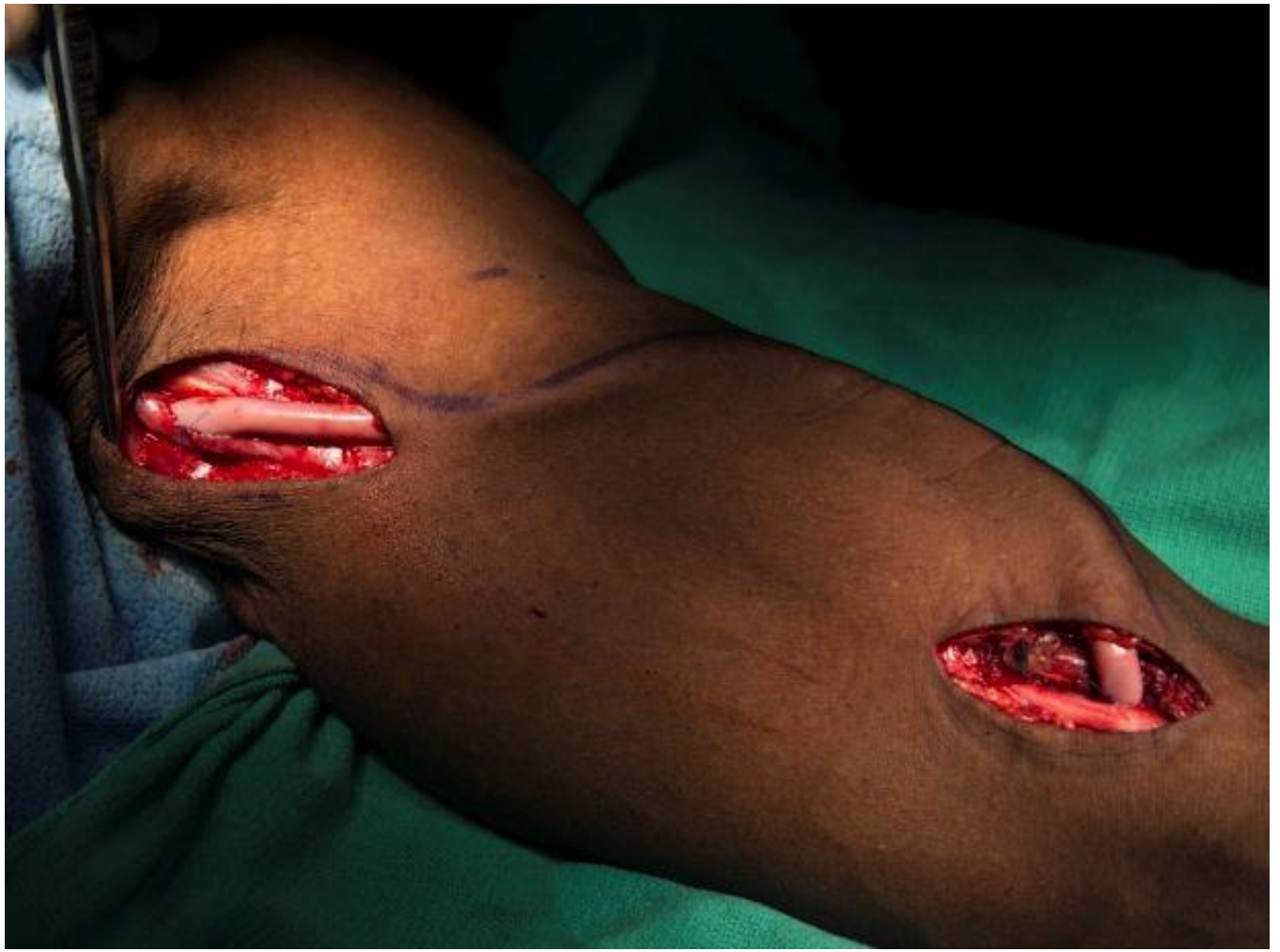
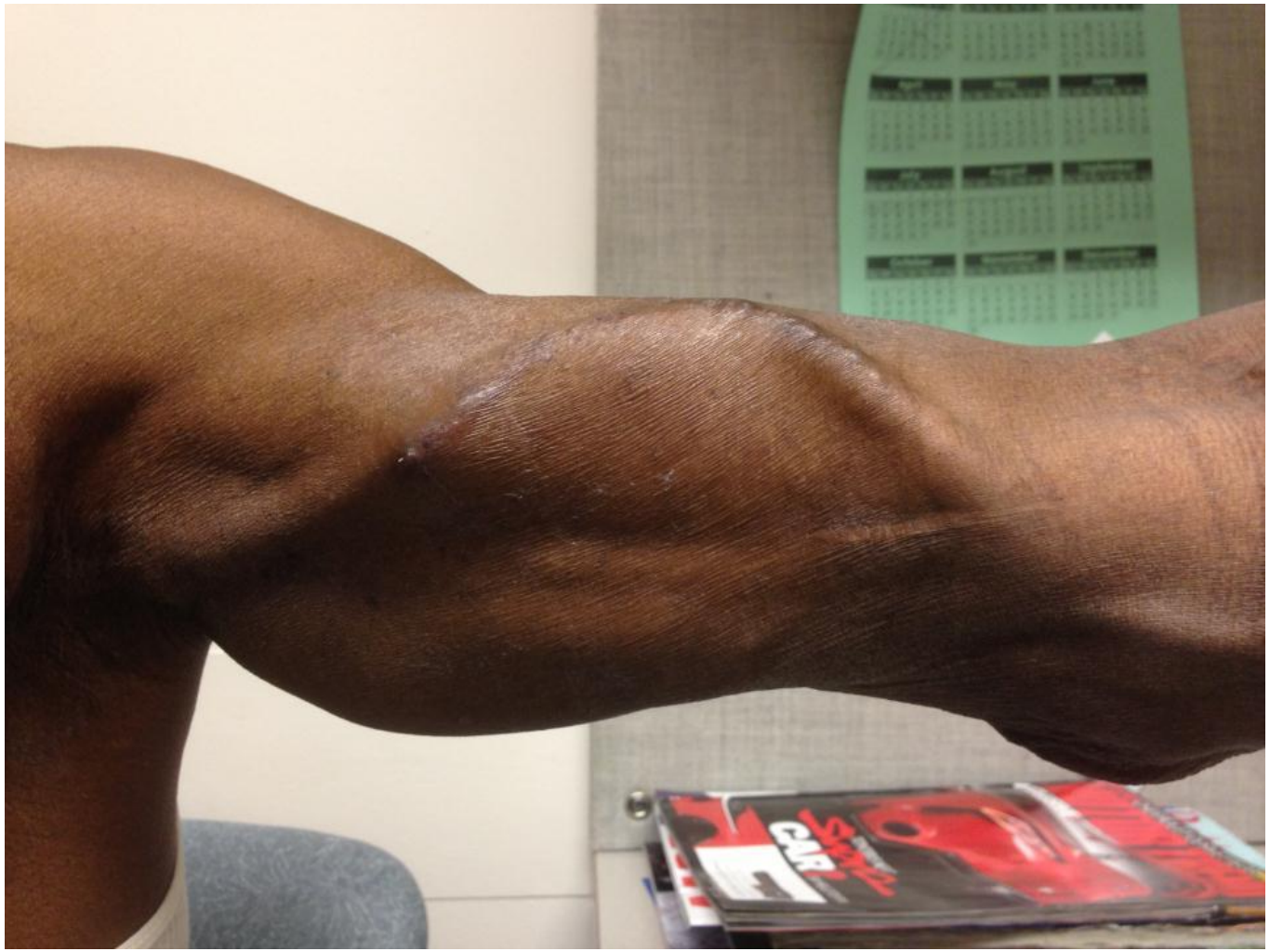
First US HAV Implant



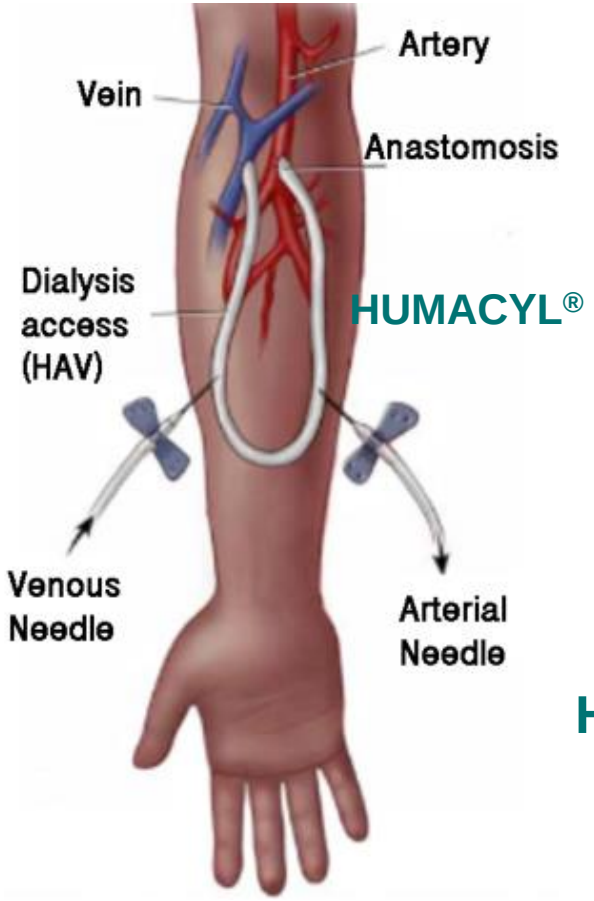
First US HAV Implant

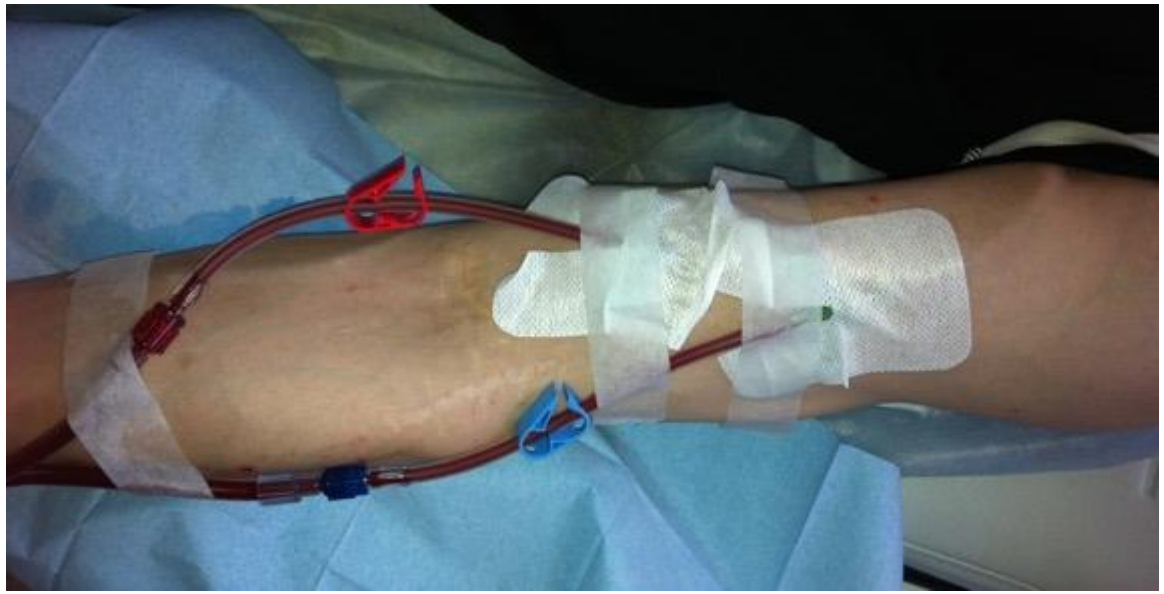


First US HAV Implant at 18 Months



HUMACYL® Vessel – *Our First Product Candidate, First Indication*





HUMACYL® Implanted for Hemodialysis Access

- 450 Patient years of exposure
- >50,000 dialysis sessions / cannulations

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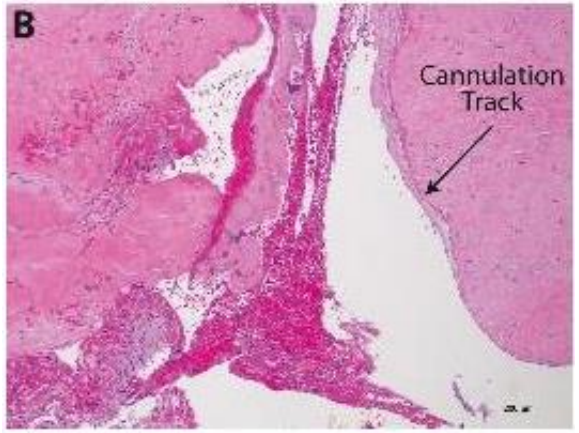
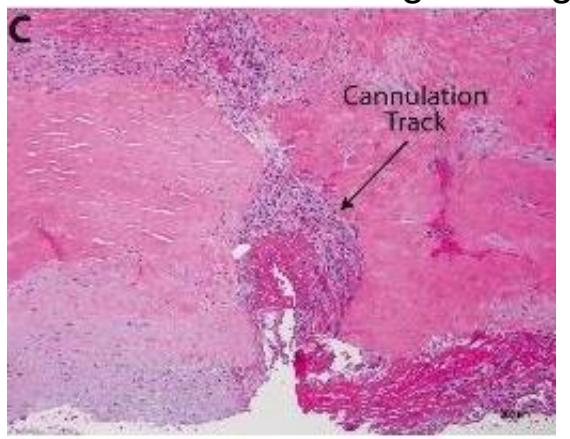
Clinical Evidence of Healing

Low magnification of 3 cannulation sites

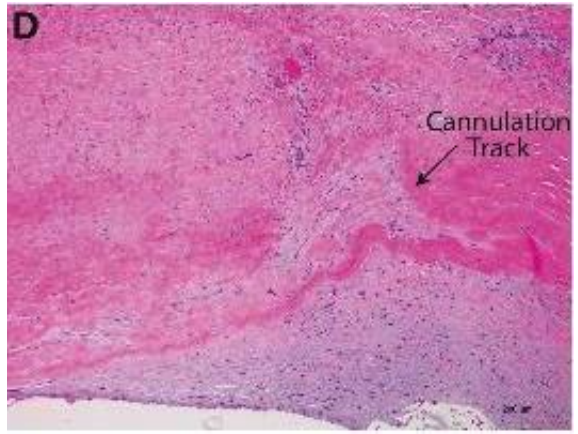
Fresh cannulation site



Cannulation site during healing



Cannulation site repaired



Repopulation with host vascular cells and angiogenesis enable healing

- **Clinical data[1] suggests after cannulation, HAV potentially heals to close the cannulation injury site. In contrast, PTFE has permanent cannulation injury with no healing.**

[1] HUMACYL® Patient CLN-PRO-V003 01-001 histology Phase II trial, 2014. unpublished data. A section of an implanted Humacyte graft removed at 11 months. All images are Hematoxylin & Eosin stain (H&E) (n=1)

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Lancet Publication – May 2016

Bioengineered human acellular vessels for dialysis access in patients with end-stage renal disease: two phase 2 single-arm trials

Jeffrey H Lawson, Marc H Glickman, Marek Ilzecki, Tomasz Jakimowicz, Andrzej Jaroszynski, Eric K Peden, Alison J Pilgrim, Heather L Prichard, Malgorzata Guziewicz, Stanisław Przywara, Jacek Szmidt, Jakub Turek, Wojciech Witkiewicz, Norbert Zapotoczny, Tomasz Zubilewicz, Laura E Niklason

Lancet 2016; 387: 2026–34
See Editorial page 1969 and 1970
See Comment page 1976

Humacyte, Durham, NC, USA
(J H Lawson MD PhD, H L Prichard PhD,

Summary

Background For patients with end-stage renal disease who are not candidates for fistula, dialysis access grafts are the best option for chronic haemodialysis. However, polytetrafluoroethylene arteriovenous grafts are prone to thrombosis, infection, and intimal hyperplasia at the venous anastomosis. We developed and tested a bioengineered human acellular vessel as a potential solution to these limitations in dialysis access.

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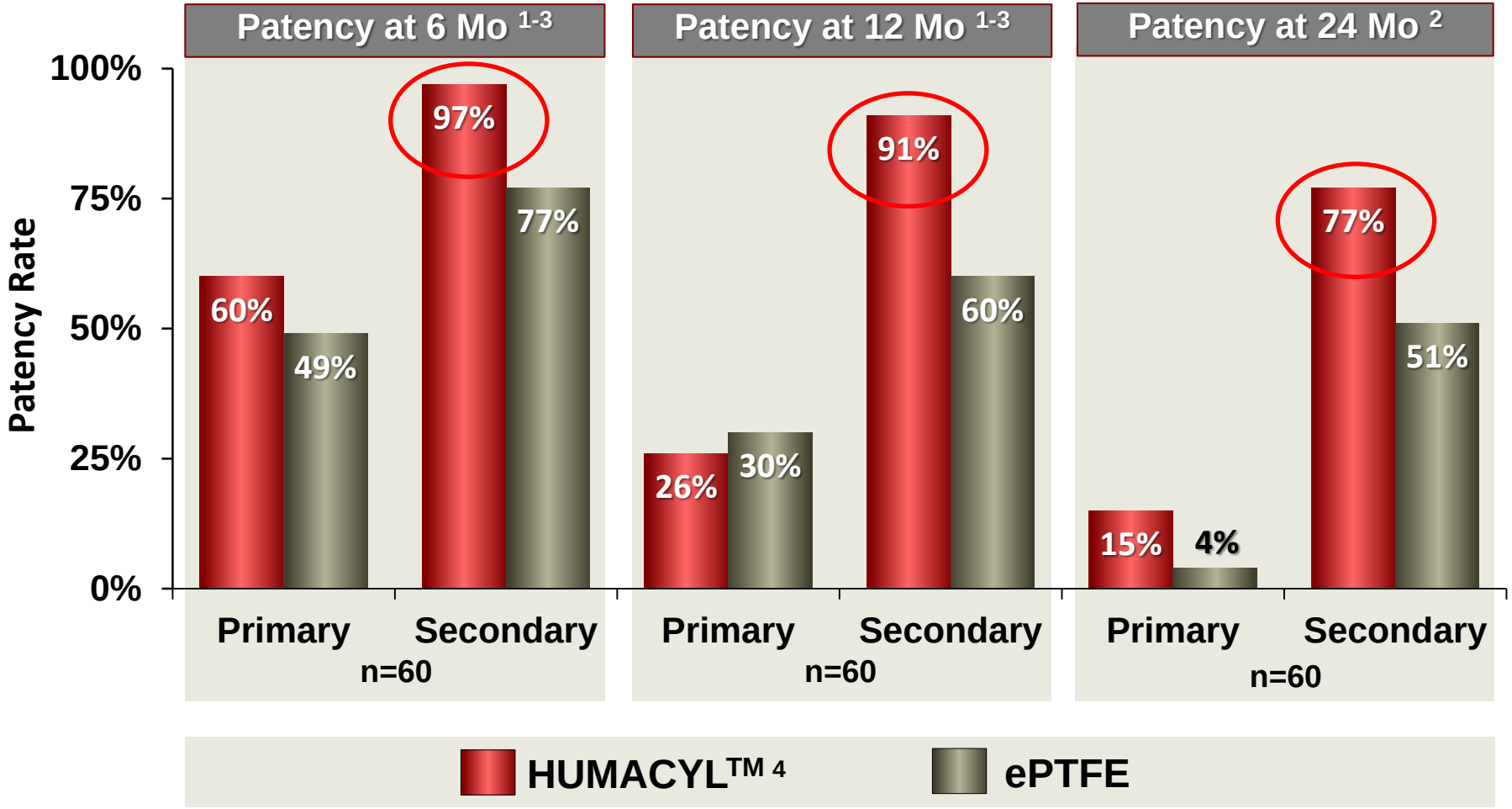
Superior HUMACYL™ Durable Patency



HUMACYL™ Phase II Data vs Estimated Historical ePTFE Data

Longer Durable Patency with a Similar Rate of Interventions

[1] Huber *Sem in Dial*, 2004,17:3.
[2] Miller *Am J Kid Dis, 2000,36:68.*
[3] Dixon, BS., *et al. NEJM,* 2009,5/21; 360(21), 2191-2201.
[4] Humacyte Phase II data, All pooled patients Poland and USA, CSR, as of May 2016.

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Humacyte Development Timeline

2004

Founded by Drs. Laura Niklason, Shannon Dahl, Juliana Blum
Morrisville, NC

2013

First human surgical implantation of human acellular vessel (HAV) at Duke University, NC

2014

Humacyte received Fast Track Designation for HUMACYL® for Vascular Access in Hemodialysis Program

2017

Humacyte Receives FDA Regenerative Medicine Advanced Therapy (RMAT) Expedited Review Designation for HUMACYL®

RMAT

2018

FMC and Humacyte announced global partnership supported by a $150M equity investment

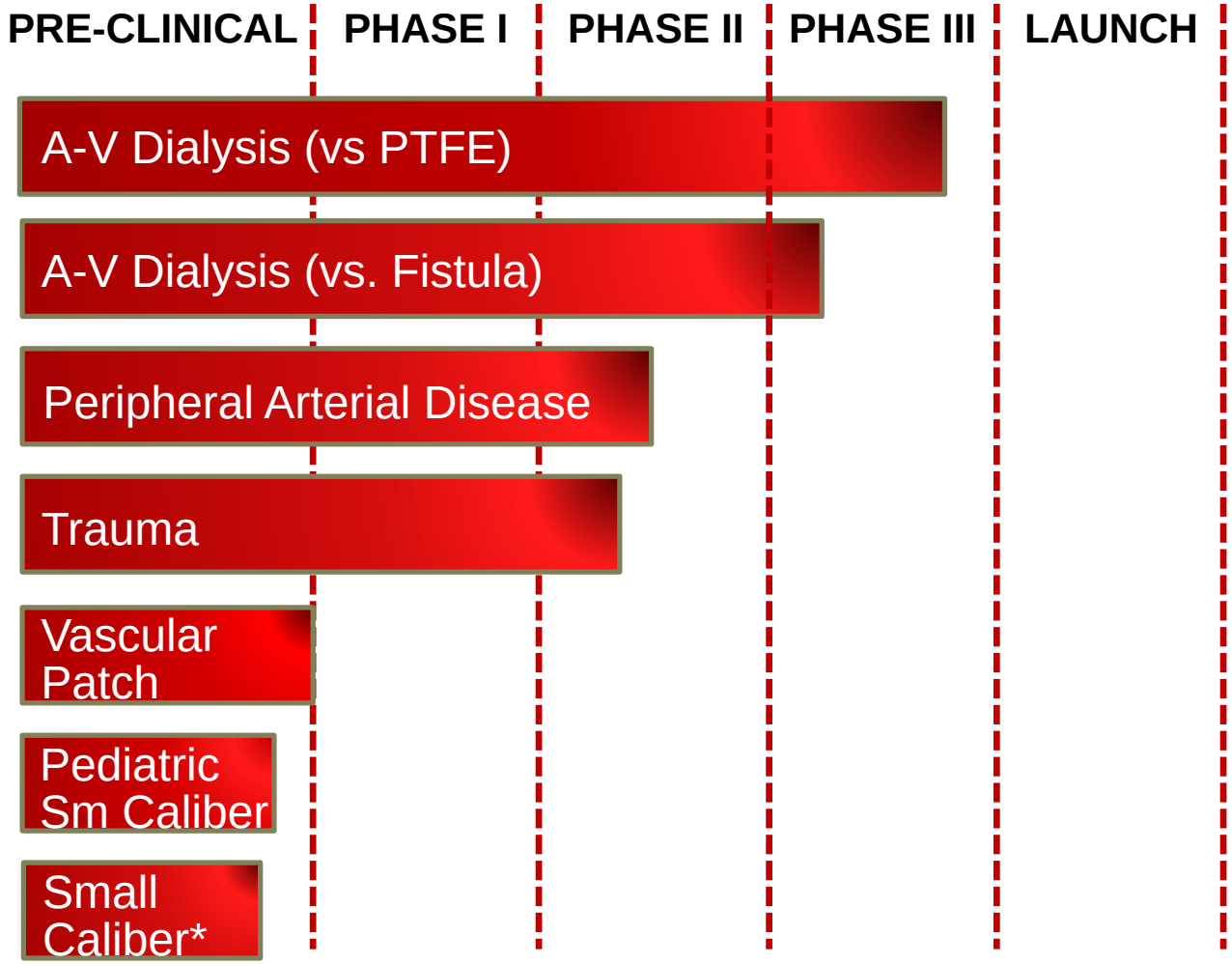
2020

Projected U.S. BLA submission for Vascular Access

2021 & Beyond

Vascular Access Product Launch & Future Indications (PAD, Trauma) for Vascular Repair & Reconstruction

Advanced Stage Clinical / Product Pipeline



*** Small Caliber for potential coronary bypass, below-the-knee and reconstructive applications**

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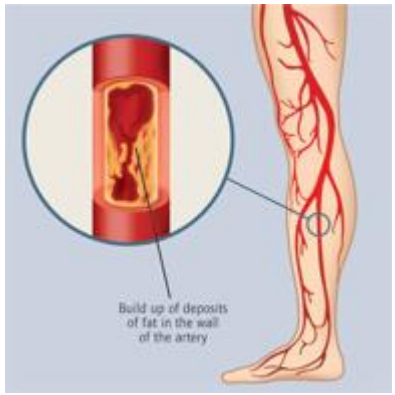
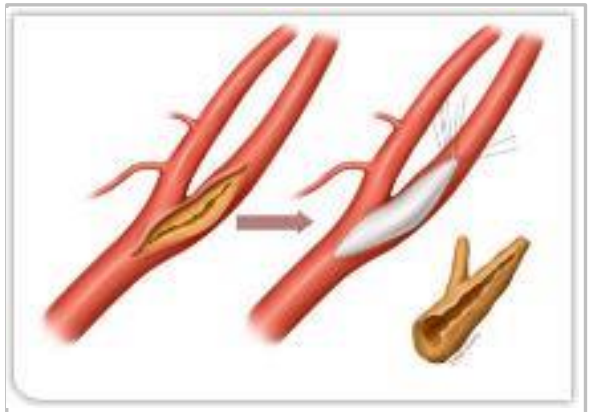
Significant Capacity to Pursue Platform Opportunities

85,000 sq ft Facility

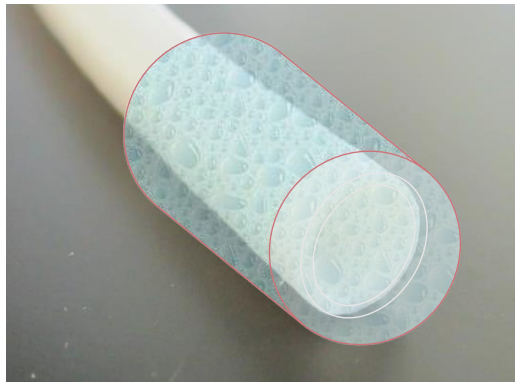


PAD - Above & Below the Knee

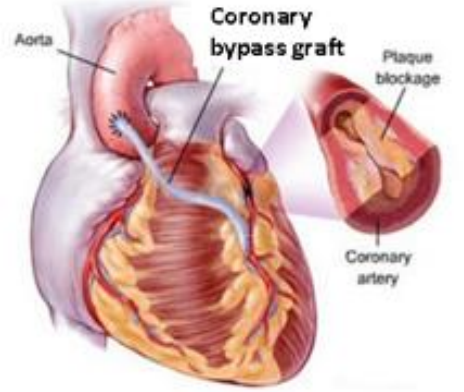
Vascular Reconstruction (Battlefield Trauma)



Vascular Patch



Implant to treat Type I Diabetes



Coronary Bypass

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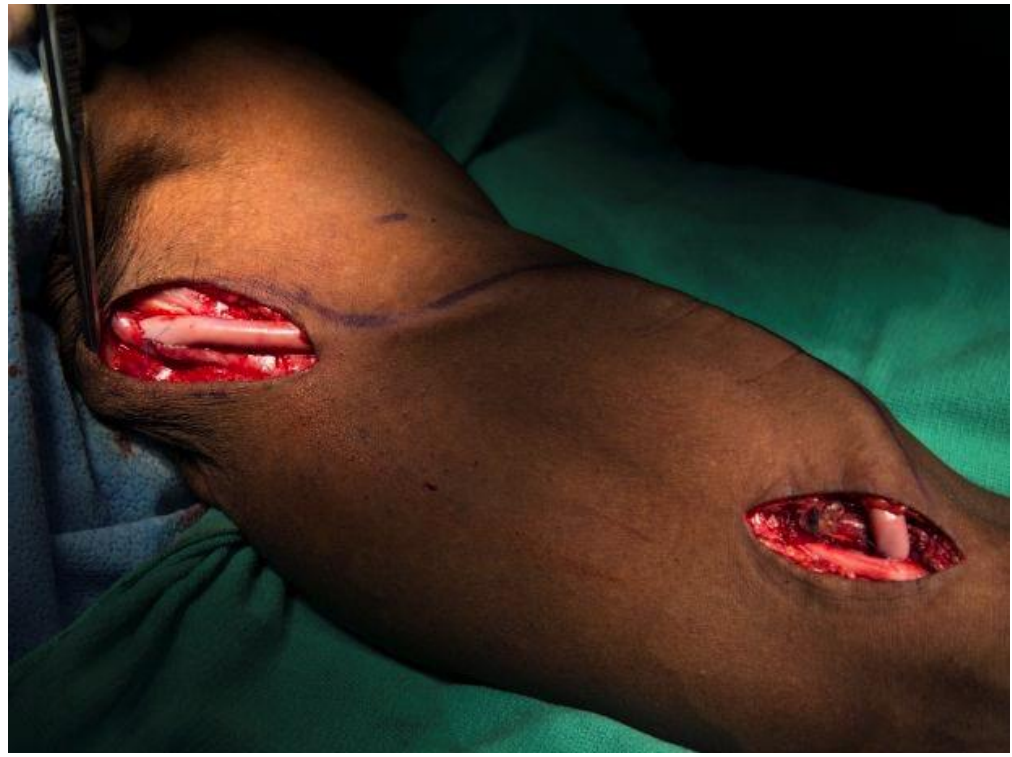
Humacyte – Summary and Next Steps

- Off-the-shelf bioengineered vascular tissues are possible
- Breakthrough innovation in large therapeutic areas serving significant unmet medical need
- Non immunogenic, integrate with native tissue, repopulate and remodel



- Complete Phase III clinical trial(s)
- Seek FDA approval
- Continuing to integrate the patient voice and perspective to our mission

HUMACYTE

Thank You

Humacyte Investigational Bioengineered Vessel may one day offer patients with an alternative option for dialysis access and peripheral arterial disease

We would like to thank those patients who have enrolled ongoing studies evaluating this investigational vessel

Learn more at www.humacyte.com

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