

Designing, modelling and manufacturing composite hydrogels for biomedical applications

Joe Surmon

BCI Symposium

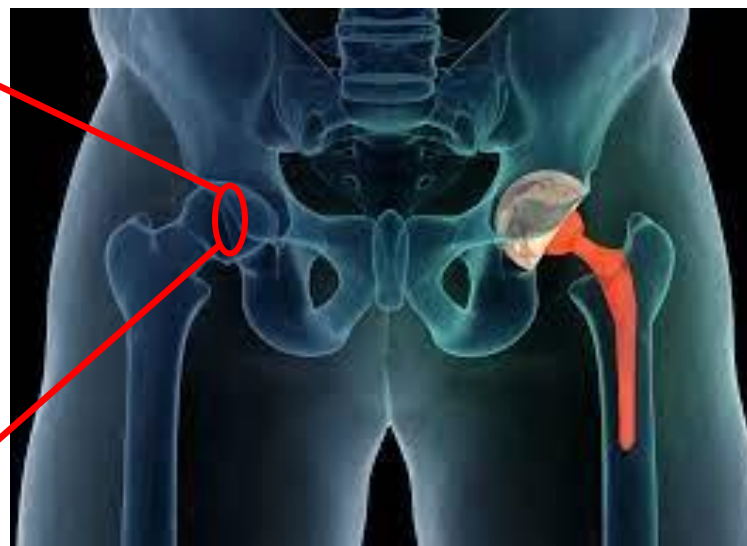
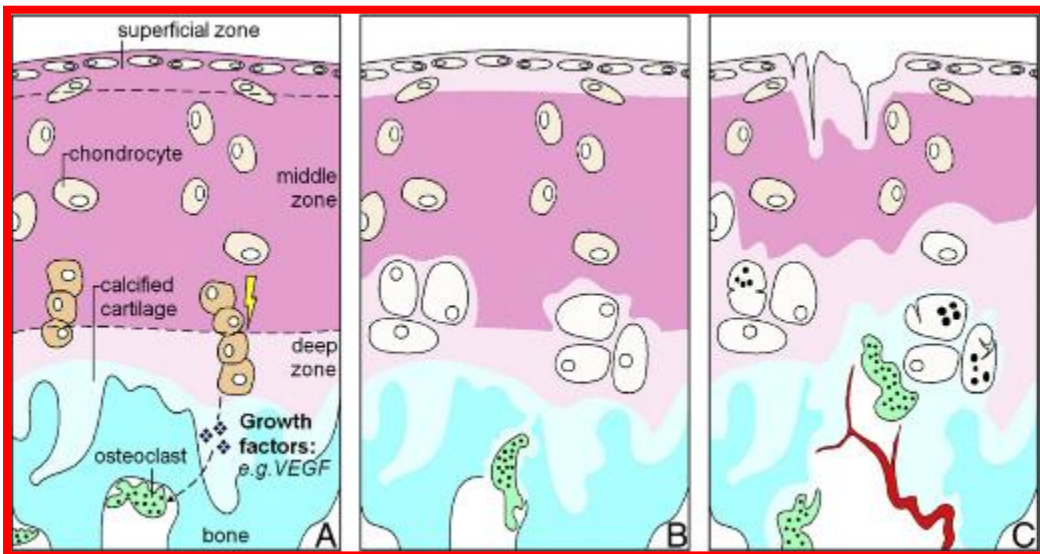
04/04/23



Challenge

Osteoarthritis

- Affecting hundreds of millions worldwide (>10% over 60s worldwide)
- Significantly damaging QOL, independence and mobility
- Current treatment: pain management and complete joint replacement



Gen1 – Bioinert (Metals)



Gen2 – Bioactive (Bioglass)

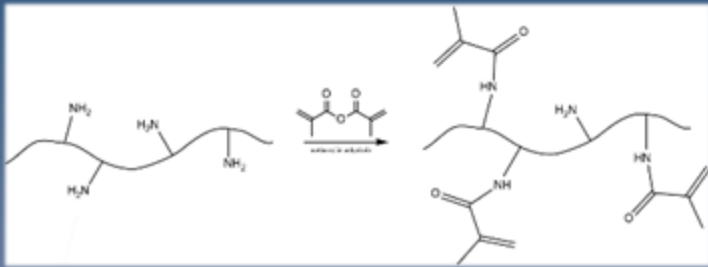


Gen3 – Bioinductive (?)

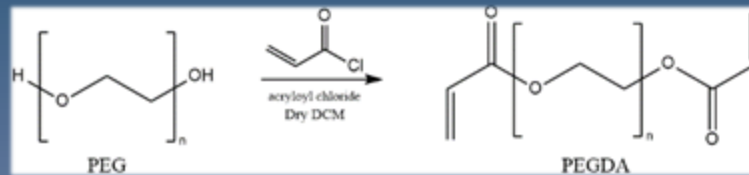


Materials

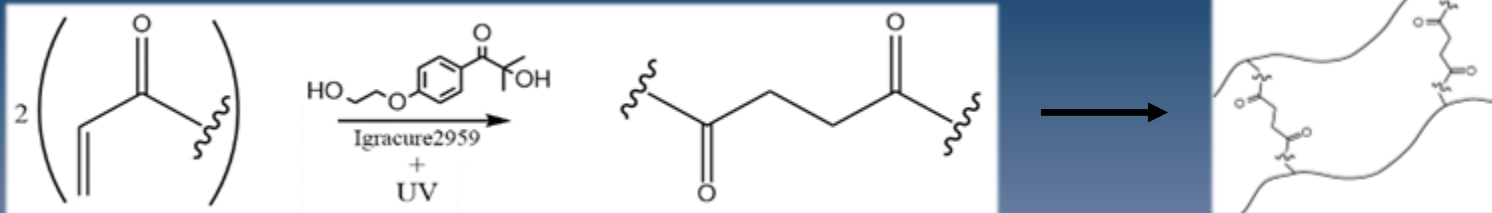
1. GelMA - Alginate DN - Natural



2. PEGDA – Alginate DN - Synthetic

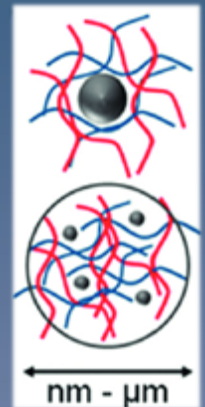
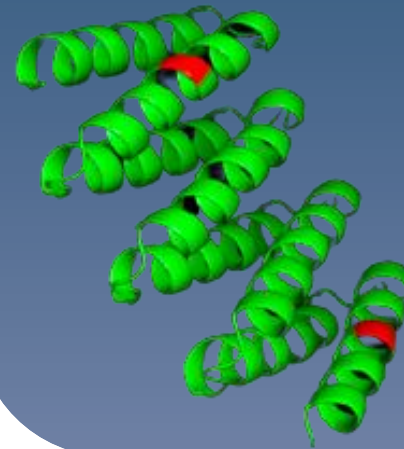


Network Formation



3. Additives

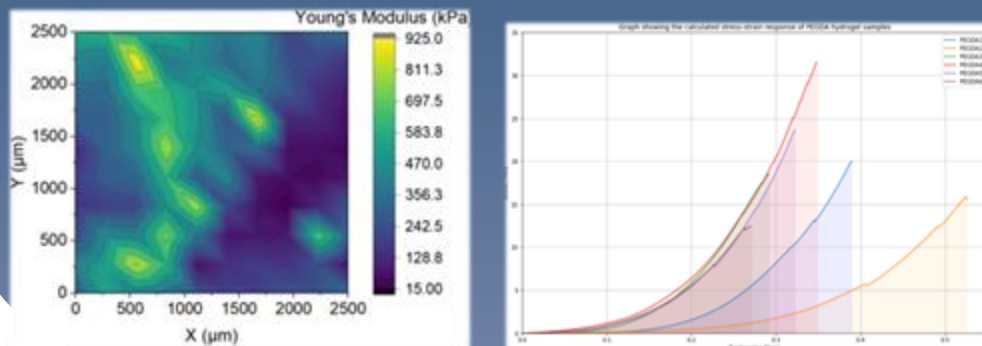
- 'Spring-like' Proteins
- Hydroxyapatite
- Nanoclay



Methods

Experimental

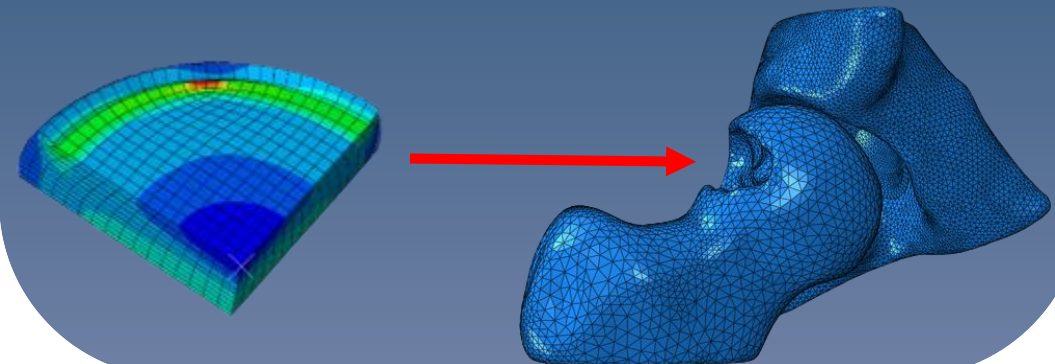
- Physical Characterisation
 - LVER determination
 - Swelling
- Mechanical Characterisation
 - Compressive strength
 - Fracture resistance



Generate
Material
properties

Modelling

- Parametric studies into:
 - Shear
 - Compression
- Full hip-joint simulation

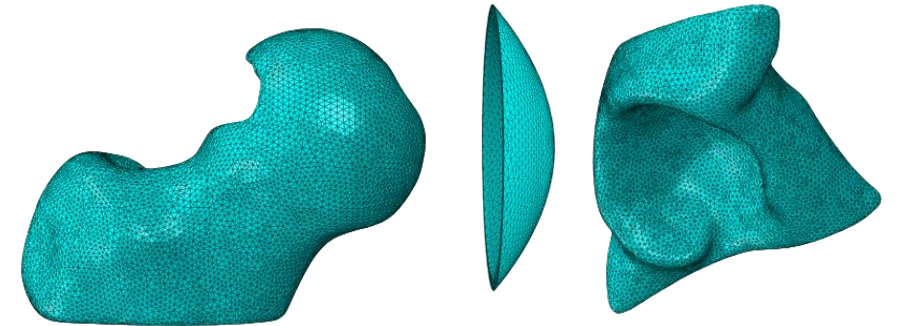
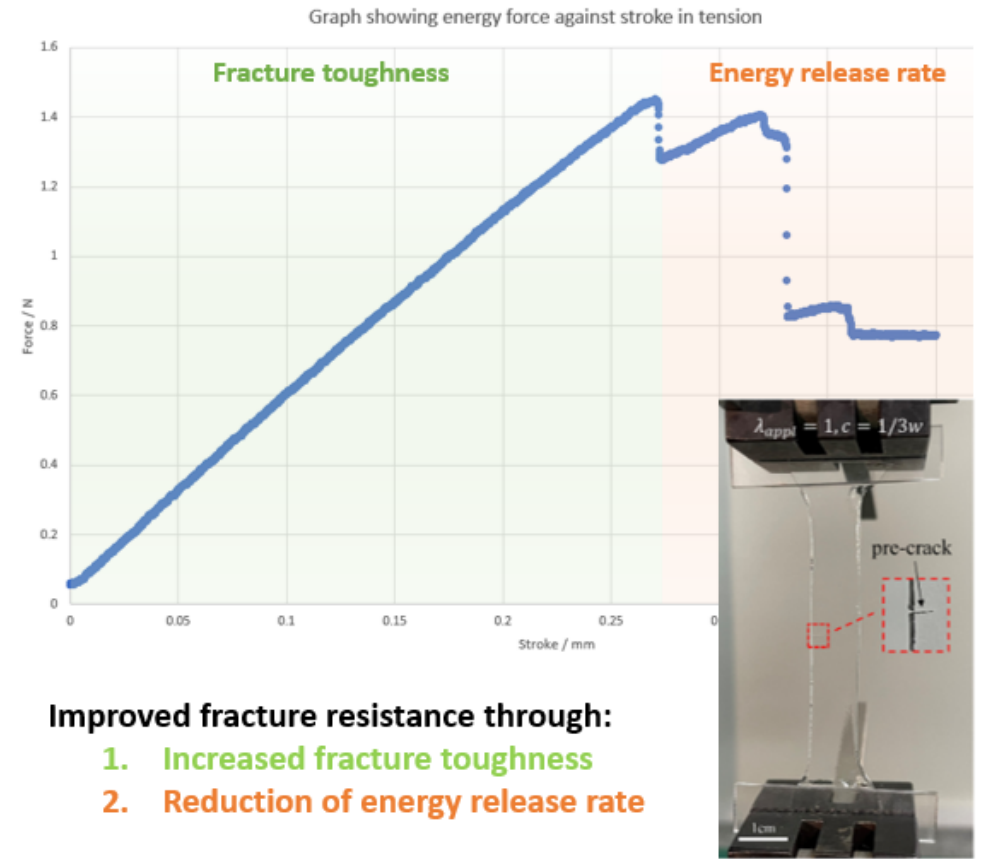


Inform and
supplement
experimental
direction



Future Work

- Fracture resistance testing
- Simulation of materials within joint model
- Fatigue life testing
- Articular Cartilage testing





Acknowledgements

Richard Trask, Sebastien Rochat, Kate Robson-Brown
and everyone in the ONE group.

Thank you for listening

joe.surmon@bristol.ac.uk

bristol.ac.uk/composites