Tissue Engineered Vascular Grafts



***Nevena Slavova**, Prof Frederik Claeyssens, Dr Nicola Green*
Department of Chemical and Biological Engineering,
Kroto Research Institute, Red Hill, Sheffield City Centre, S3 7HQ
nslavova1@sheffield.ac.uk

TERMIS EU-Chapter PALMA DE MALLORCA 21-24 APRIL / SPAIN
termis EUROPE
University of Sheffield
UKRI Engineering and Physical Sciences Research Council
TERUMO Aortic

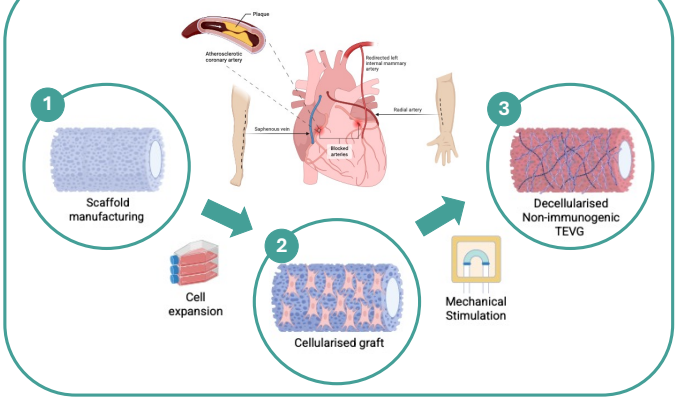
Why do we need tissue engineered vascular grafts (TEVG)?

Globally, 1 in 12 people live with a cardiovascular disease and are at risk of having a heart attack. Coronary artery bypass surgery is a standard but complex life-saving procedure to treat severe coronary disease. It is performed to restore insufficient blood flow to the heart caused by vessel occlusion, using a graft.

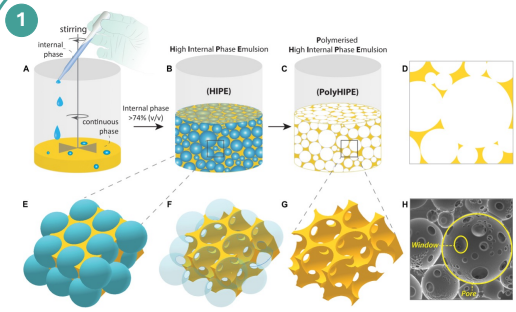
Current drawbacks, TEVGs could overcome as the next-generation graft:

- **Remove risk of donor site morbidity and improve patency**
- **Off-the-shelf non-immunogenic potential**
- **Small-diameter application without compliance mismatch and thrombosis**

Project Aims



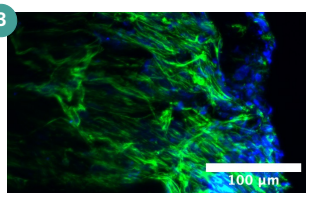
Methods

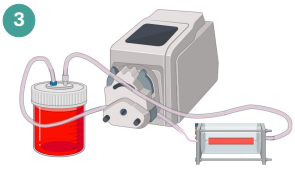


Emulsion templating of high internal phase emulsions with poly (glycerol sebacate) methacrylate

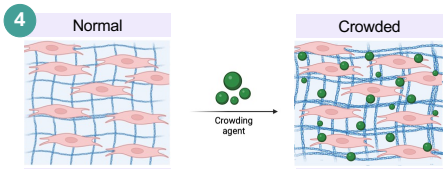


PGSM polyHIPE grafts after injection moulding

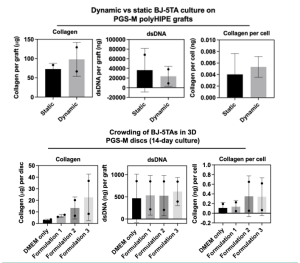




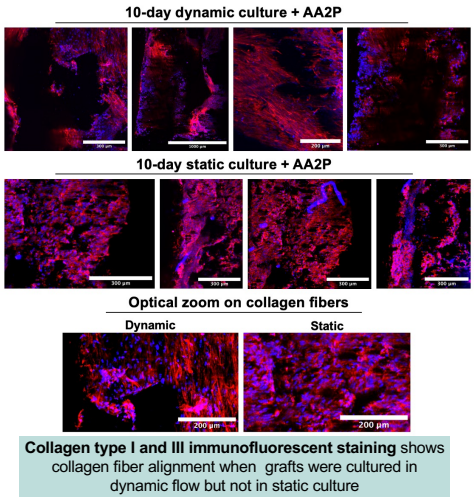
Flow dynamic cell culture of dermal fibroblasts



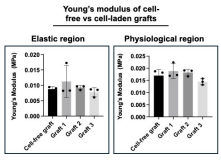
Results

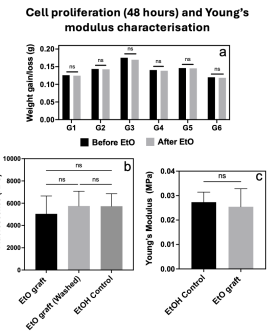


Dynamic flow culture and crowding **increase collagen** production per cell



Collagen type I and III immunofluorescent staining shows collagen fiber alignment when grafts were cultured in dynamic flow but not in static culture





Ethylene oxide sterilisation of PGSM grafts has **no effect on**:

a. Graft weight
b. Cell proliferation on graft
c. Young's modulus

What's next?

Dynamic flow culture increases the production of collagen and contributes to alignment of the collagen fibers. Different crowding also increase collagen production in 3D.

Future work will include:

- **Regiment that combines crowding and dynamic flow.**
- **Measuring changes in elastin, laminin and glycosaminoglycans**
- **Decellularised graft characterisation**

Key References

1. *Zoghbi, W. A. et al. Sustainable Development Goals and the Future of Cardiovascular Health: A Statement From the Global Cardiovascular Disease Taskforce. J. Am. Heart Assoc.* ***3****, e000504 (2014).*
2. *The Tissue-Engineered Vascular Graft—Past, Present, and Future | Tissue Engineering Part B: Reviews. https://www.liebertpub.com/doi/full/10.1089/ten.teb.2015.0100.*
3. *Versatile, elastomeric and degradable polyHIPEs of poly(glycerol sebacate)-methacrylate and their application in vascular graft tissue-engineering - ScienceDirect. https://www.sciencedirect.com/science/article/pii/S2590049823000929#abs0015.*

ADVANCED+ BIOMEDICAL MATERIALS Centre for Doctoral Training
MANCHESTER 1824 The University of Manchester
The University Of Sheffield.