



The University of Manchester



Tissue Engineering in Altered Gravity

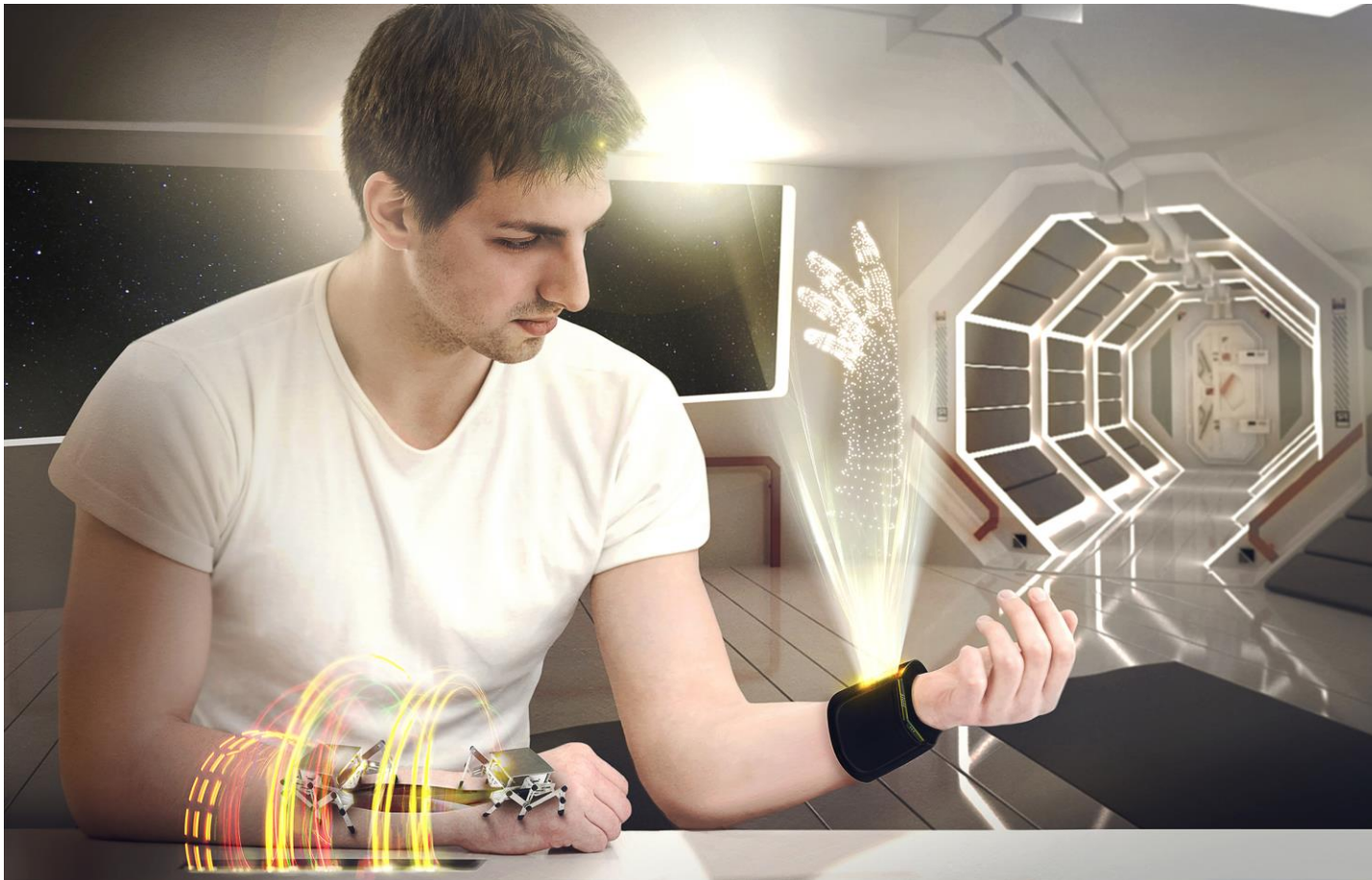
Miguel Ferreira

PhD Student – The University of Manchester

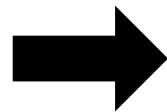
SELGRA MC Member

 @miguel3d

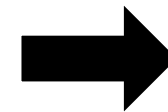
TISSUE ENGINEERING



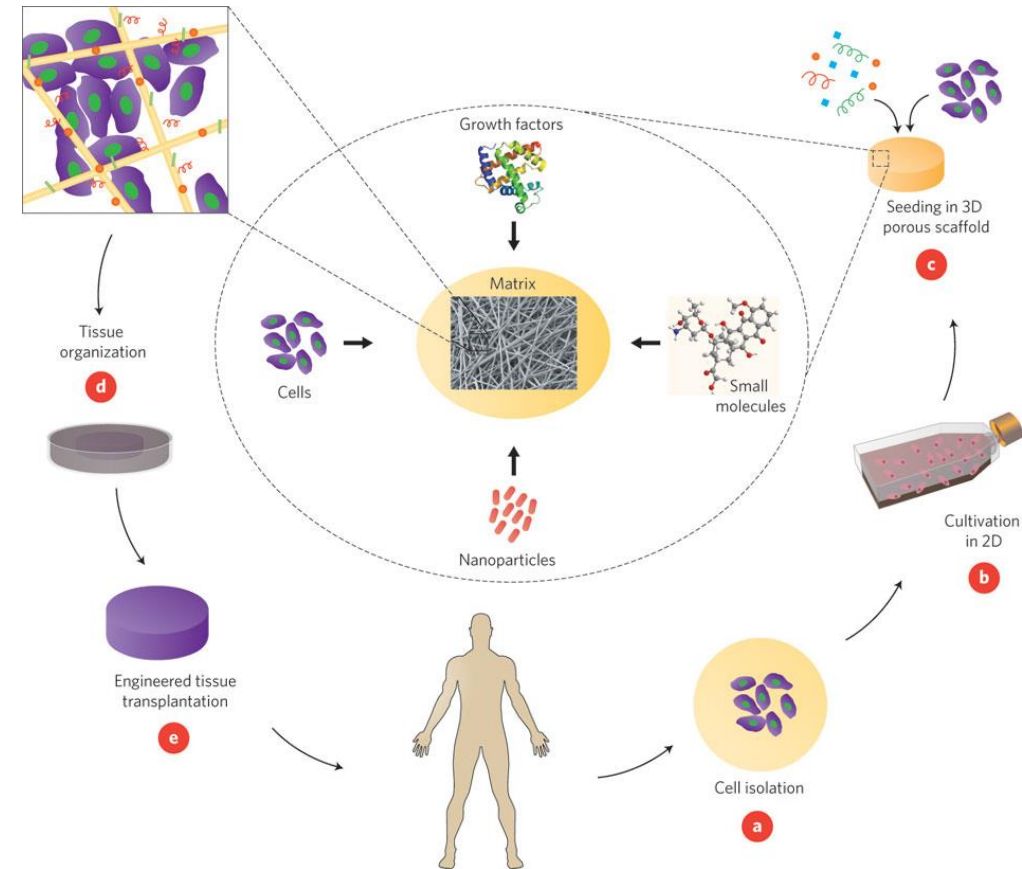
Disease, Injury



Cells
Biomaterials
Biochemical Factors

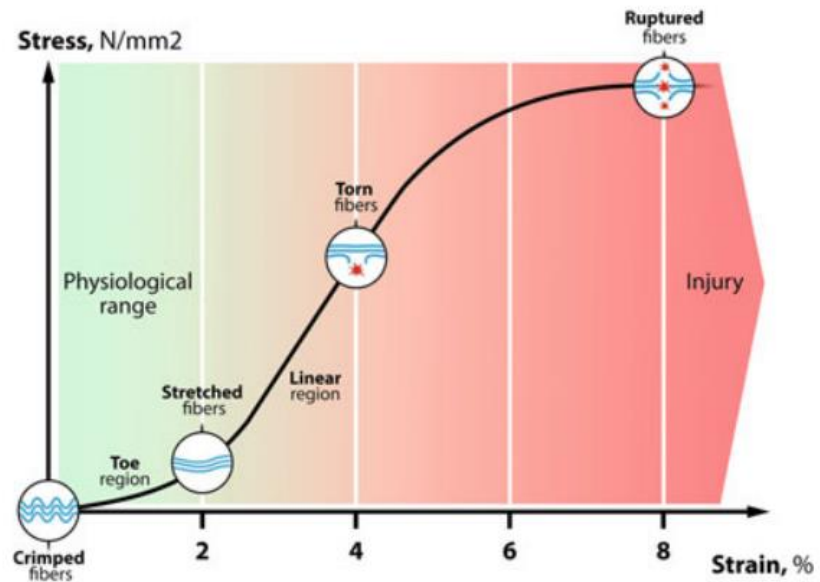


Restore, maintain, improve,
regenerate biological tissues



MECHANICAL ENVIRONMENT AFFECTS CELLS

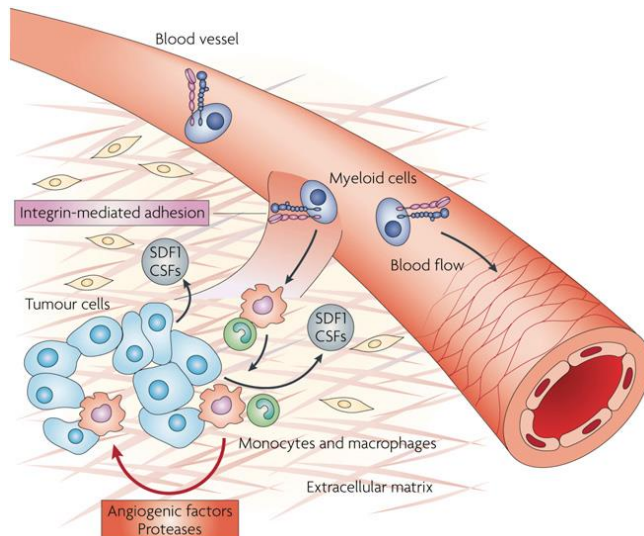
COMPRESSION / TENSION



ALTERED GRAVITY

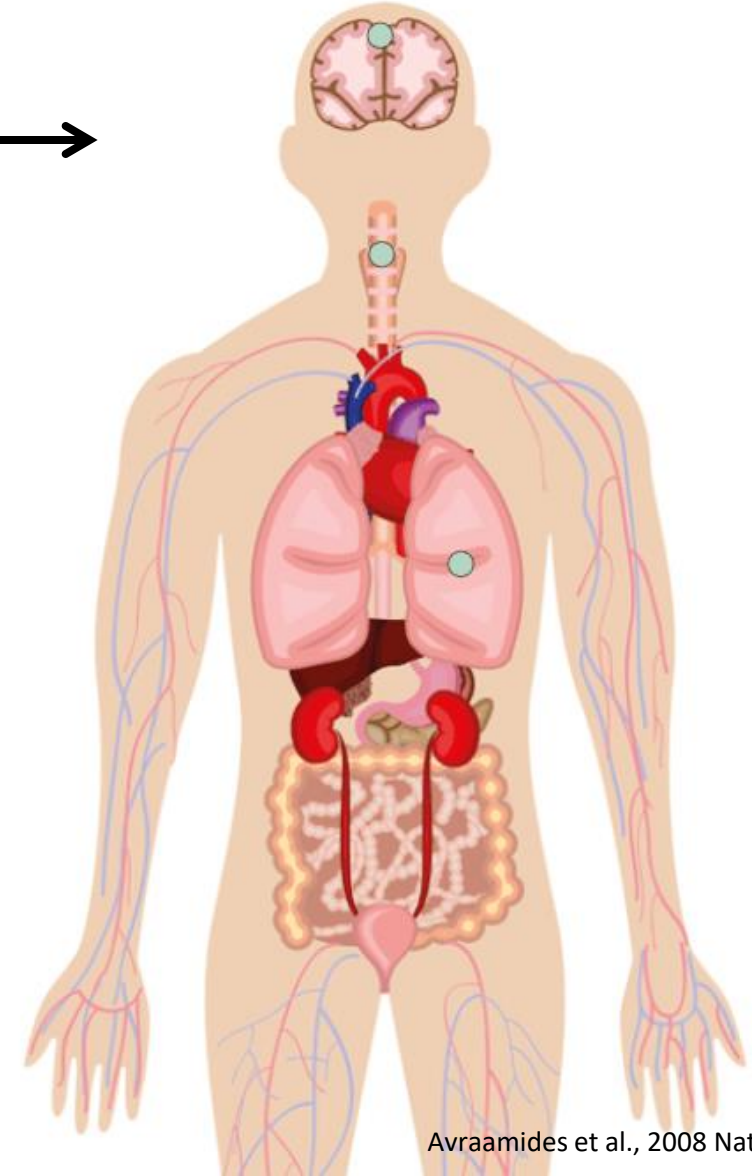
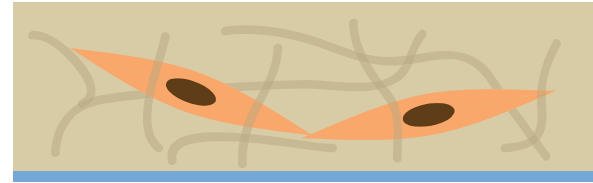
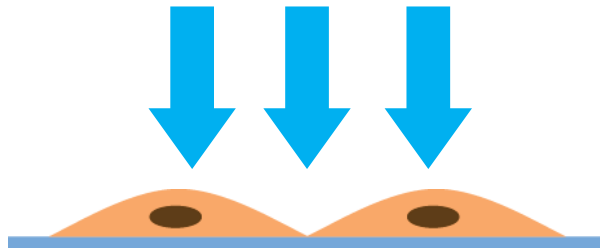


SHEAR



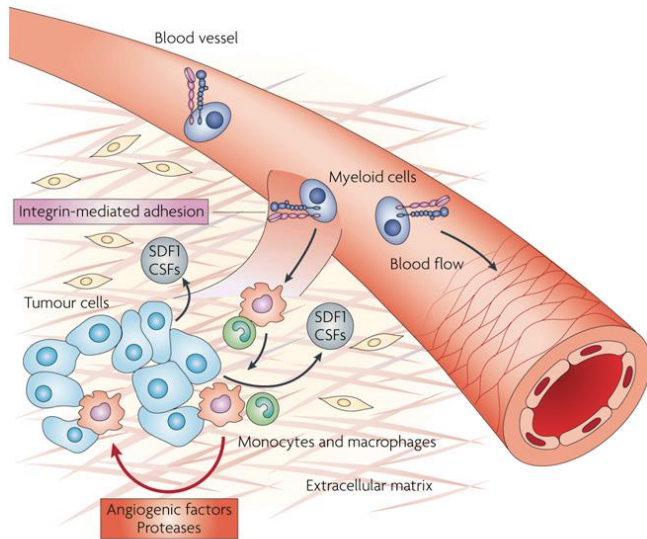
HYPERGRAVITY FOR TISSUE ENGINEERING

Hypergravity



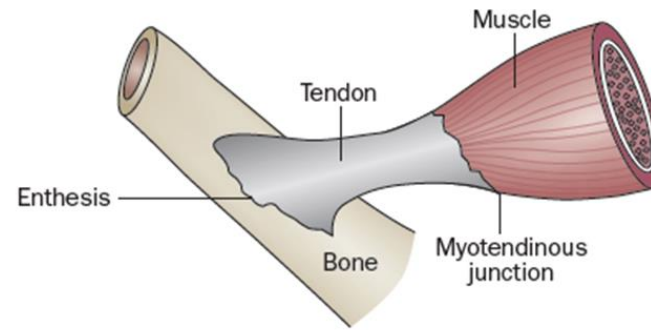
APPLICATIONS

Blood vessels



Nature Reviews | Cancer

Tendons



ESA SPIN YOUR THESIS!



LARGE DIAMETER CENTRIFUGE



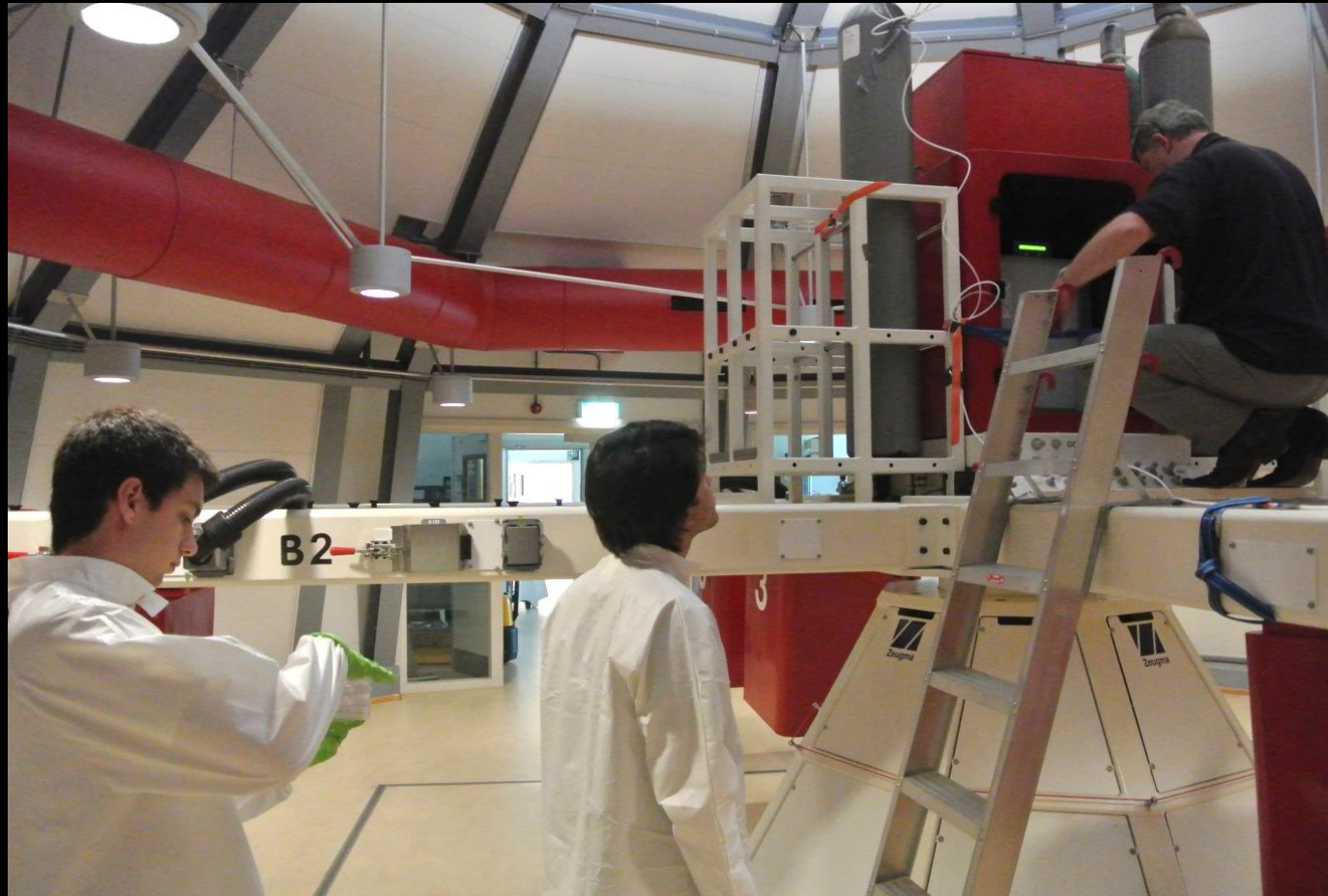
← 8 m →

THE LARGE DIAMETER CENTRIFUGE

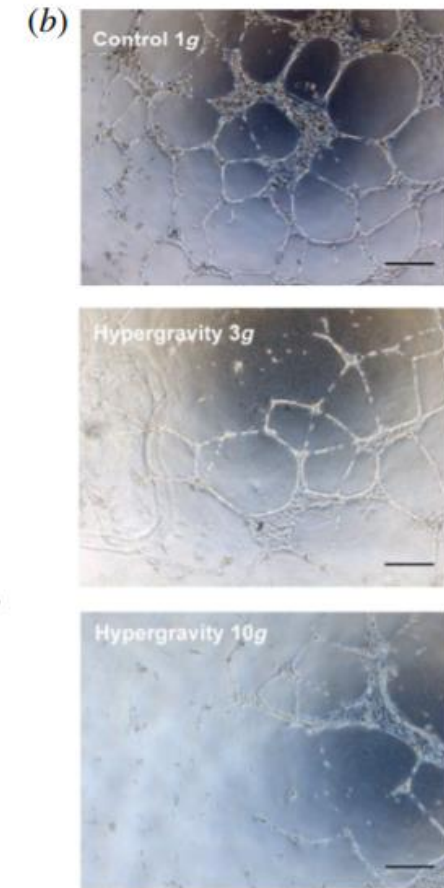
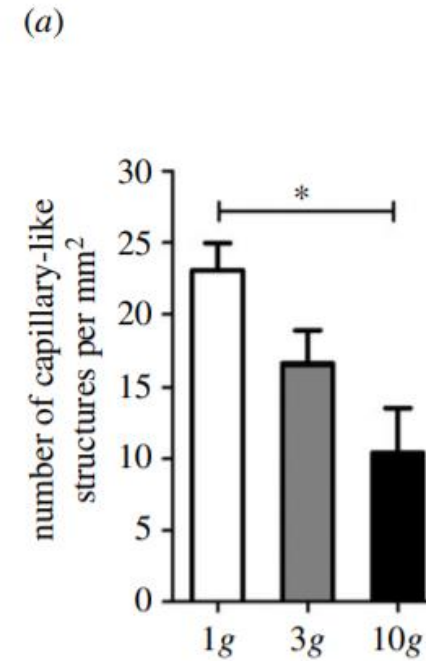
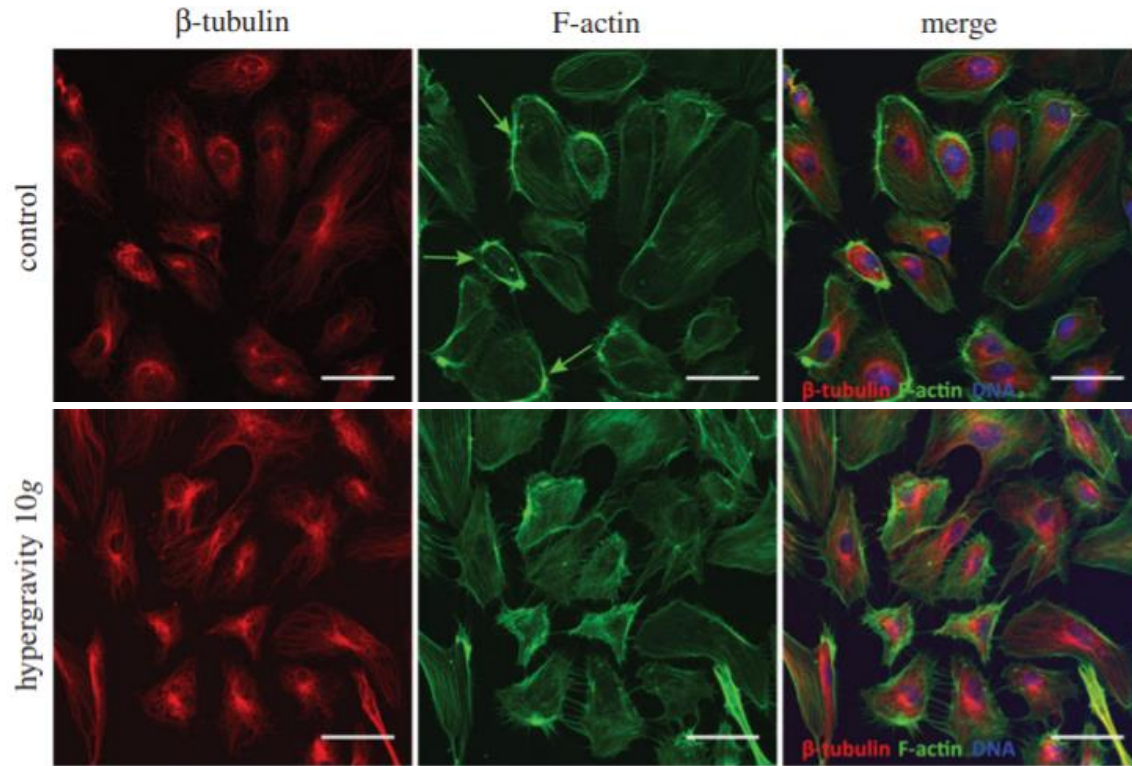
SELGRA



THE LARGE DIAMETER CENTRIFUGE



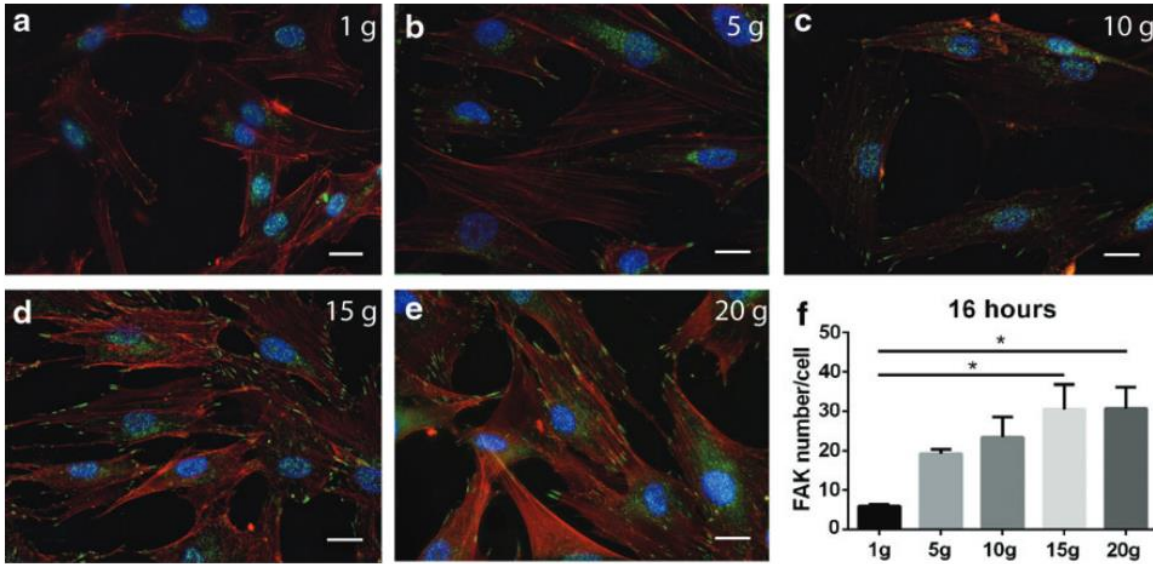
RESULTS – ENDOTHELIAL CELLS



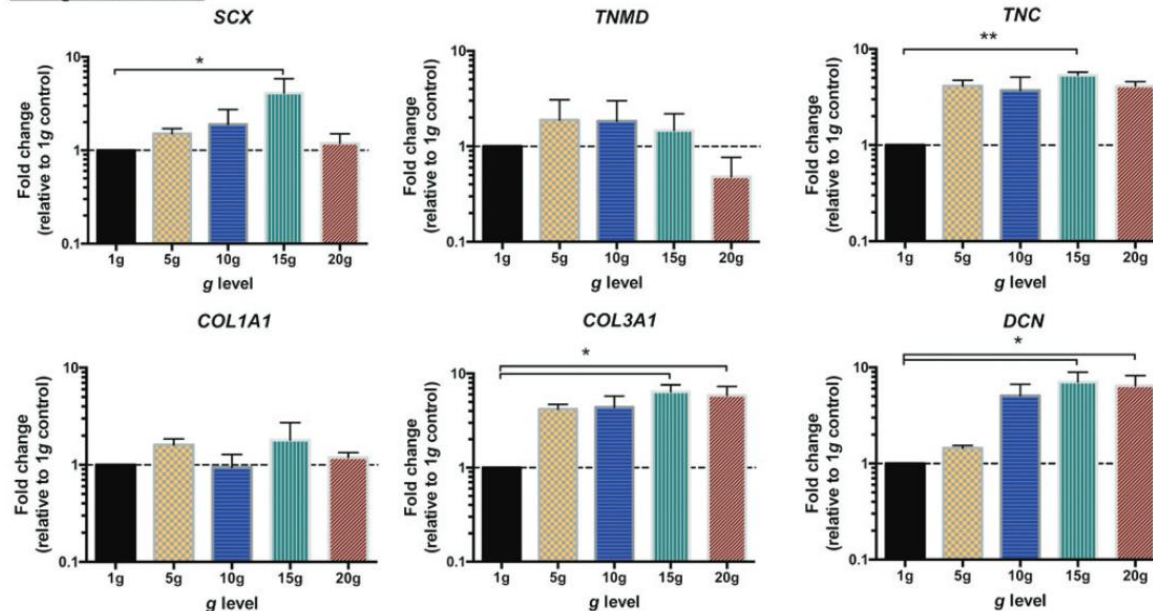
Culture of endothelial cells in Hypergravity:

- Decreased assembly of HUVECs into capillary-like structures, with 10g level significantly reducing their organization capacity.

RESULTS – TENDON-DERIVED CELLS



Tenogenic markers

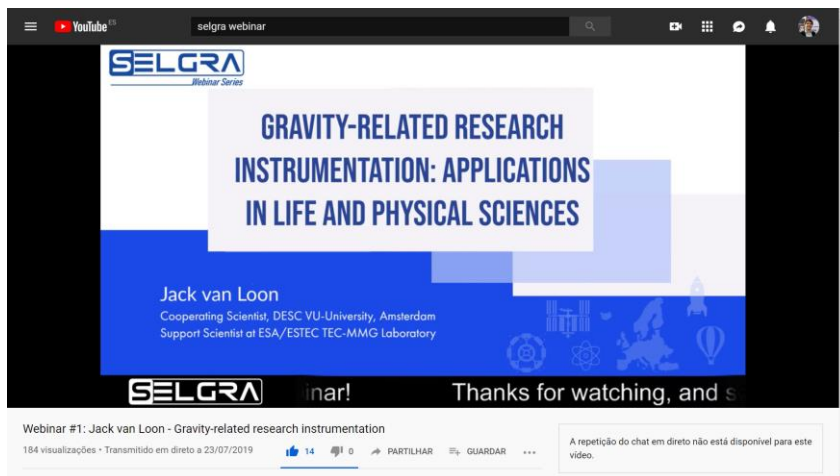
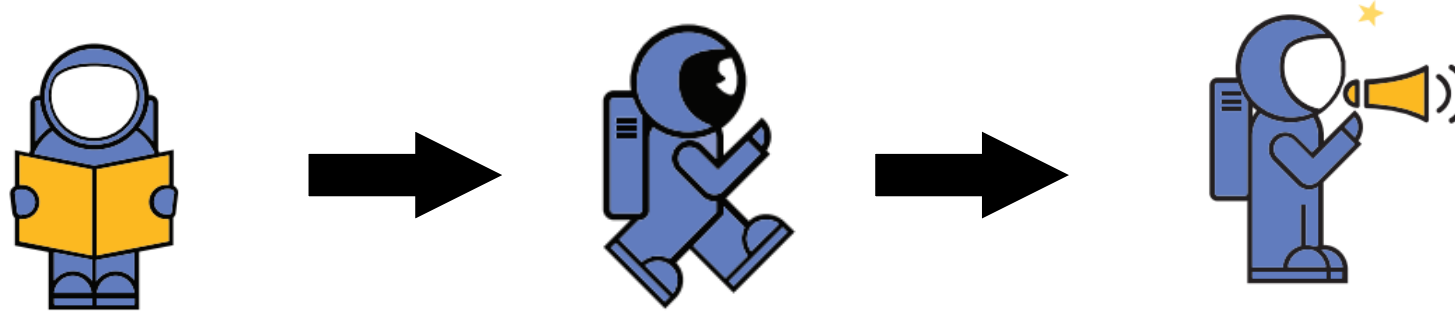


Culture of tendon-derived cells in Hypergravity:

- Limited cell proliferation
- Tendency toward upregulation of tenogenic markers

ADVICE

LEARN – LOOK FOR OPPORTUNITIES – APPLY!



LIFE
GLIDE YOUR EXPERIMENT CHALLENGE

Apply to fly your experiment based on **altered gravity** for free!

European student?
In a gravity / space related field?

Apply today for up to €700 Conference grant

elgra.org/selgra

ACKNOWLEDGEMENTS



Biocarrier group
 Daniel Carvalho
 Guilherme Aresta
 Pedro L. Granja
 Maria Gomez-Lázaro
 Cristina Barrias
 David Gomes
 Sílvia Bidarra
 Susana Carrilho
 Andreia Silva



Serviço de Ortopedia, Hospital da Prelada
 Tendon samples



Natacha Callens
 Lily Ha
 Jack van Loon
 Alan Dowson
 Nigel Savage
 Lukas Pfeiffer



Raquel Costa-Almeida
 Manuela E. Gomes
 Elsa Silva



Carla Ferreira
 Adélio Mendes
 Fernando Monteiro
 Emília Soares



The University of Manchester



UNIÃO EUROPEIA

Fundo Europeu de Desenvolvimento Regional

Portuguese Science Foundation
 PhD grant (Raquel Costa-Almeida): SFRH/BD/96593/2013
 Consolidator grant (Manuela E. Gomes): IF/00593/2015



MIT Portugal Program
 PhD program in Bioengineering Systems