Tissue Engineering Human Blood Vessels

Jeffrey H. Lawson, M.D., Ph.D.
Chief Medical Officer
Humacyte Incorporated
Professor of Surgery and Pathology
Departments of Surgery and Pathology
Duke University Medical Center

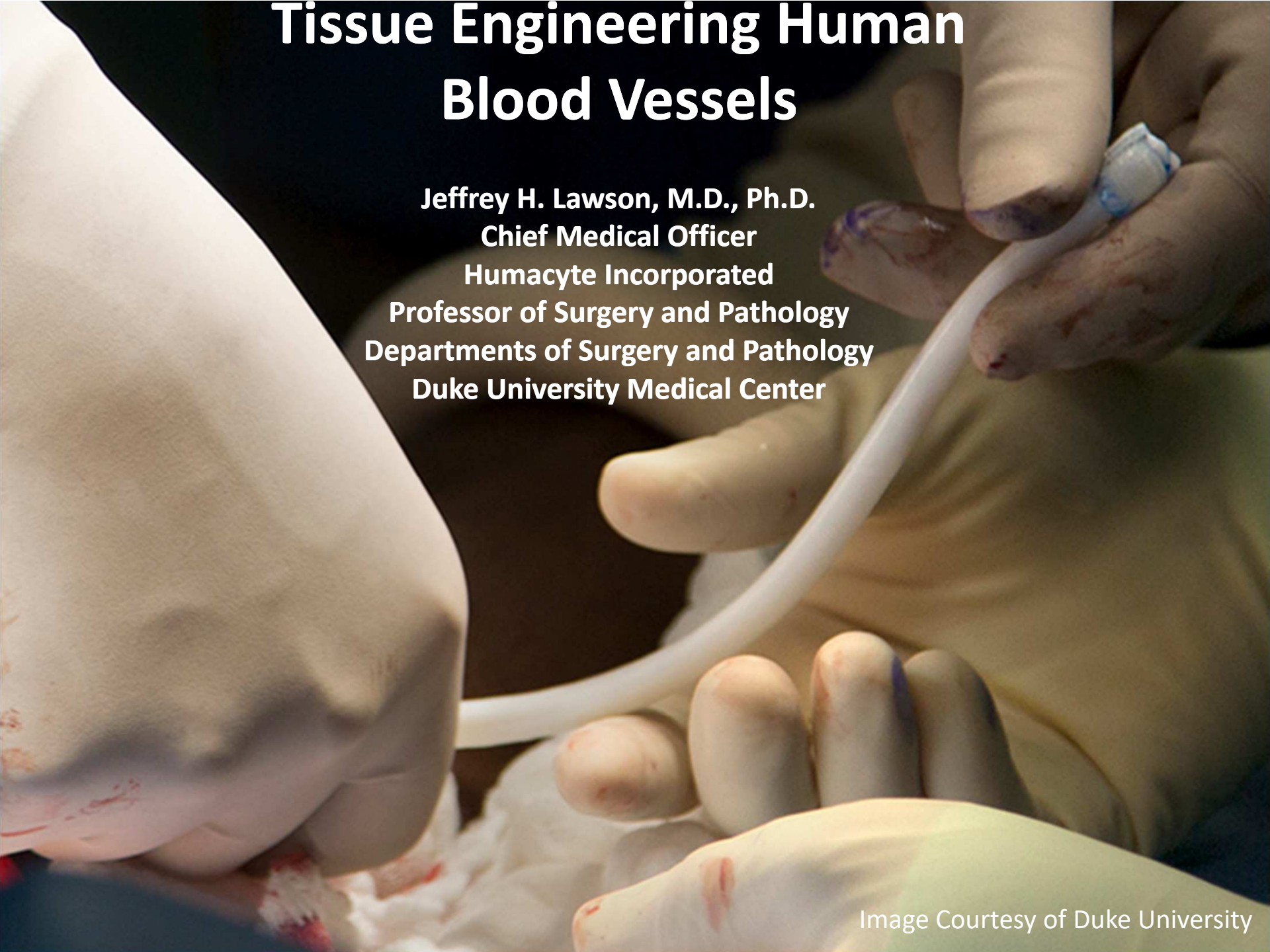


Image Courtesy of Duke University

Disclosure Information

Financial Disclosure and Conflicts:

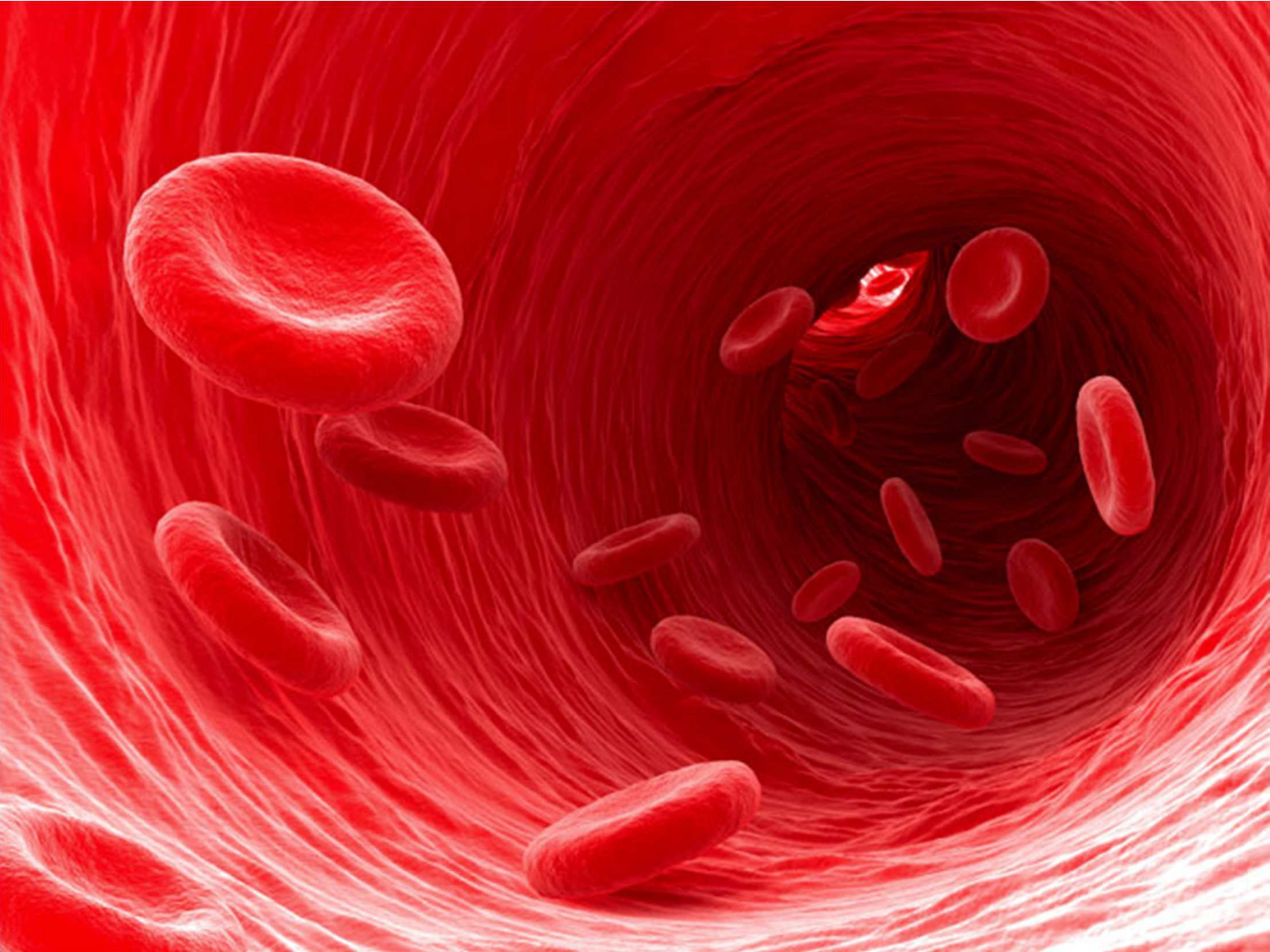
Humacyte Chief Medical Officer: Salary, Stock Options and (past) Research Funding

Disclaimer:

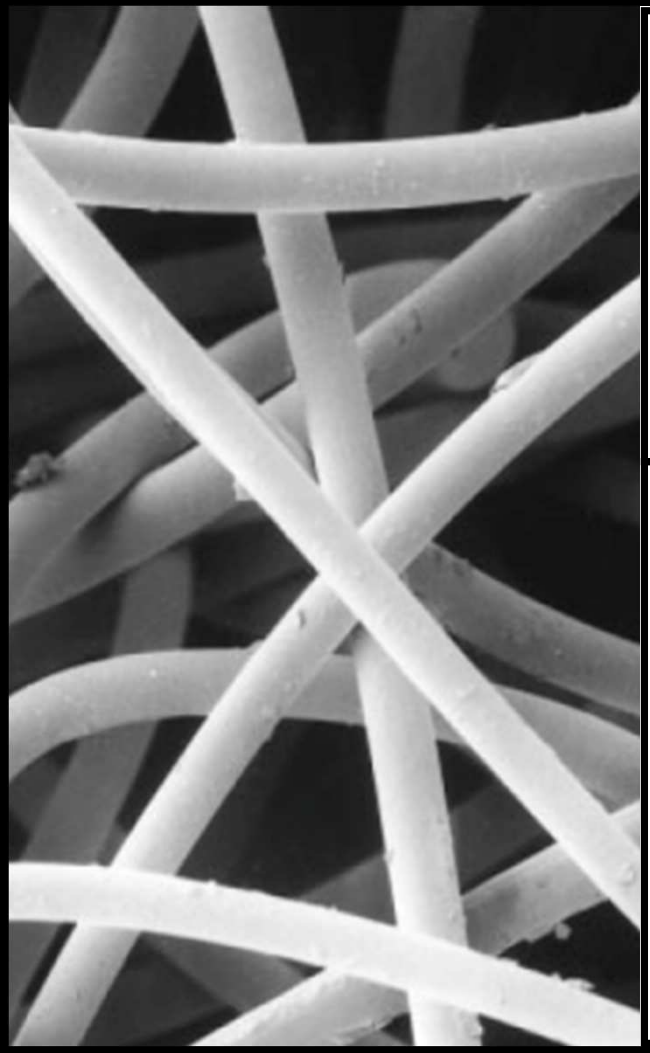
The Humacyte investigational bioengineered vessel is an investigational biologic currently being studied in Poland and the US to evaluate its potential safety and preliminary efficacy when used as a vascular access in patients with End Stage Renal Disease requiring hemodialysis and in patients with Peripheral Arterial Disease.

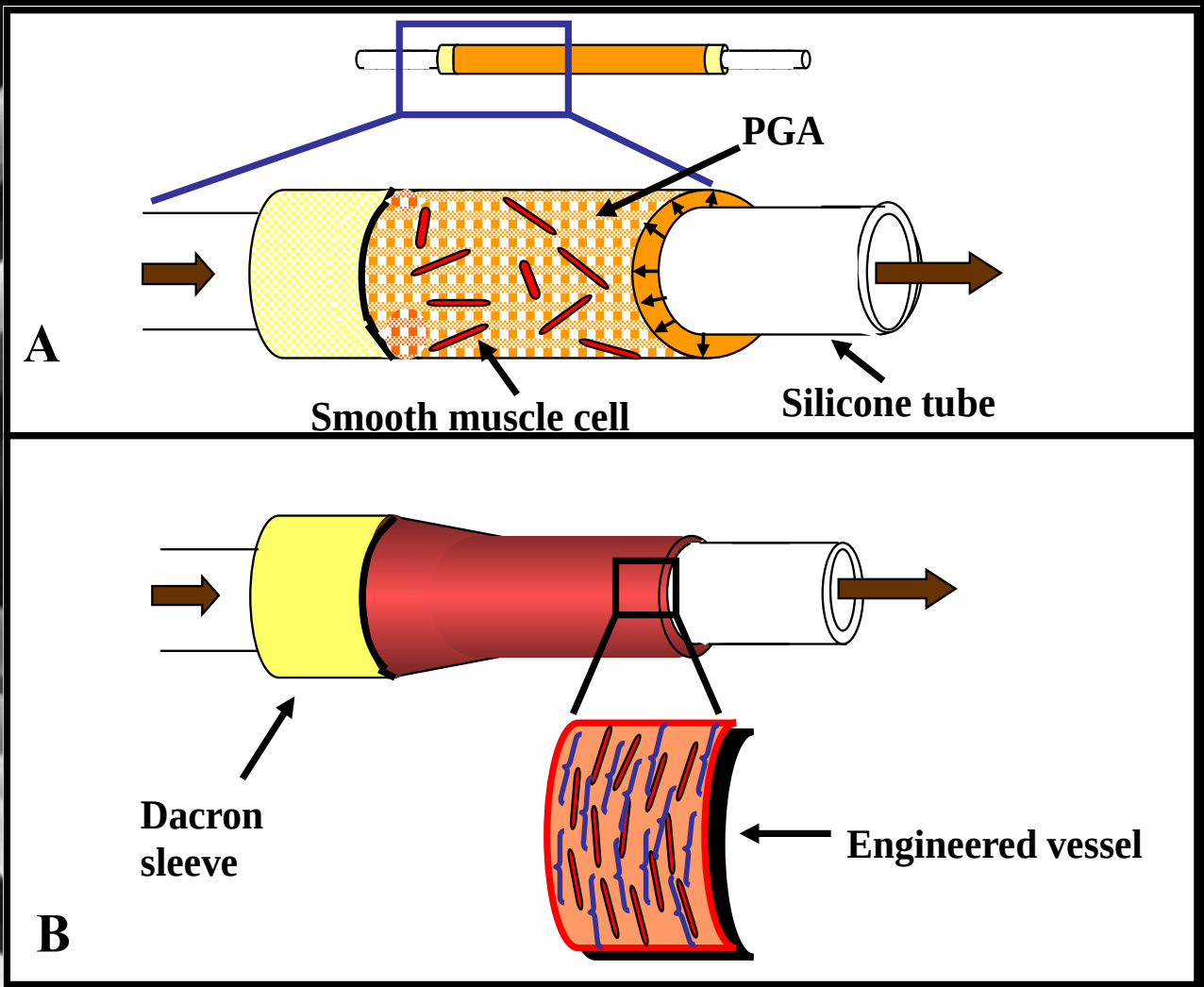
This investigational product has not been submitted for regulatory approval by the FDA or any other regulatory authority. Both the clinical significance of the data reviewed in this presentation, and any potential future indication(s), warnings, precautions, and adverse reactions are unknown at this time.

This presentation includes unpublished data as of September, 2016.

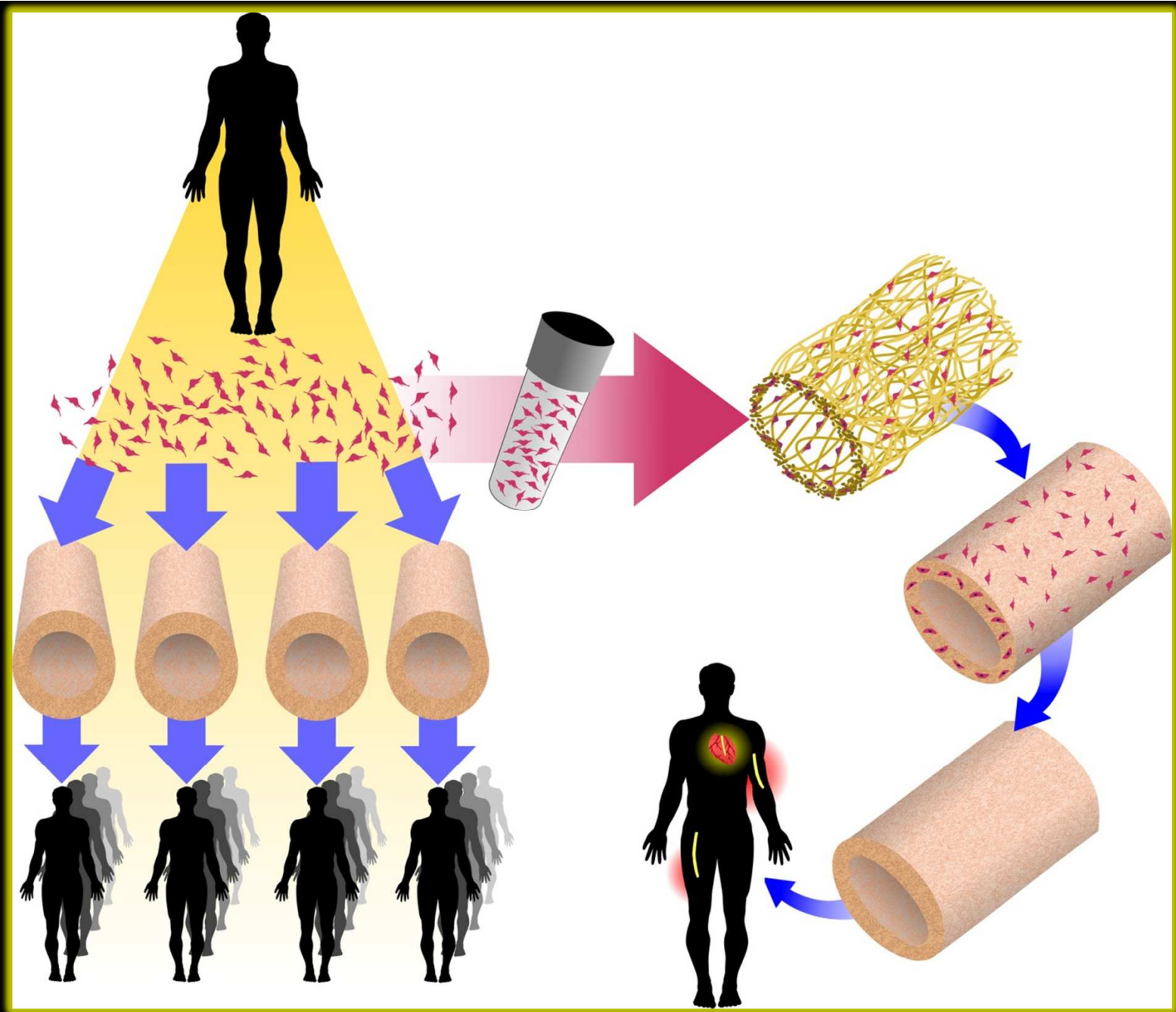


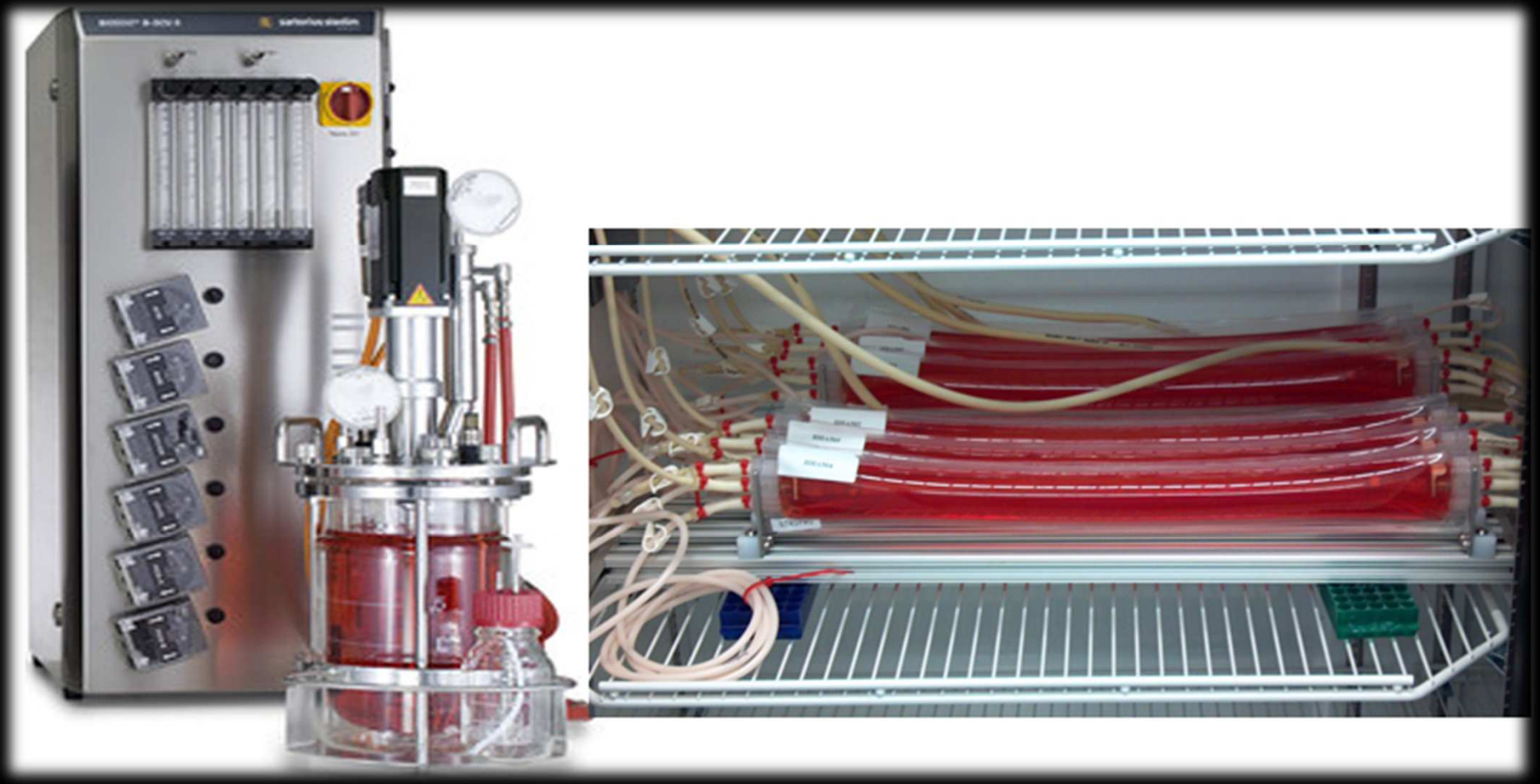
Polymer scaffold is designed to guide tissue shape ...

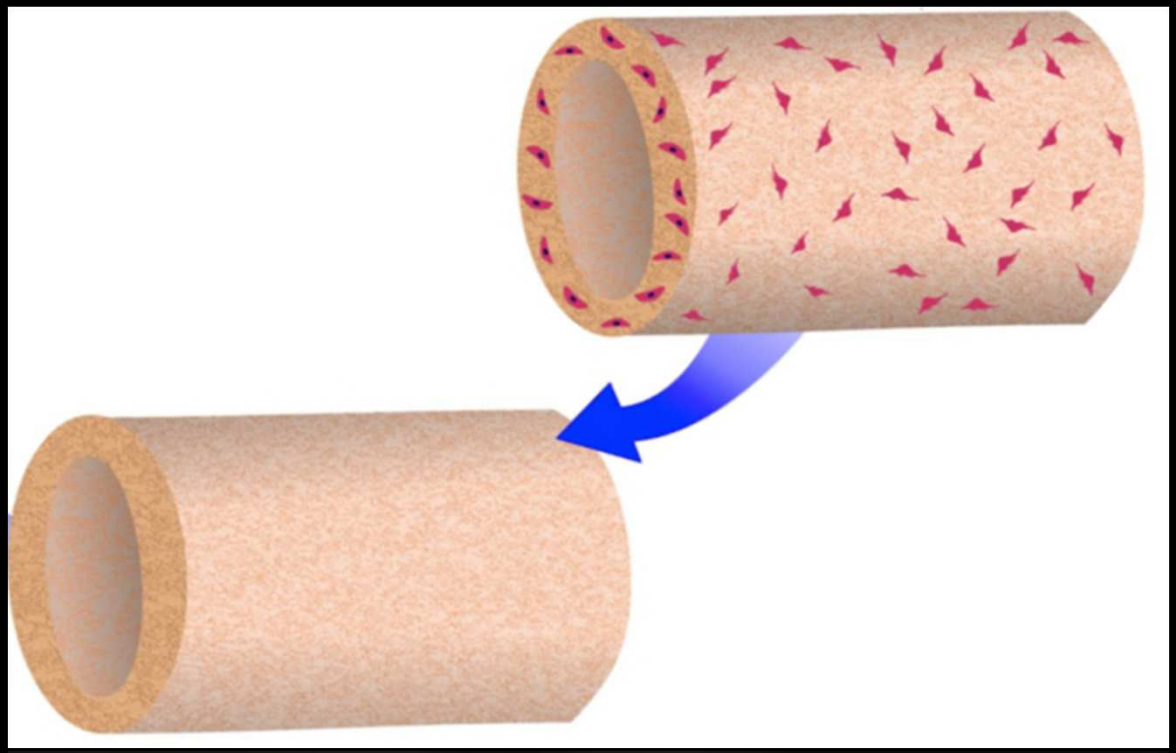




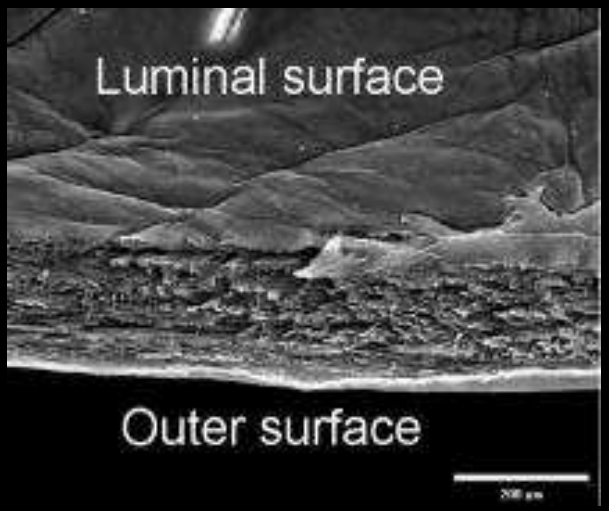
... and designed to degrade



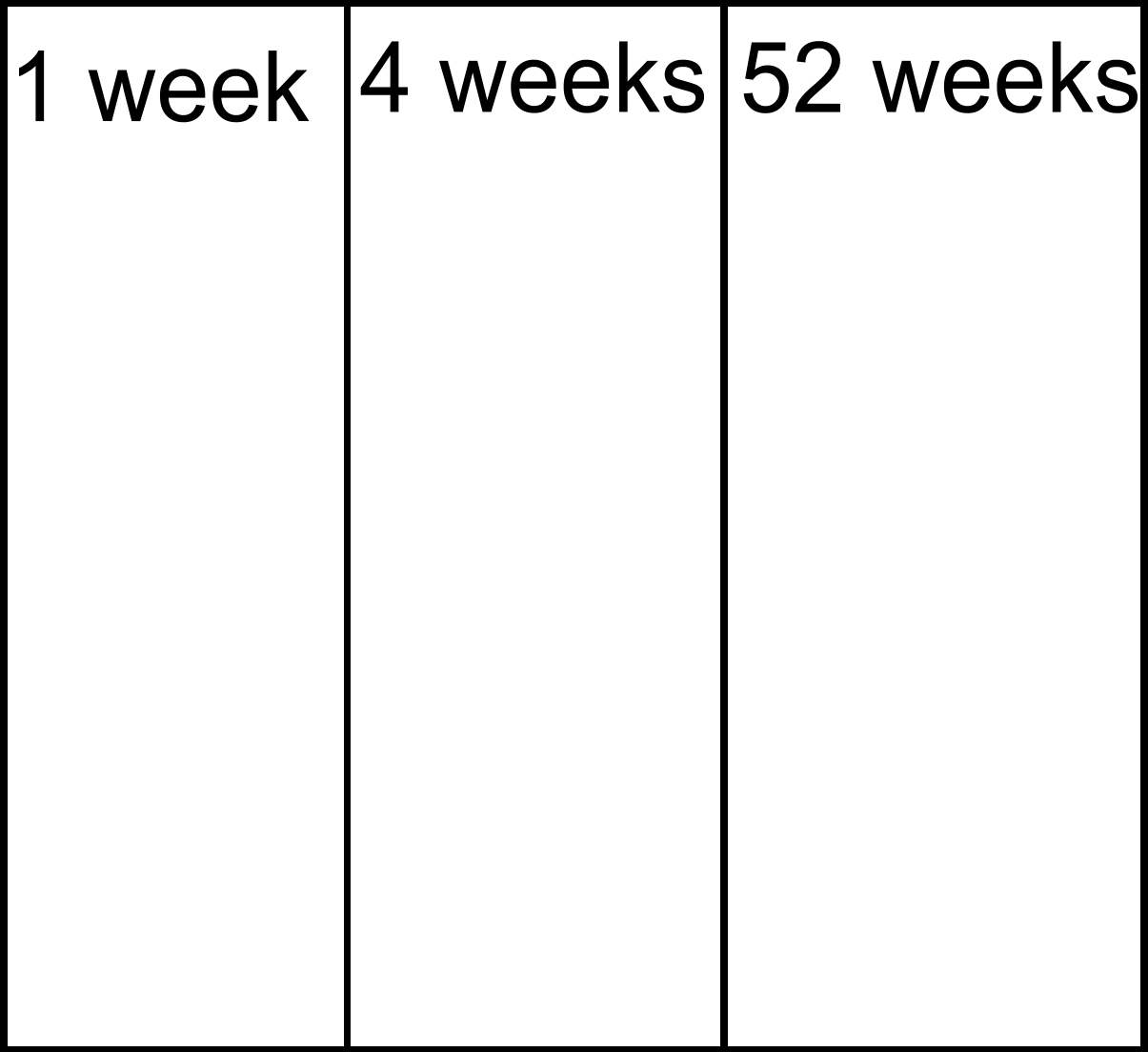




	Suture Strength (g)	Burst Pressure (mmHg)
HAVG	181 ± 18 (16)	3337 ± 343 (10)
Human saphenous vein	196 ± 29 (7)	1599 ± 877 (7)
Human internal mammary artery	138 ± 50 (6)	3196 ± 1264 (16)

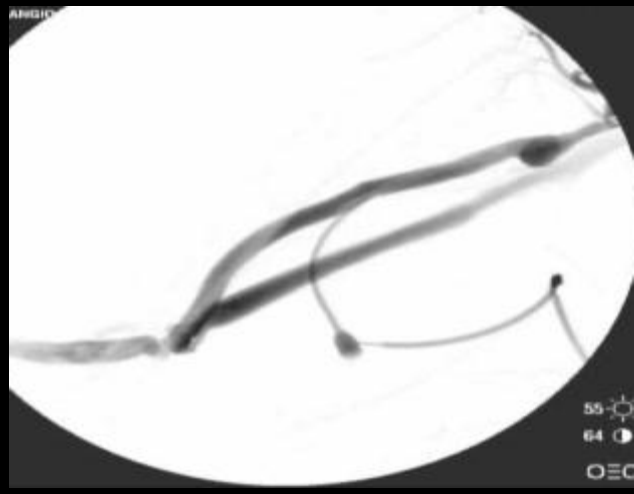


Kink Radius

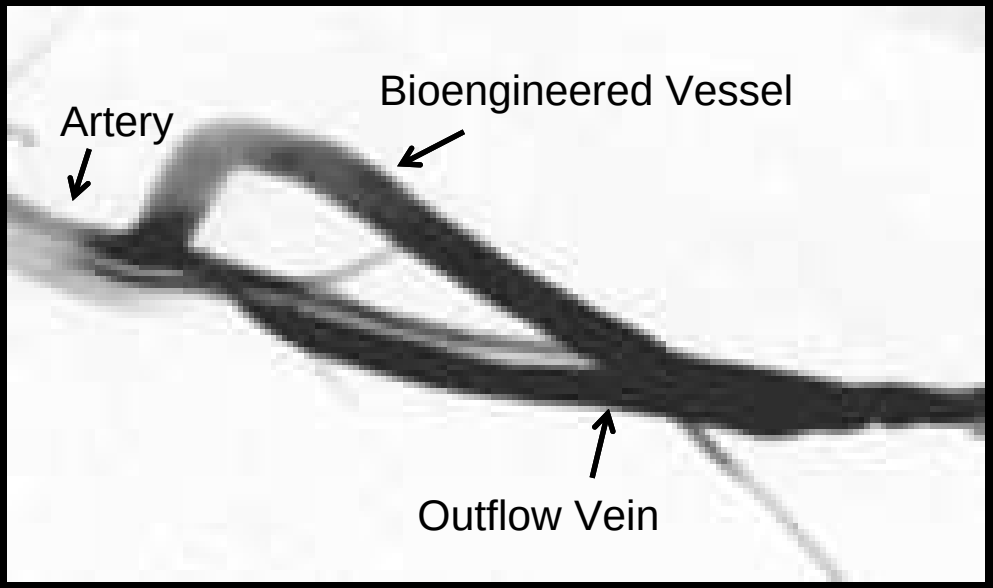


Long-term durability

Dahl et al., *Sci Transl Med*, 2011, 68ra9.

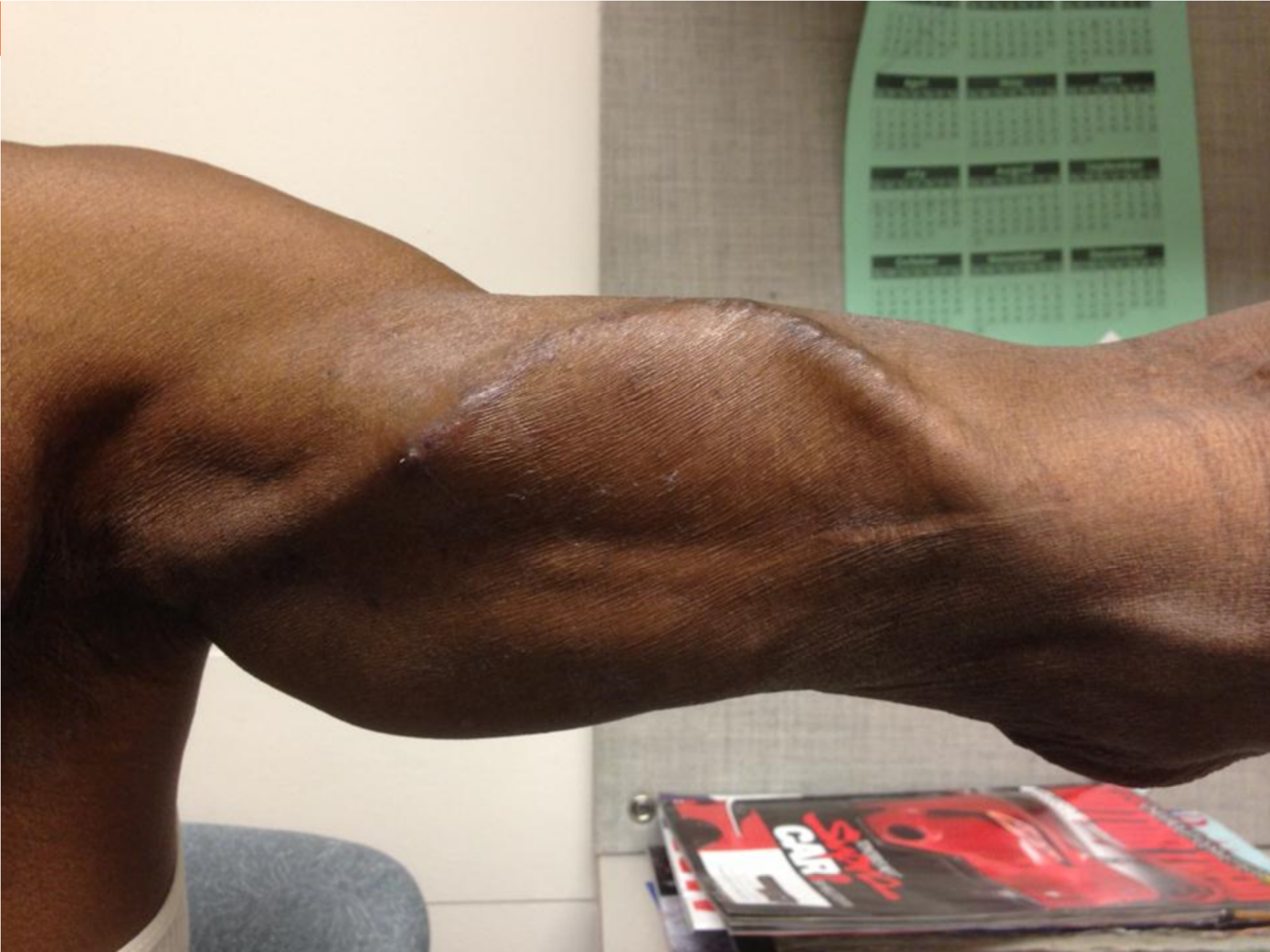

55
64

Bioengineered Vessel

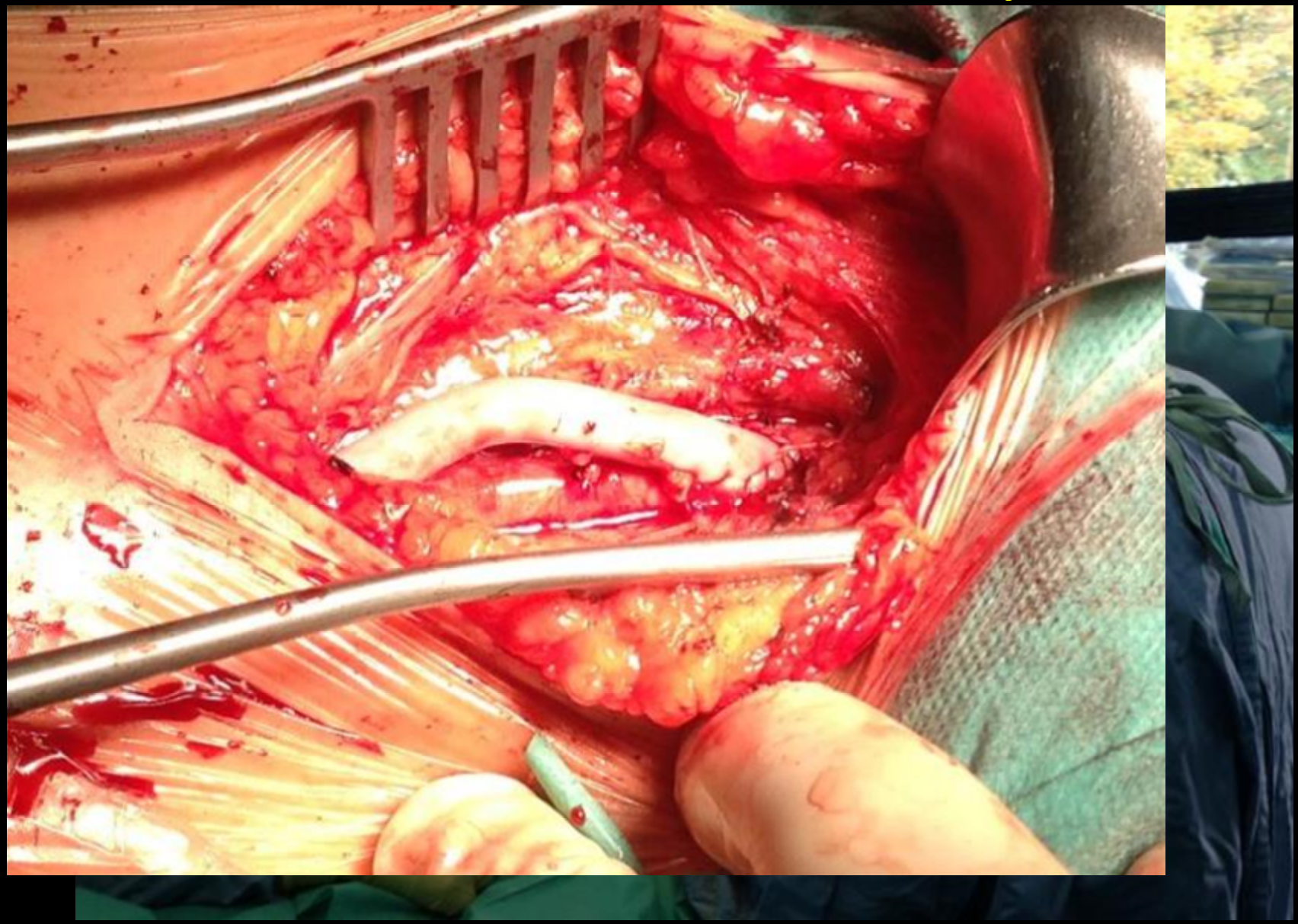


Dahl et al., *Sci Transl Med*, 2011, 68ra9.

6 Month Explant


CAR

First Arterial Fem-Pop Bypass
Szczecin Poland: October 11, 2013



Humacyte Phase 2 Human Studies

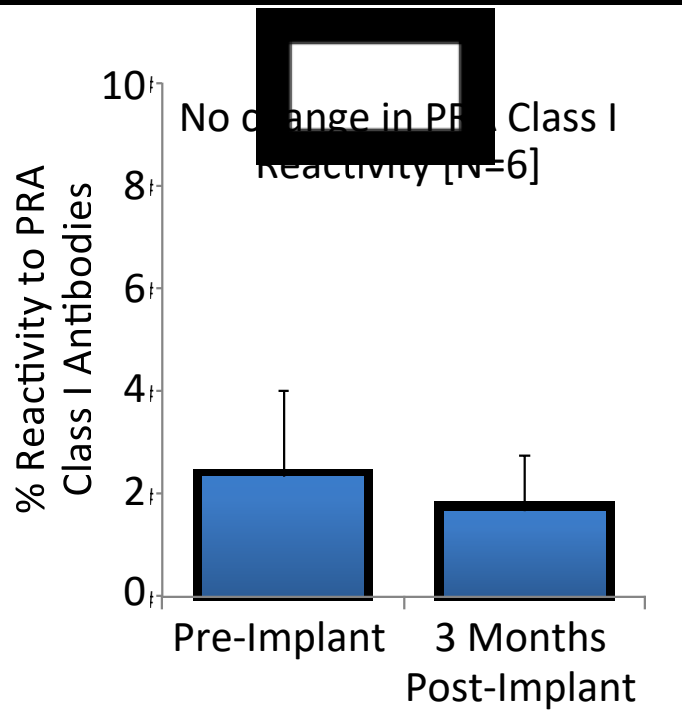
Phase 2 Study	AV Access Poland	AV Access USA	PAD Poland
First Patient Enrolled	Dec 2012	Jun 2013	Oct 2013
Last Patient Enrolled	May 2014	Jul 2014	Jun 2014
Total Number of Patients	**40**	**20**	**20**
Last subject, last visit (2 years)	May 2016	Jul 2016	Jun 2016
Database closure	Jun 2016	Aug 2016	Jul 2016
Final signed study report	Sep 2016	Nov 2016	Oct 2016

- Studies continue to proceed well
- No safety signals seen related to implanted vessel failure
- Excellent vessel durability (longest implant now approaching 4 years)
- Patients followed longitudinally up to 5 years - ongoing

Lancet Publication – May 2016

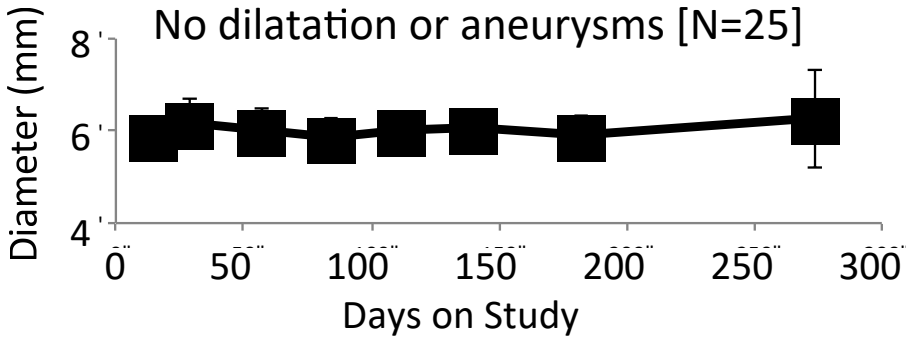
First-in-Man Human Implants (6 months)

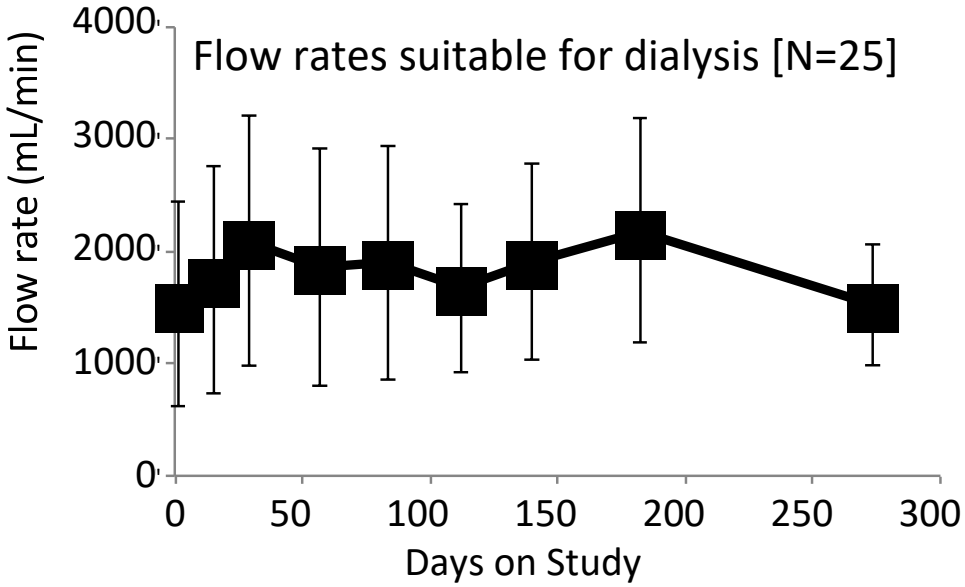
No indication of immune response



- 0% reactivity to PRA Class 2 in pre- & post-implant measurements [N=6]

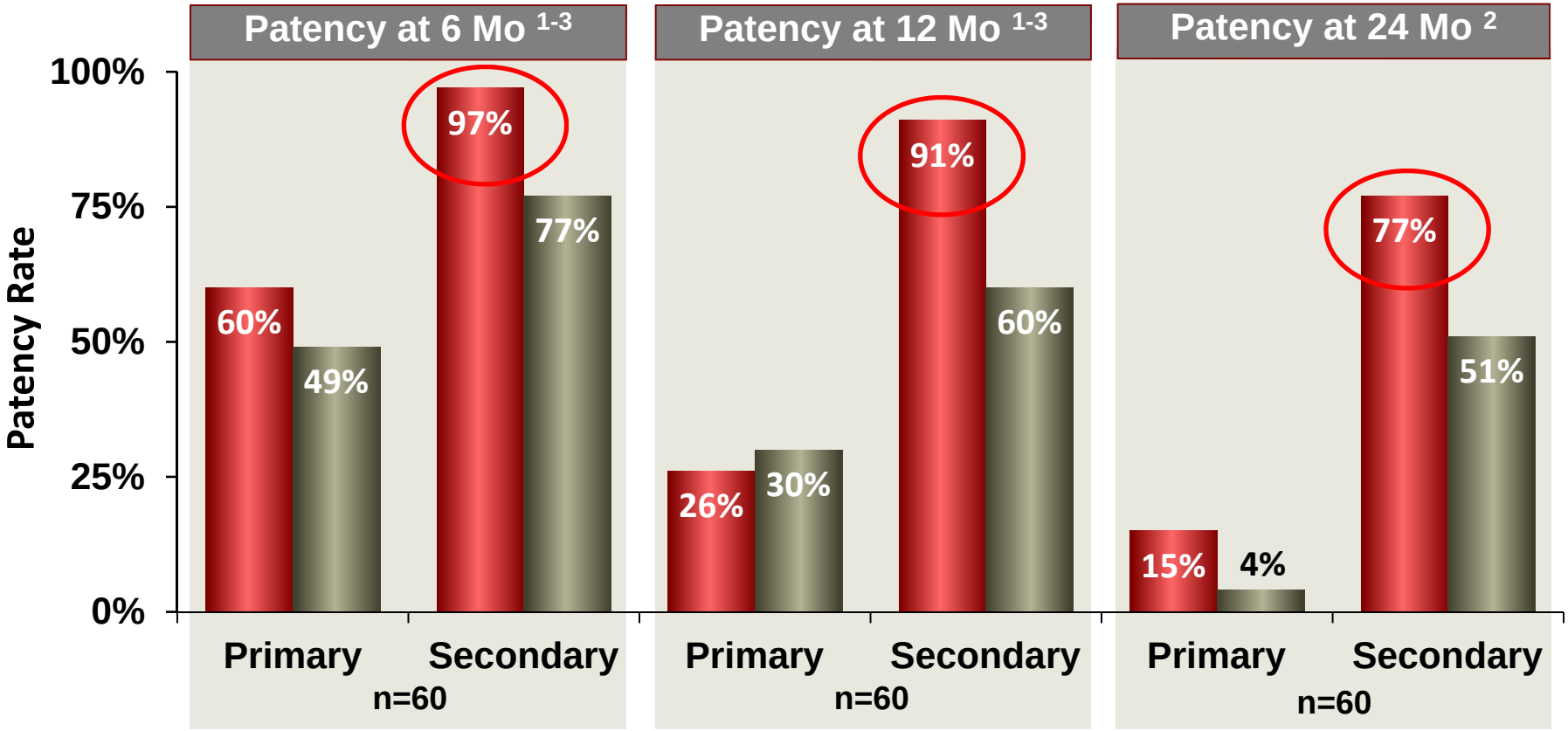
No evidence of structural failure





Lawson et al., *American Heart Association Meeting, Dallas TX* , 2013

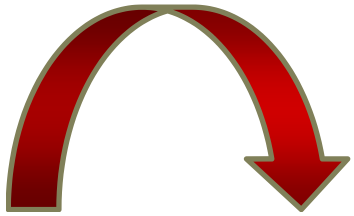
Superior HUMACYL™ Durable Patency



HUMACYL™ Phase II Data vs Estimated Historical ePTFE Data

[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.

Humacyte Vessel Repopulates with the Patients Own Progenitor Cells in Human Recipients



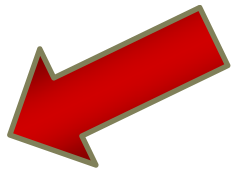
- CD68+ Monocytic cells repopulate early
- At later time points, aSMA+ cells (derived from CD68+ cells) occupy the matrix.

Healing of the Needle Cannulation Tract (Explant at 44 weeks)

H&E

CD68 Immunostain (brown)

aSMA Immunostain (brown)



Lumen

Lumen

Lumen

- Needle cannulation sites re-populate with blood-derived monocytic CD68+ cells, may contribute to smooth muscle.

Vessel Lumen Repopulates with the Patients Own (CD31+) Endothelium Following Implantation

CD31 Immunostain (brown) 16 weeks:

44 weeks – mid-graft:

55 weeks – anastomosis:

Lumen

Lumen

Lumen

- Endothelial staining visible at anastomoses, and at the mid-graft. Likely derived from circulating endothelial progenitor cells (EPCs).

Ongoing Phase 3 Study (HUMANITY Trial)

- **Clinical Study**
  - 350 patients – head to head vs. ePTFE
  - 6 countries, ~ 40 sites
  - 2 year follow up
  - Primary end point – secondary (enduring) patency
  - Secondary end points – infection and intervention rates

- **Regulatory Status**
  - US, UK, Israel and Poland approved and enrolling patients
  - Germany and Portugal approval pending

- **Operations**
  - Successful vessel manufacturing, quality assurance and vessel release
  - Successful vessel distribution to US, European and Israeli sites
  - First patient enrolled May 2016. **169 patients as of Jan 2017**
  - Projected enrollment through August 2017.

Thank You