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NHS The Leeds Teaching Hospitals NHS Trust

Surgical Technologies Theme

Professor David Jayne

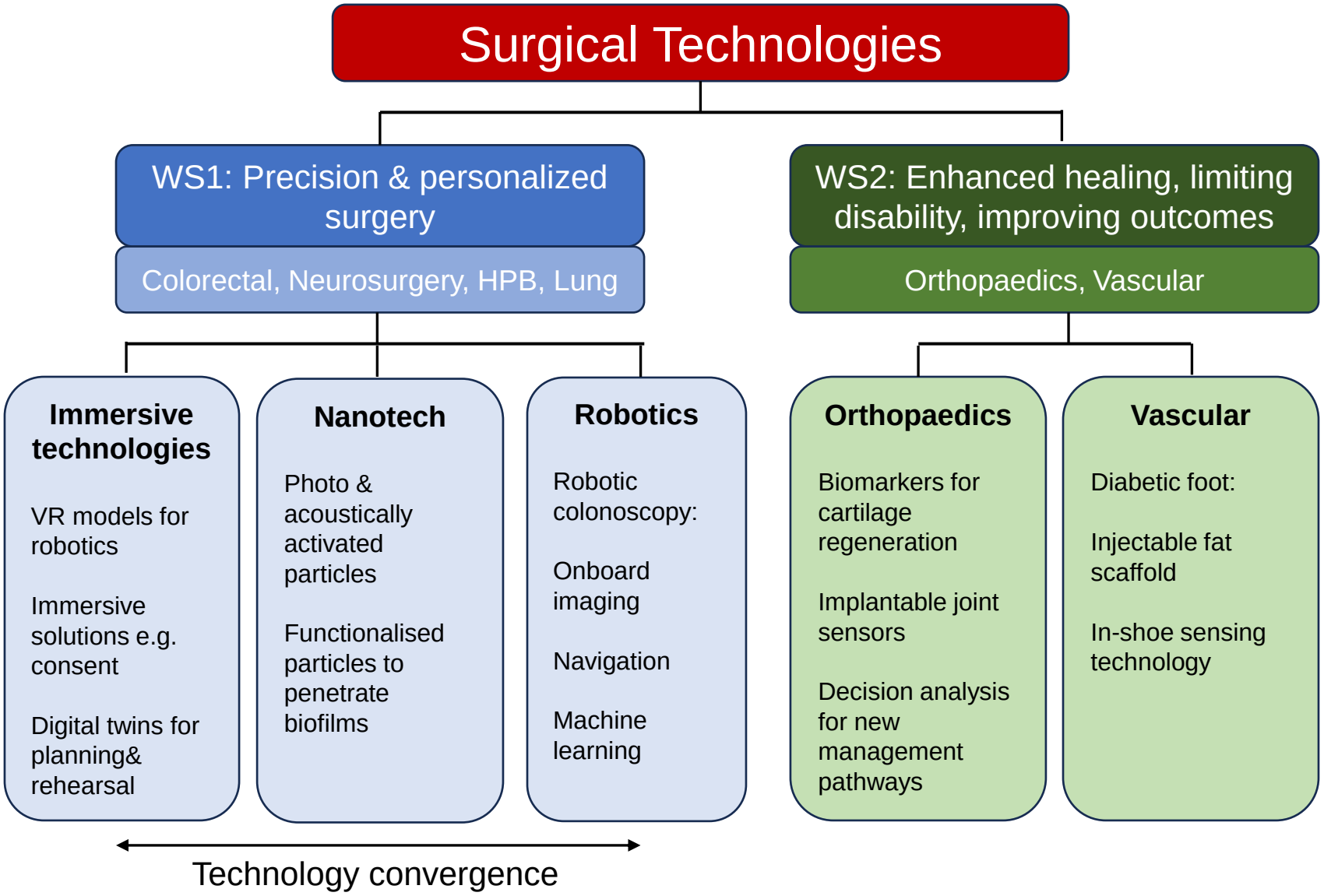
Surgical Technologies

WS1: Precision & personalised surgery

To capitalize on 3 technologies revolutionizing surgical practice with the power to make precision and personalised surgery part of routine NHS care

WS2: Enhanced healing, limiting disability, and improving outcomes

To refine, validate, employ innovations addressing prevention, management, salvage treatment in patients with OA, fractures, and diabetic foot ulcer


Surgical Technologies
WS1: Precision & personalized surgery
Colorectal, Neurosurgery, HPB, Lung
WS2: Enhanced healing, limiting disability, improving outcomes
Orthopaedics, Vascular
Immersive technologies
VR models for robotics
Immersive solutions e.g. consent
Digital twins for planning& rehearsal
Nanotech
Photo & acoustically activated particles
Functionalised particles to penetrate biofilms
Robotics
Robotic colonoscopy:
Onboard imaging
Navigation
Machine learning
Orthopaedics
Biomarkers for cartilage regeneration
Implantable joint sensors
Decision analysis for new management pathways
Vascular
Diabetic foot:
Injectable fat scaffold
In-shoe sensing technology
Technology convergence

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WS1: Precision and Personalised Surgery

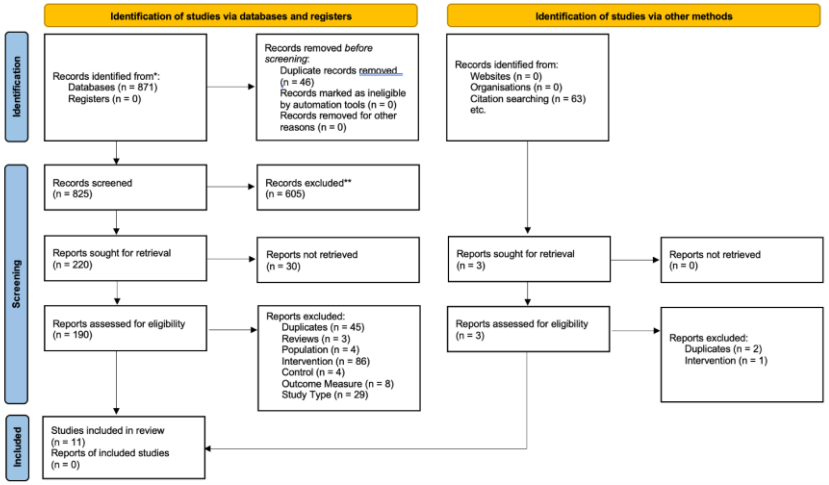
WS1: Immersive Technologies

Mathew, Mushtaq, Bolton

Systematic review of XR for Surgery – completed

Generated 10 recommendations for future research:

1. Standardization of iVR Definition
2. Detailed Reporting of iVR Training Interventions
3. Conducting Larger Scale, Longitudinal Studies
4. In-depth Analysis of Experience Surveys
5. Investigation of Learning Curves
6. Integration with Other Training Methods
7. Impact of iVR on Teamwork & Communication Skills
8. Exploration of Individual Differences
9. Cost-Benefit Analysis
10. Effect of iVR on Patient Outcomes

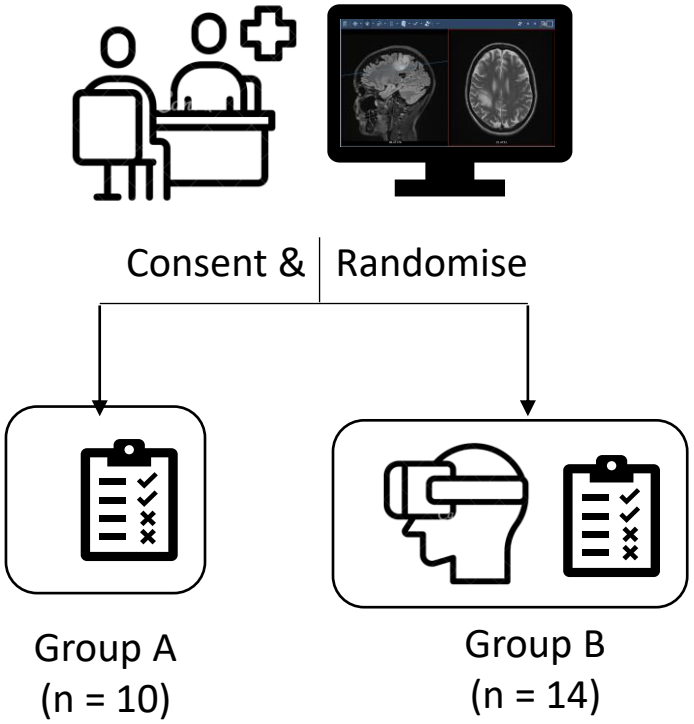


WS1: Immersive Technologies

Mathews, Mushtaq, Bolton

Feasibility study

- Preoperative patient understanding



Brain Leap

- Randomised comparison
- 24 patients
- Patients diagnosed with intracranial tumour

Funding

- Centre for Neurosciences, LTHT (salary and equipment)

WS1: Immersive Technologies

Mathews, Mushtaq, Bolton

VR to augment neurorehabilitation

RecoVR Reality

- Feasibility study
- 35 patients
- Traumatic brain injury or resection of brain tumour

Recruitment completed

- Acceptable to patients
- Refinement of protocol
- Improved engagement in recovery

Funding

- NIHR Brain Injury MIC
- Industry partner SynchVR
- Leeds Hospital Charity

WS1: Immersive Technologies

Mathews, Mushtaq, Bolton

Future directions

1. **RecoVR:A pragmatic clinical effectiveness evaluation in the NHS (target is NIHR EME):** 1:1 unblinded RCT comparing VR augmented neurorehabilitation vs standard of care after neurotrauma or neurosurgery.

- **Mechanistic sub-studies:** Trial sample vs healthy controls wearing shielded VR headsets undergoing multi-parametric MRI and EMG sensors to map neuronal activity.

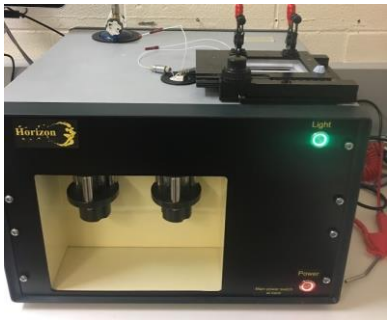
1. **Brain Leap: A pragmatic clinical effectiveness evaluation in the NHS (NIHR RfPB):** 1:1 unblinded RCT. MR enhanced consultation vs standard computer monitor for complex neurosurgical pathologies.

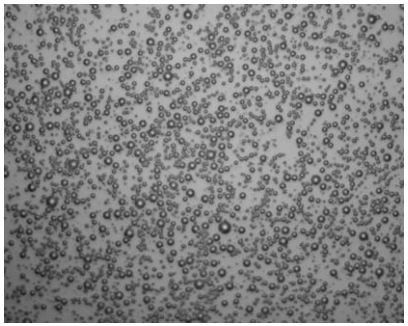
WS1: Nanotechnology

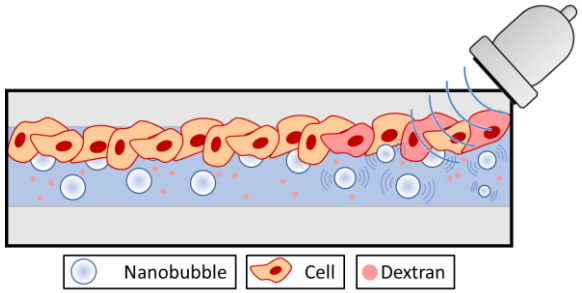
Evans, Quyn, Jayne

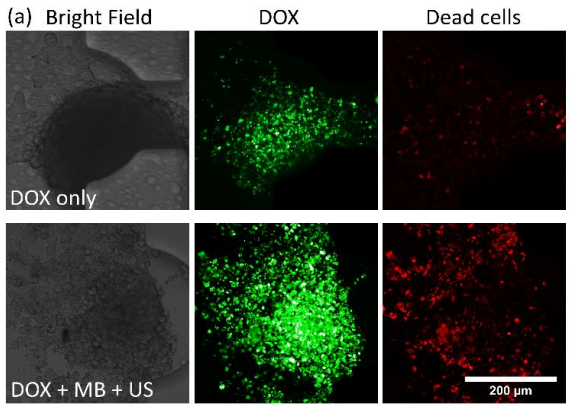
Colonic epithelium lined by protective biofilm

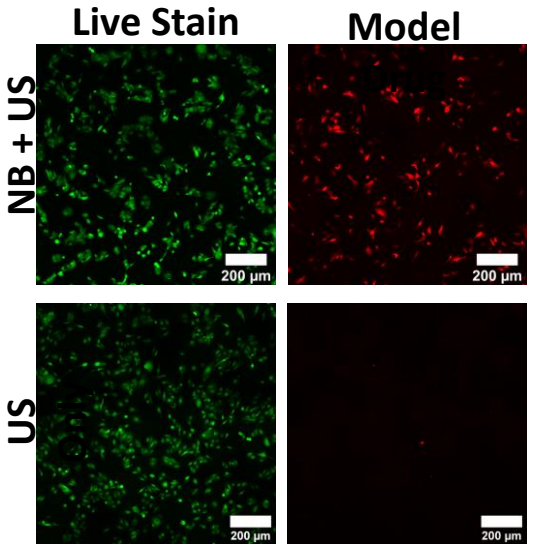
Aim: to develop liposomal technology to target/disrupt the mucosal biofilm





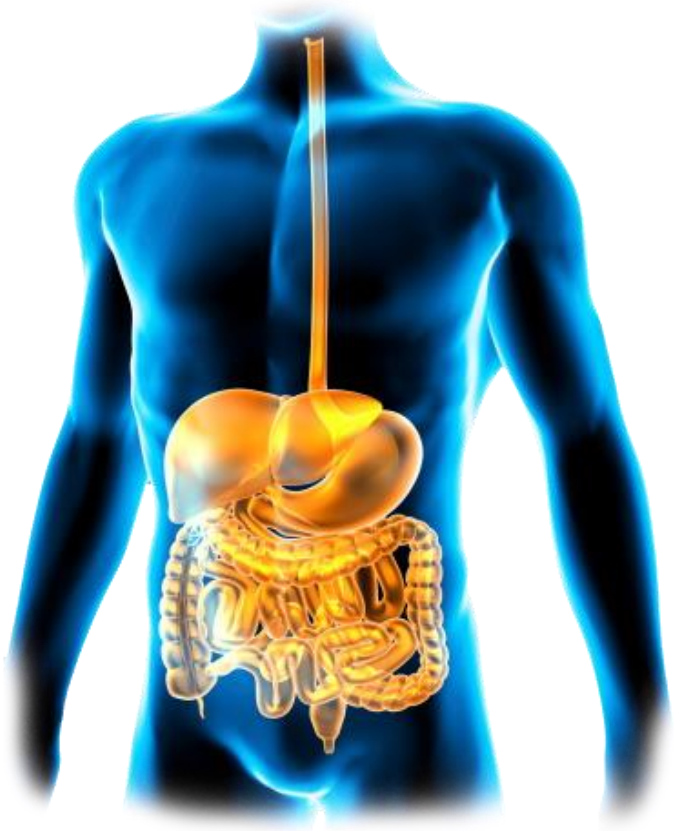


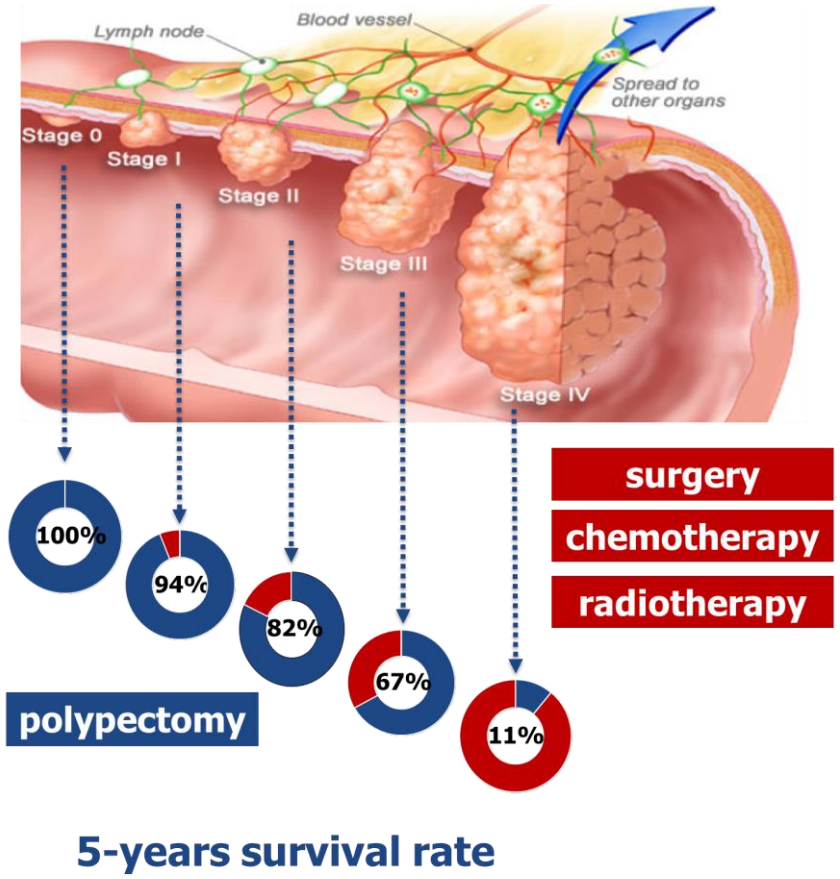




WS1: Robotic colonoscopy

Valdastri, Chalmers





WS1: Robotic colonoscopy

Valdastri, Chalmers

☹ **Painful**

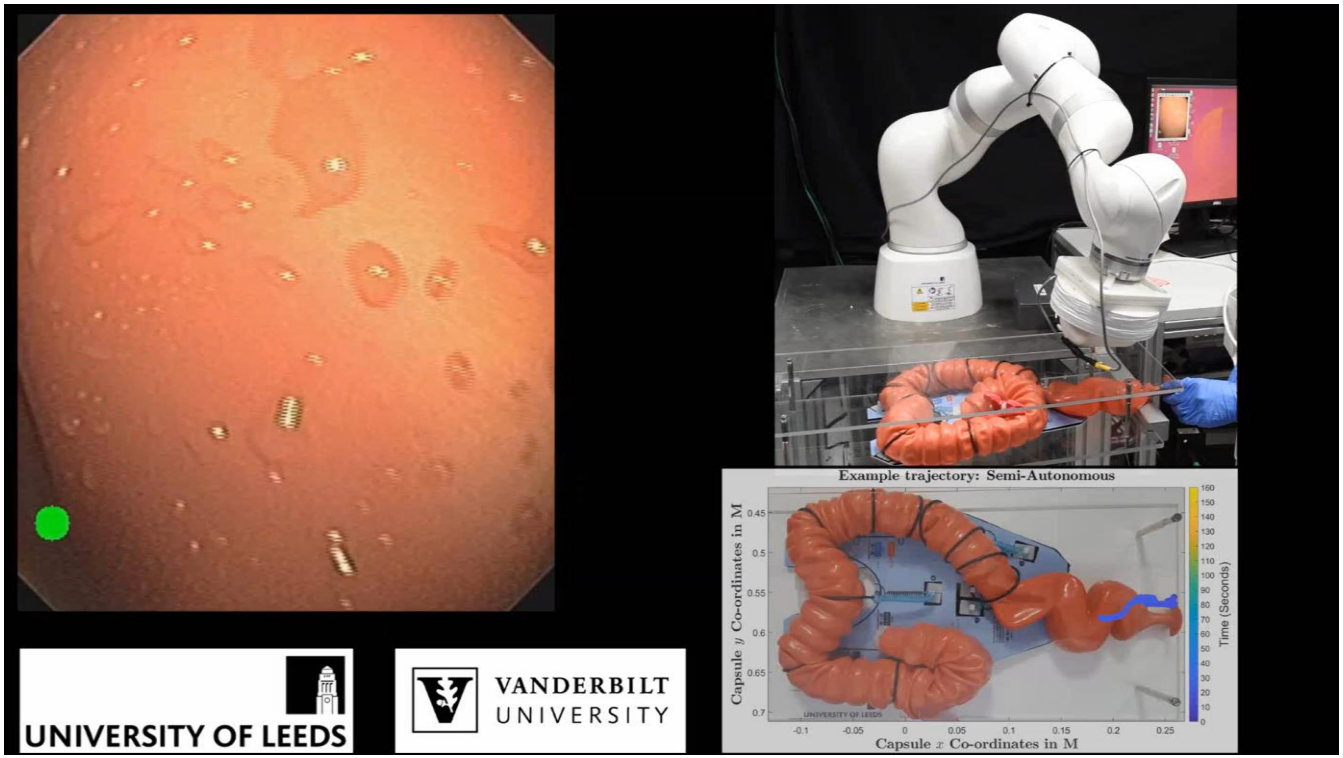
☹ **Unintuitive**

☹ **Instrument is expansive**

WS1: Robotic colonoscopy

Valdastri, Chalmers

Average Time to Caecum: 4.28 min (10 users, 5 reps each, 100% success)



On board imaging and polyp detection; AI driven navigation

VR training programme

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WS2: Enhanced healing, limiting disability, and improving outcomes

WS2: Elective Othopaedics

Pandit, van Duren

ARK study

- Wearable sensors to monitor postop recovery following knee replacement
- 149/250 patients recruited
- Primary end point: Oxford Knee Score at 6 months
- Secondary: Functional, Pain, PROMS,
  KOOS, EQ-5D, Patient satisfaction, Healthcare resource utilisation

B Braun: BPM sensor

WS2: Elective Orthopaedics

Pandit, van Duren

iSMART

Implantable sensors for monitoring knee joint replacement

Medacta Int: £2.3M + £2M in-kind + £675L UoL match

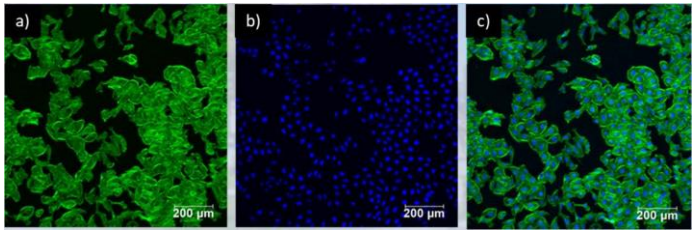
Regulatory approvals by Q4 2025; First-in-human Q2 2026

WS2: Trauma

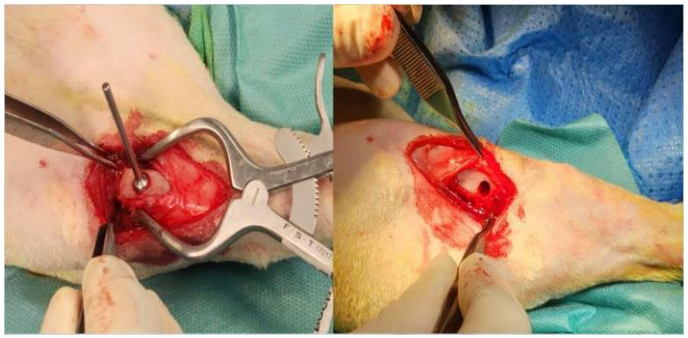
Jha, Giannoudis

Bone adhesive for fracture fixation

Cytotoxicity testing



Animal studies



Benefits

Reduce screws
Promote healing
Antimicrobial properties
Bone gap reduction
Laser and radio imaging

Outputs

Patent filed 2022
New IP
Publications
Collaborations

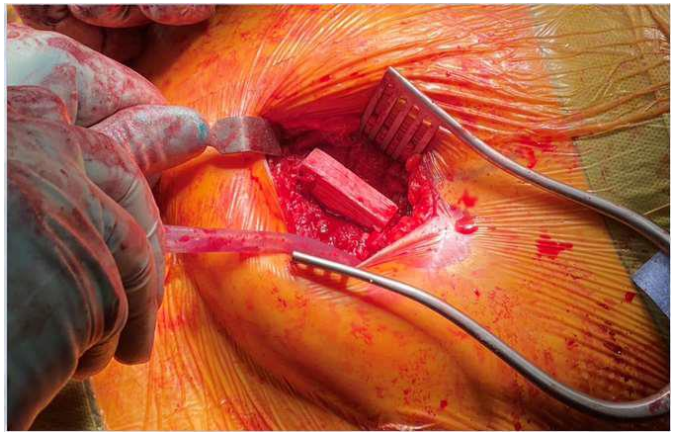
WS2: Trauma

Jha, Giannoudis

Green bone for hip defect restoration

Phase 1: original scaffolds
industry proof-of-concept study

15 patient hip augmentation



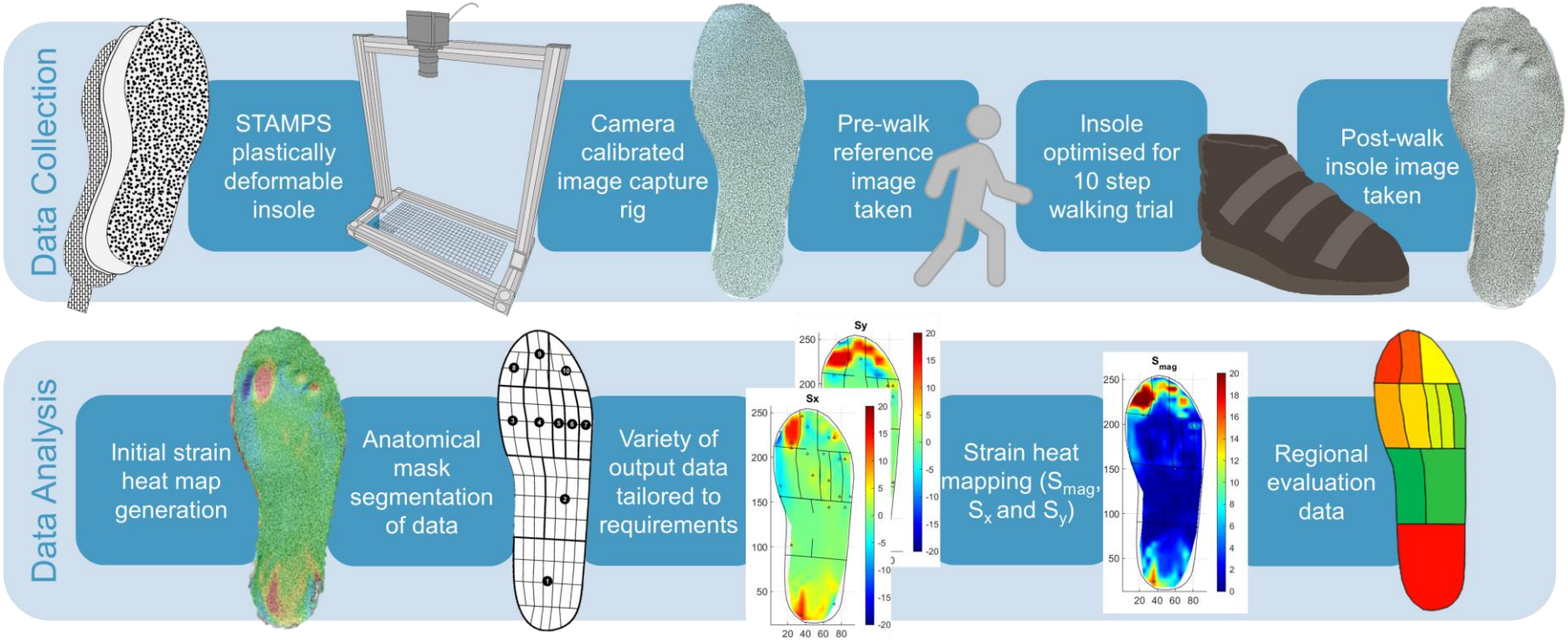
Phase 2: Laser drilled scaffolds
IAA funding

Improved angiogenesis & osteogenesis

WS2: Diabetic Foot

Russell, Culmer

Strain analysis of plantar surface



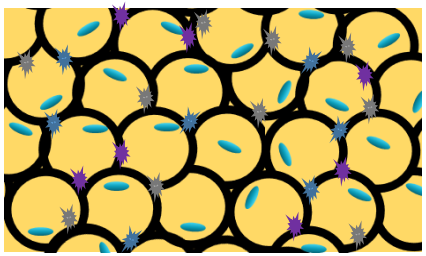
Proof-of-concept study completed

WS2: Diabetic Foot

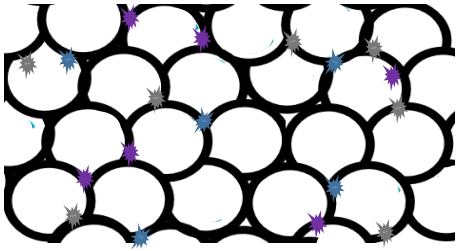
Russell, Culmer

Decellularised fat scaffolds

Native adipose



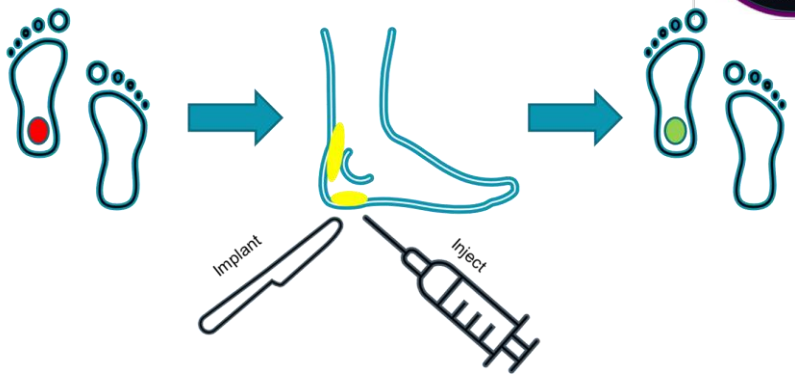
Decellularised adipose

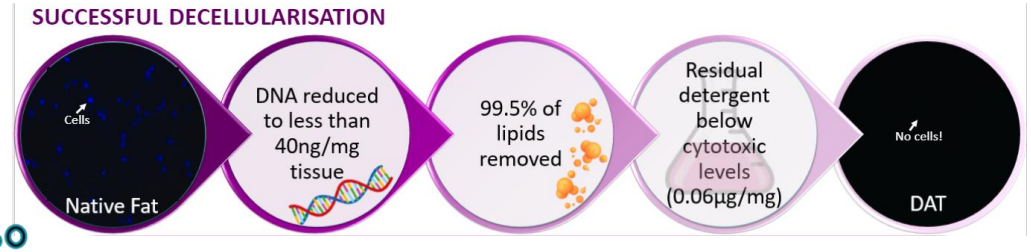


Benefits

Implant or inject
Restore local biomechanics
Encourage host-cell infiltration
Reduce inflammation

PhD student recruited





Long term functional regeneration