

Medical Engineering Solutions for Fifty Active Years after Fifty

How can we be more active and live more
healthily for the second half of our lives?

John Fisher

Eileen Ingham

iMBE

Engineering '50 active years after 50' through multi-disciplinary
research, innovation, knowledge creation and translation.

THE CHALLENGE OF AGEING POPULATION

- Estimate 75% of current fifty year olds will live to be over 90
- Musculoskeletal system starts to age and degrade after age of fifty
- Ageing population needs to keep active to avoid co-morbidity
- Potentially another 100 million steps after age of fifty
- Estimate five fold increase in joint replacements by 2030
- Major societal challenge to sustain an active population over fifty
- Major research challenge engineering solutions “50 active years after 50”
- Need to address degeneration of musculoskeletal & cardiovascular systems

CONTENT OF LECTURE

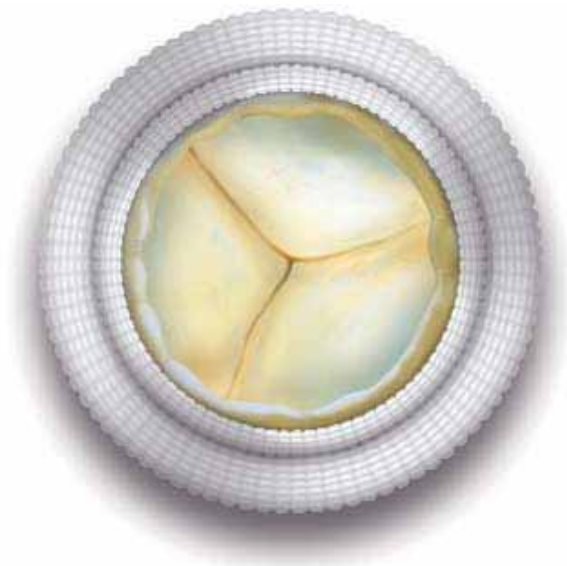
- Historical examples of medical engineering solutions for elderly
- Examples of current research and innovation for longer lasting artificial joints for younger and more active patients
- Current research on regenerative biological scaffolds being developed and translated for repair of the cardiovascular and musculoskeletal system
- Description of a systematic and integrated approach to research technology innovation and commercialisation of medical technology

HISTORICALLY WE HAVE ENGINEERED DEVICES TO TREAT ELDERLY

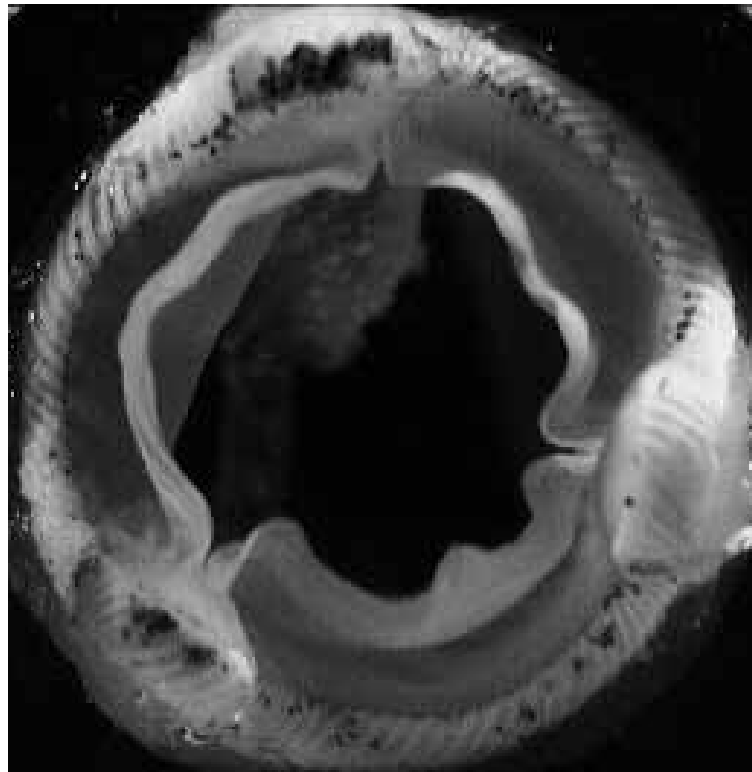
Artificial hip joint
Developed in UK 1960
Manufactured in Leeds
Over 50 years successful
clinical use in
patients over 70s



HISTORICALLY - RESEARCHED & DEVELOPED DEVICES TO TREAT ELDERLY



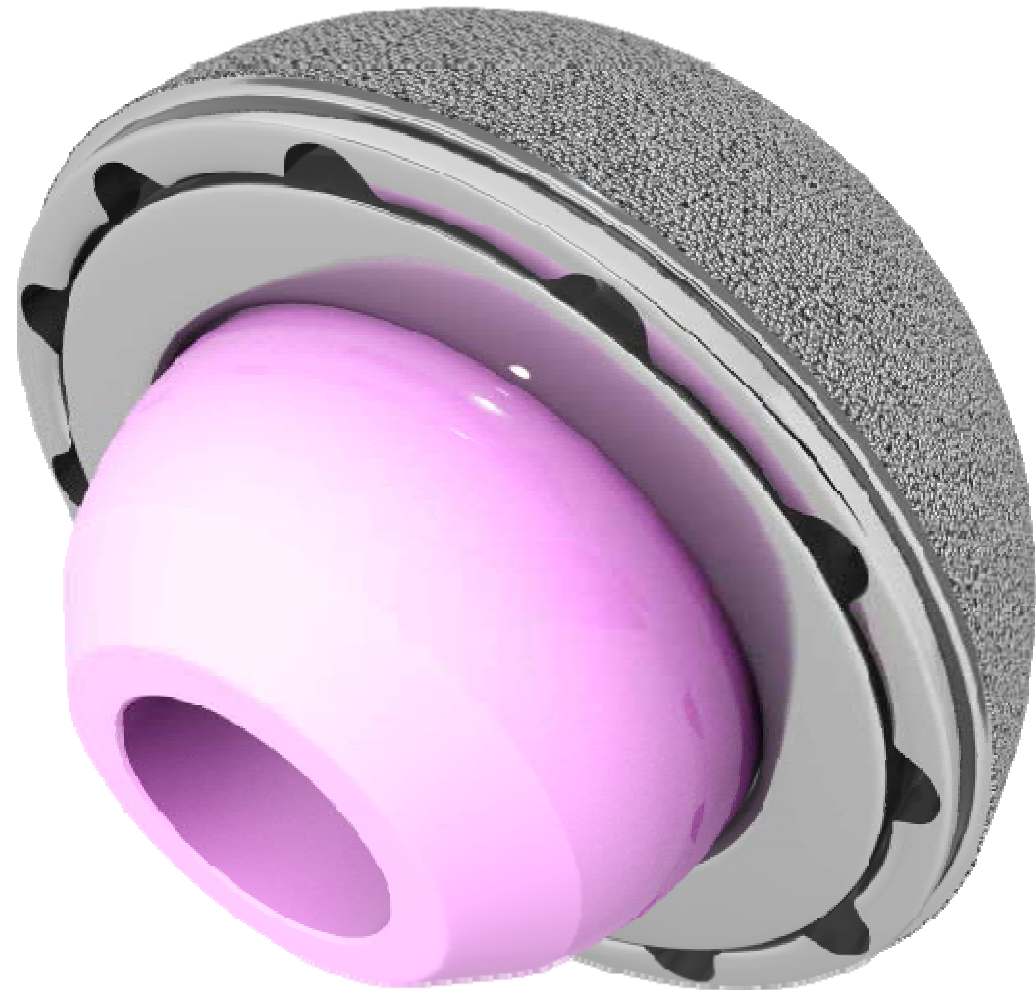
Aspire bioprosthesis heart valve
U of Leeds design
Manufactured Leeds since 1990
20 years clinical history in elderly



RECENT RESEARCH AND CURRENT DEVICES - CERAMIC ON METAL HIP

Currently increased number of joint replacements in under 65s, which need to last much longer

Researched U of Leeds
Assigned to DePuy
Developed in Leeds
Marketed world wide
Low wear longer lasting hip joint , which addresses needs of ageing population
50 active years after 50



RECENT RESEARCH AND CURRENT DEVICES - PARTIAL KNEE REPLACEMENT

Earlier
intervention
Partial
Knee
Replacement



Research at the U of Leeds defined
new law for polyethylene wear
and new low wear design solutions

Partial knee marketed globally DePuy
Early tissue sparing intervention



Pre clinical simulation /evaluation
Demonstrate reliability and value
U of Leeds - Largest joint simulation
laboratory in the world

CURRENT RESEARCH, FUTURE PRODUCTS - dCELL™ BIOLOGICAL SCAFFOLDS

Major opportunity in regenerative therapies and devices

dCELL™ Immuno compatible multi-scale biological scaffolds

Replicate natural tissue structure and architecture

Retain biomechanical properties and function

Patented processes and structures for individual tissue types

Rapidly regenerate in vivo with patients own cells.

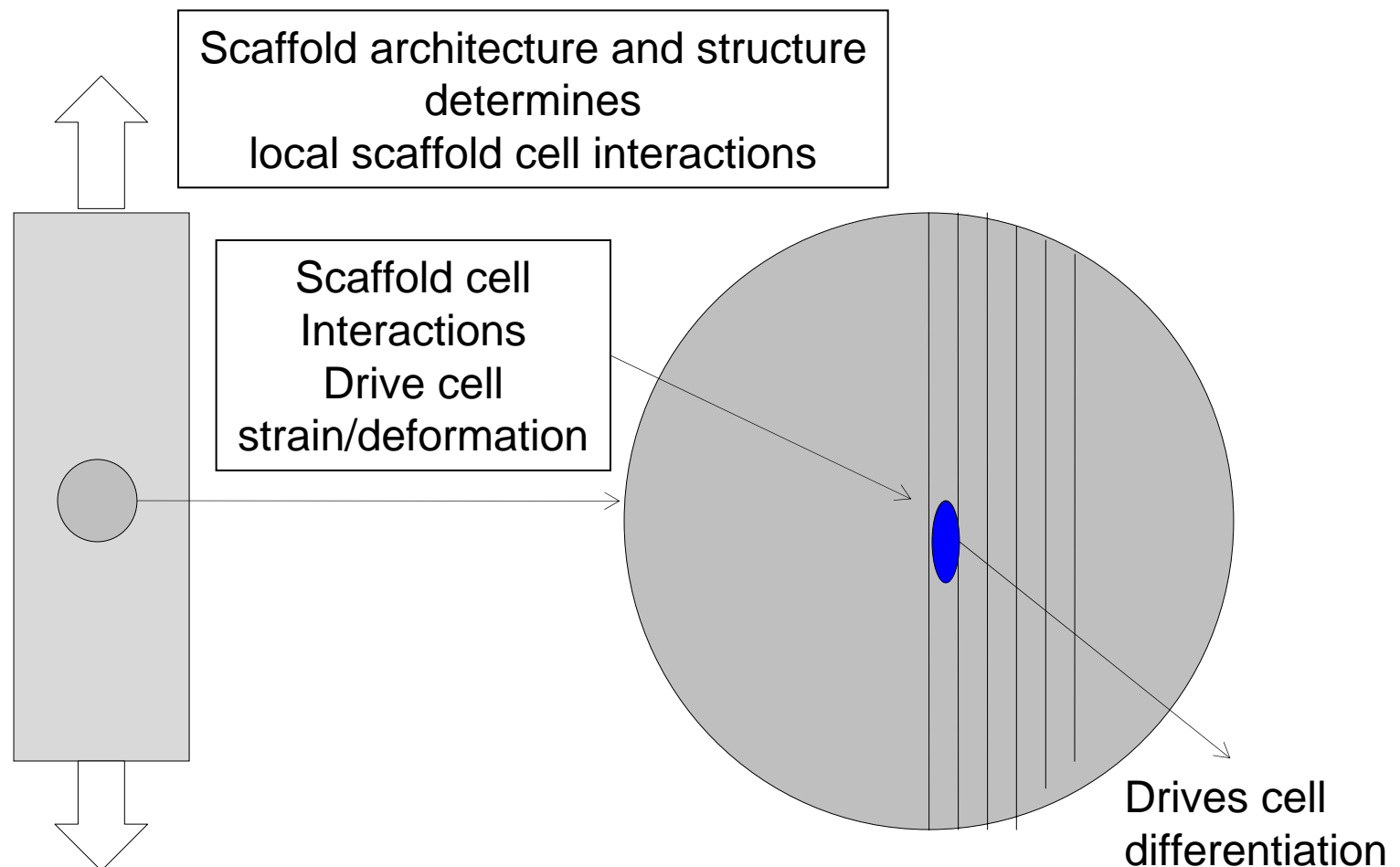
Tissue architecture generates biomechanical stimuli to drive cell differentiation

Leeds University spin out Tissue Regenix Group

AIM listed 2010,

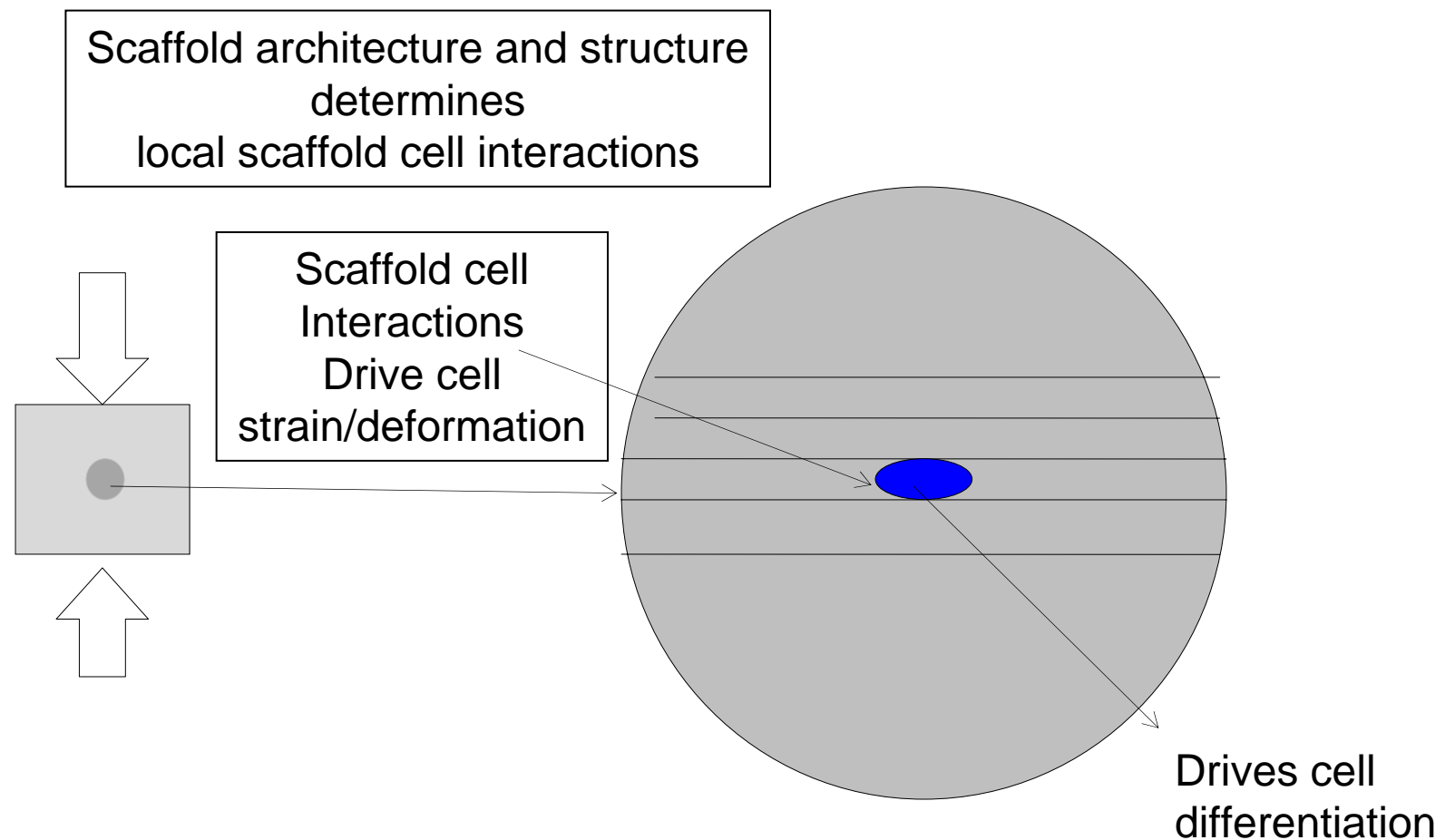
MULTI SCALE BIOLOGICAL SCAFFOLD - STRUCTURE AND FUNCTION

Scaffold bulk mechanical properties and function - ligament

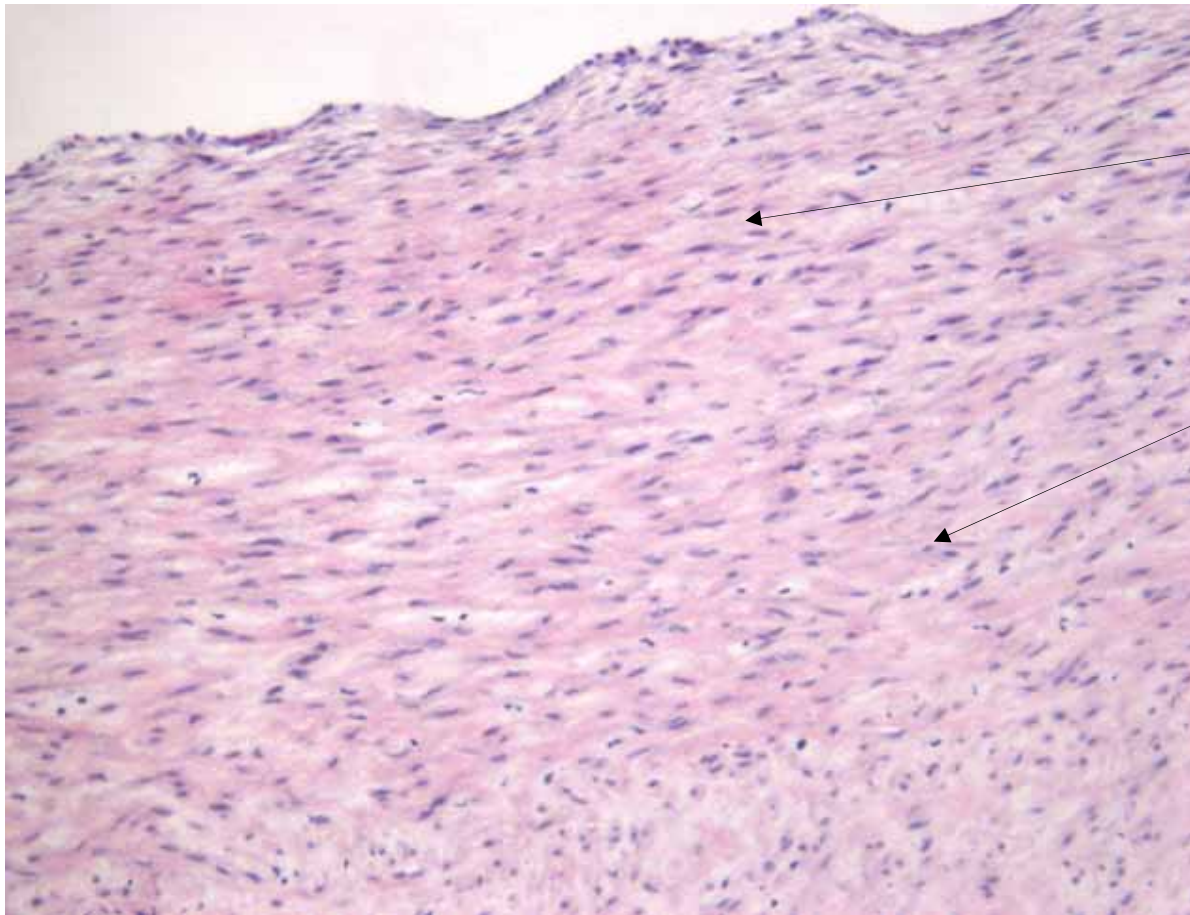


MULTI SCALE SCAFFOLD STRUCTURE AND FUNCTION

Scaffold bulk mechanical properties and function cartilage meniscus



TISSUE REGENERATION IN VIVO BLOOD VESSEL / VASCULAR PATCH

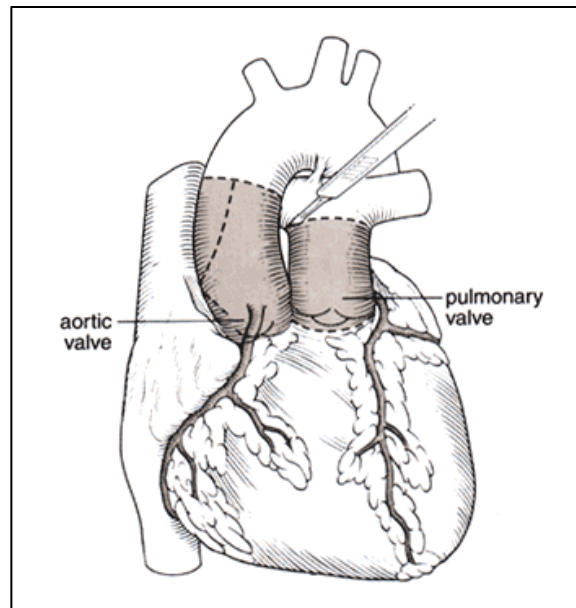


Regeneration of dCELL
Biological scaffold as
Vascular Patch
for blood vessel repair
with patients own cells

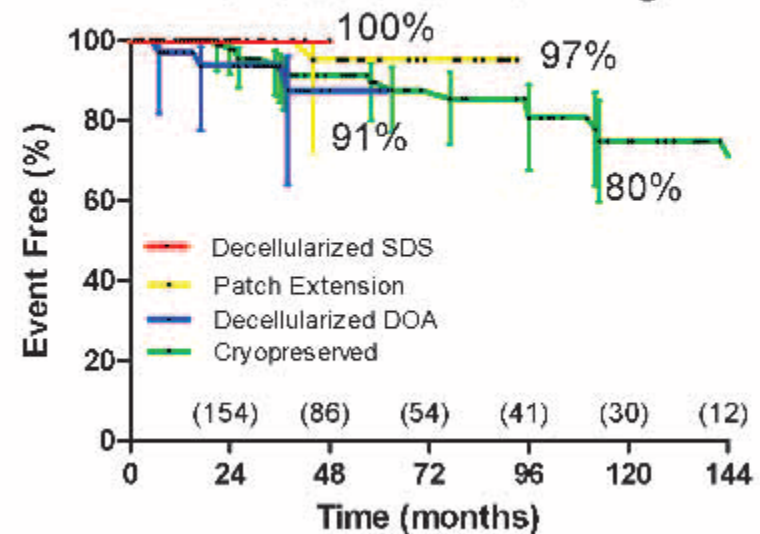
Clinical product
Tissue Regenix
Vascular patch
dCELL TM

CE mark august 2010

CLINICAL TRIAL - BIOLOGICAL SCAFFOLD FOR HEART VALVE



Ross Operation- Freedom from RVOT Reoperation or Gradients > 40 mmHg

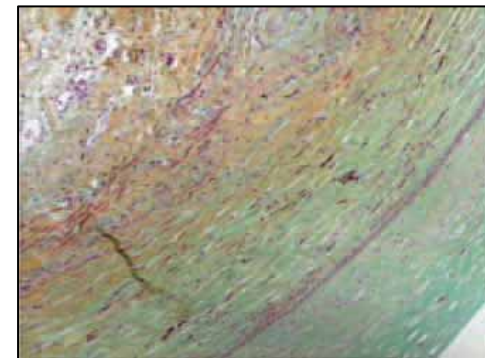


Thirteen Years' Experience with the Ross Operation

Francisco D. A. da Costa¹, Lúcia R. Santos¹, Claudinei Collatusso¹, Camila N. Matsuda¹, Sérgio A. V. Lopes¹, Sanderson Cauduro¹, João G. Roderjan¹, Eileen Ingham²

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The Journal of Heart Valve Disease 2009;18:84-94

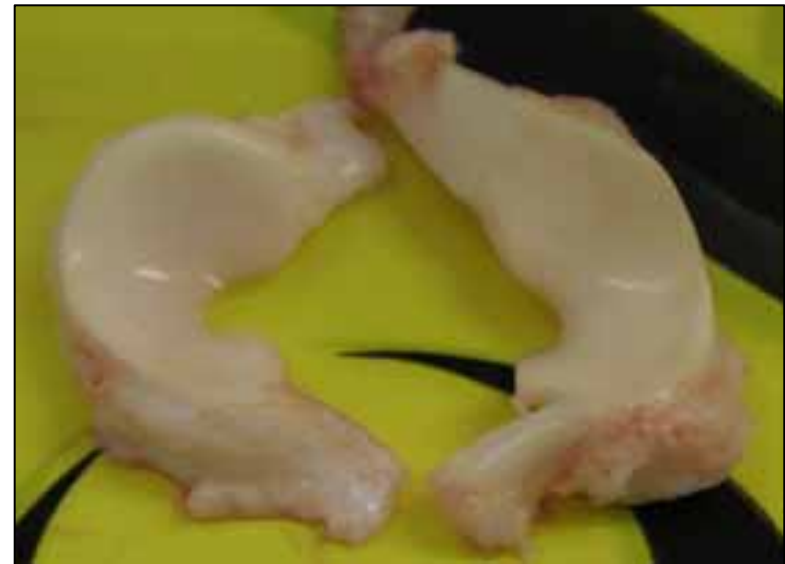


CURRENT RESEARCH, PRODUCT UNDER DEVELOPMENT - MENISCUS

Meniscus damage degeneration
responsible for OA in the knee

dCELL regenerative biological scaffold
under development for partial repair
and replacement of meniscus

Tissue Regenix Group
a U of Leeds spin out

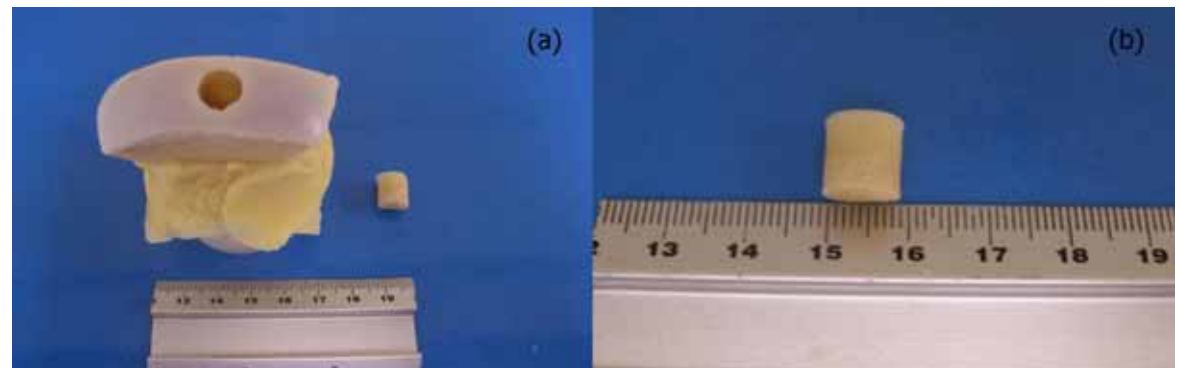


Supported by collaborative research
and development by EPSRC , BBSRC. TSB

RESEARCH OSTEOCHONDRAL DEFECT REPAIR

- Cartilage defect repair
 - dCELL osteochondral graft
 - Regenerative biological scaffold

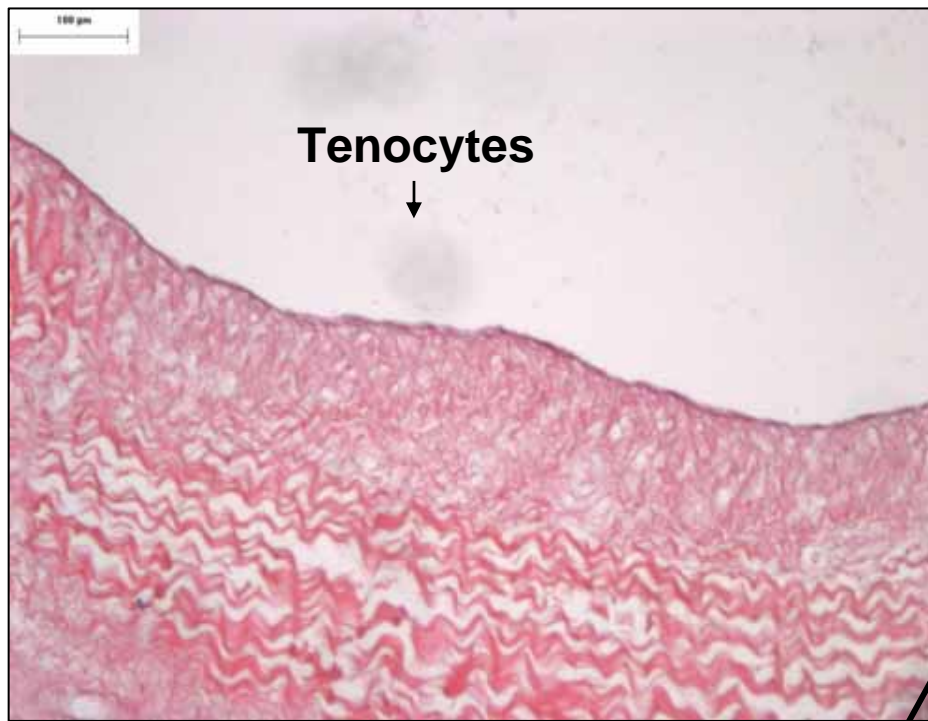
Osteochondral
defect repair



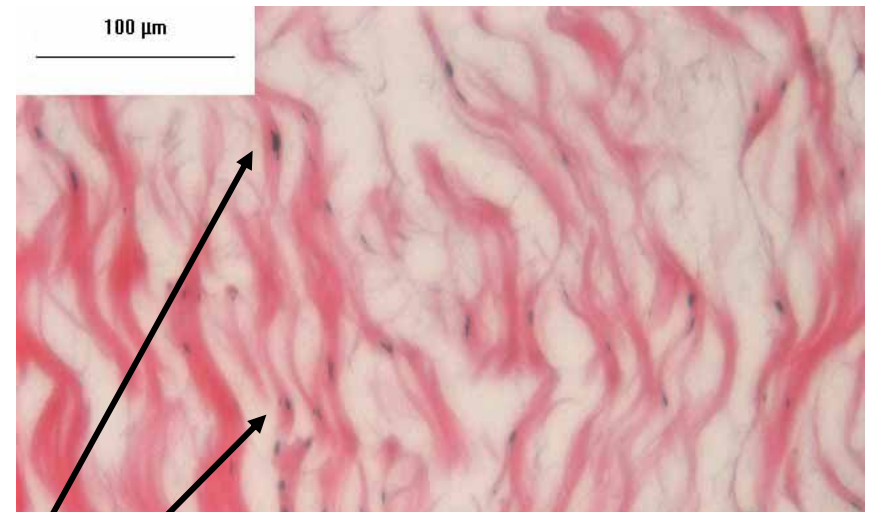
Research supported by Wellcome Trust and EPSRC

LIGAMENT REPAIR AND REGENERATION OF DCELL SCAFFOLD

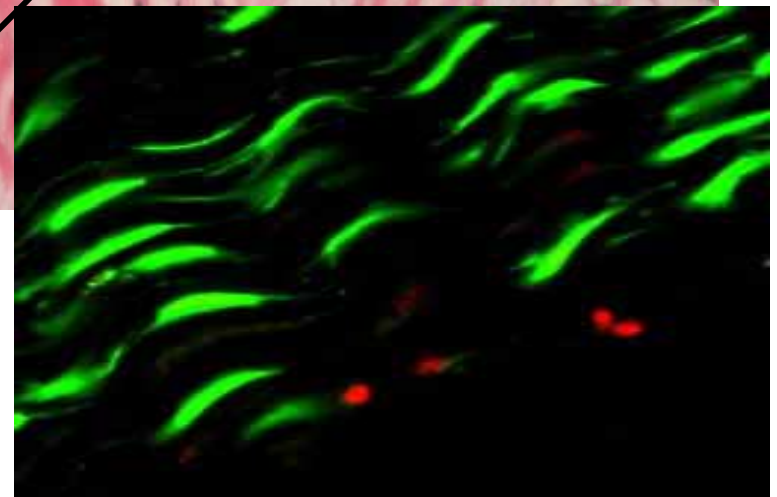
Cells on surface of scaffold at 1 week



Cells in centre of scaffold at 3 week

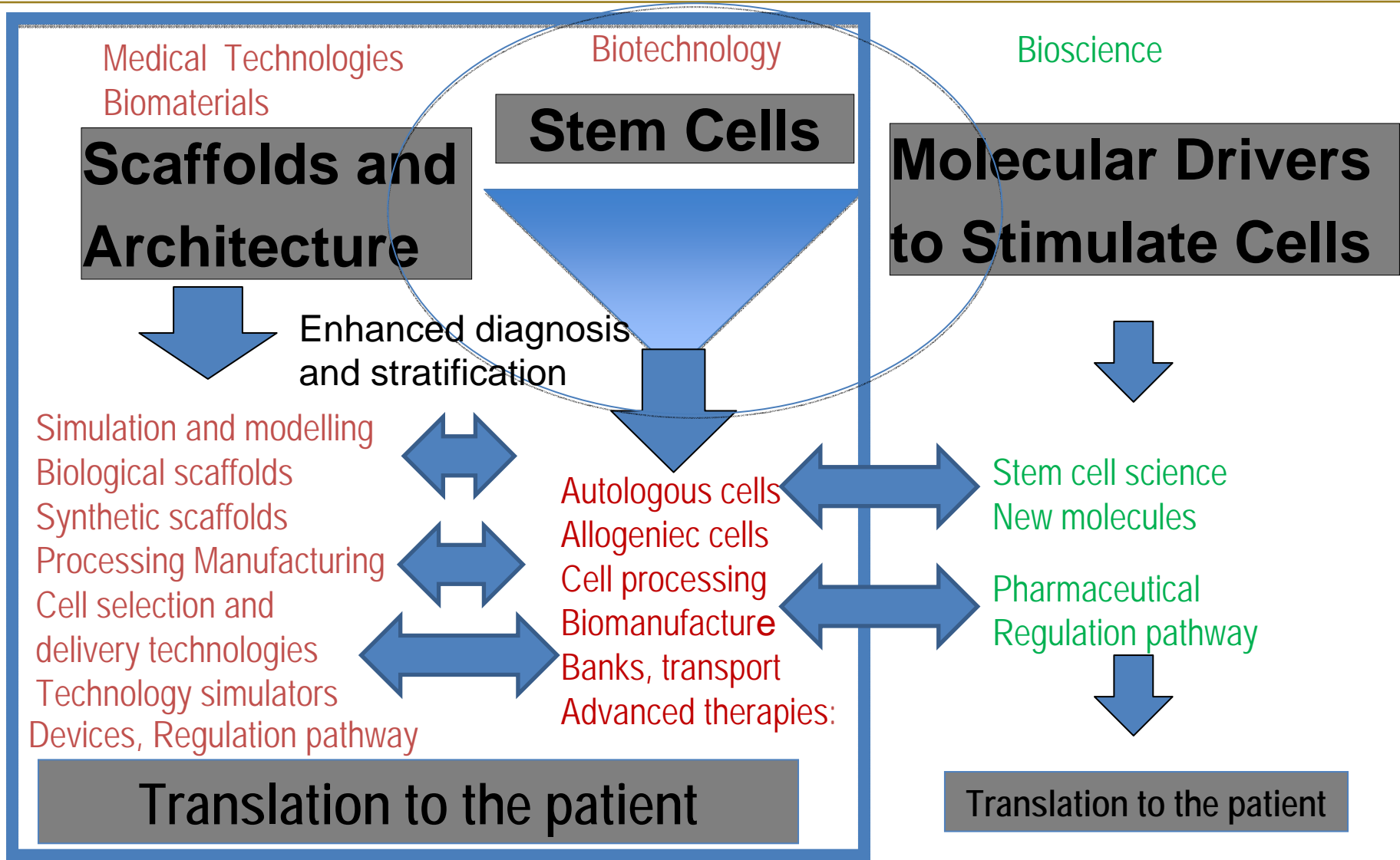


Tenocytes



dCELLPatella tendon ligament

MEDICAL TECHNOLOGIES FOR REGENERATIVE THERAPIES



IMBE INSTITUTE OF MEDICAL AND BIOLOGICAL ENGINEERING U OF LEEDS

Research Technology Innovation Centre

Research & Innovation in medical technologies

200 research and innovation staff

£50 m research and innovation funding

50 industry partners

50 clinical associates

50 active technology innovation projects



Host to national centres

WELMEC Centre of Excellence in Medical Engineering

IKC RTD Innovation and Knowledge Centre

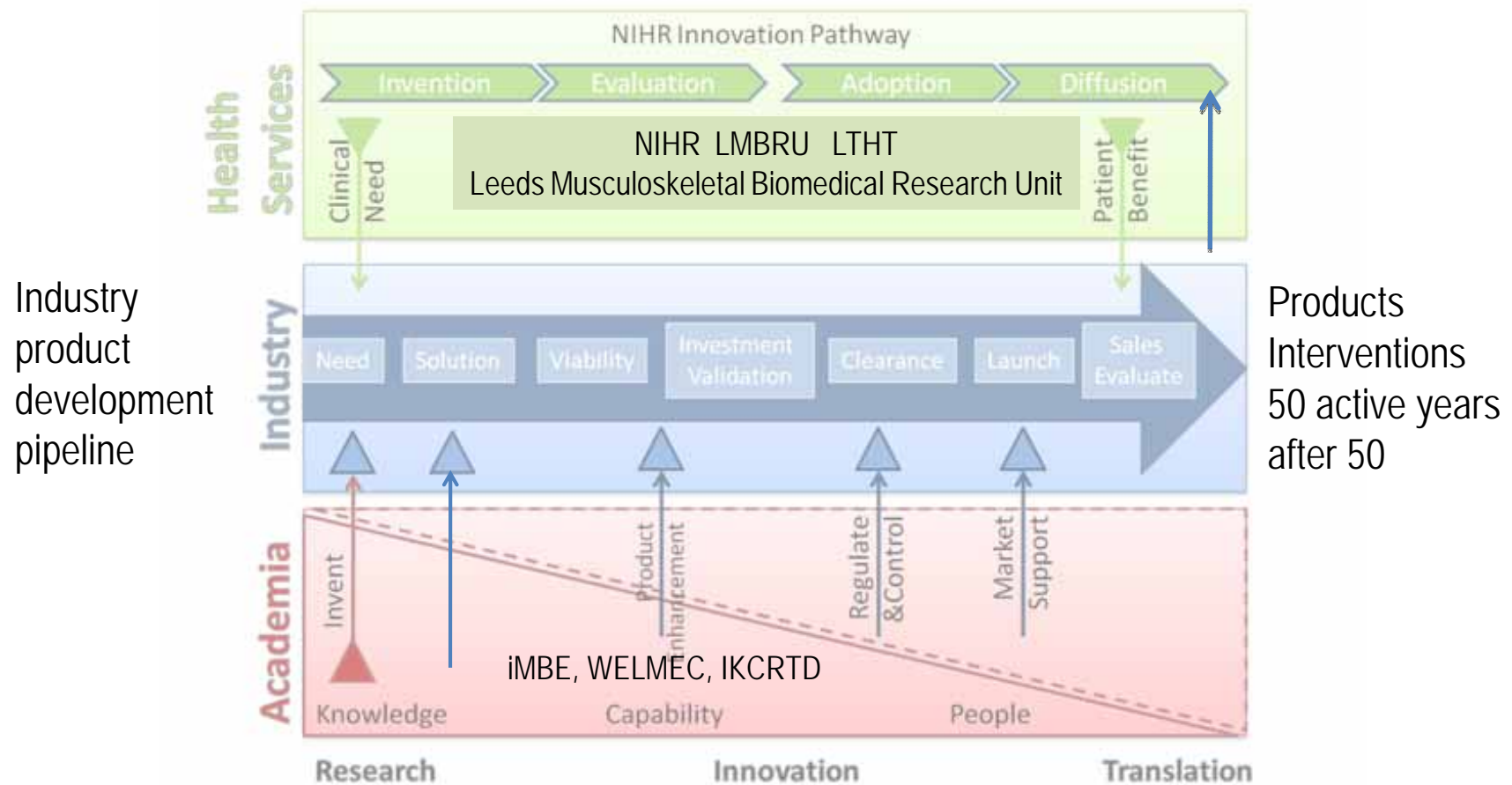
LMBRU NIHR Leeds Musculoskeletal Biomedical Research Unit

RegeNer8, N8 Centre for translational Regenerative Medicine

TERM Doctoral Training Centre Tissue Engineering and Regenerative Medicine

RESEARCH TECHNOLOGY INNOVATION CENTRE IN MEDICAL TECHNOLOGY

Research innovation capacity with industry & clinical collaborators



TAKE HOME MESSAGES – FIFTY ACTIVE YEARS AFTER FIFTY

WHY? Active ageing population “silver tsunami” a major global challenge

Medical technology market growing - globally >10%, Asia > 30%

WHAT ? UK is a global leader in medical technologies

Medical engineering has & will provide solutions for active ageing population

HOW? Integrate multidisciplinary research and innovation

Research -Technology -Development –Business- Patient

Bridge translation gap between academia and commercialisation

Key emerging technologies in Regenmed, M health, stratified interventions

Need to build on existing centres of excellence in medical technologies

Co investment and co development, Universities - Industry - NHS - Patients

Medical engineers will drive innovation in healthcare technology

ACKNOWLEDGMENT OF OUR FUNDERS




Wellcome Trust

**National Institute
Health Research**



**Technology
Strategy Board**

The Leeds Teaching Hospitals 
NHS Trust

Arthritis UK

NIH



THE CHILDREN'S
HEART SURGERY
FUND

EU

RegeNer8



Vascutek, BITECIC, JRI, Simulation
Solutions

DePuy