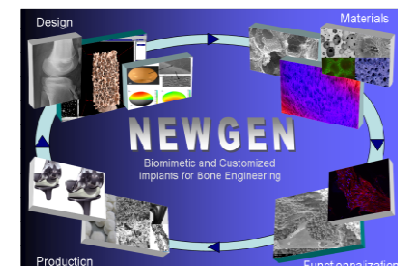
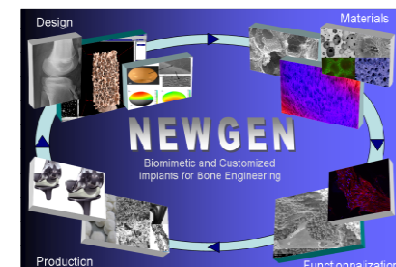


- **Complete denomination:** Higher Education Institute
- **Location (city, country):** Athlone, Ireland
- **President:** Prof. Ciaran O'Cathain
- **Contact person in NEWGEN:** Dr. Declan Devine: ddevine@ait.ie (Director of Materials Research Institute).
- **Working Group involvement:**
Management Committee member substitute
Working Group 3 member: Functionalization of implants for improved functional and therapeutic effects
- **Staff:** Dr Sean Lyons, Dr Valarie Barron, Dr. Luke Geever, Dr. Michael Nugent
- **Research topics:** Implant coatings, controlled release of API, Protein encapsulation. Development of biodegradable BSM, fracture fixation in osteoporotic bone
- **Researchers expertises:** Polymers processing, Polymer chemistry, Characterisation Composites, Covalent linking of proteins/coatings, Controlled release, Smart polymers



DEVELOPMENT OF BIOACTIVE NANOCOMPOSITES FOR BONE TISSUE ENGINEERING APPLICATIONS

- **Funding body:** Marie Curie International Outgoing Fellowship
- **Lead researcher:** Dr. Declan Devine
- **Project goals:**
 - Covalently link a combination of growth factors into the structure of a osteoconductive scaffold
 - Characterise protein release from the scaffold
 - Determine in vivo efficacy of the treatment
- **Outcomes:**
 - Growth factor retention excellent after 10 days
 - Significant increase in bone volume in the defect after 8 weeks
 - PCT filed



COST Action MP1301

Development of hydrogel based composites for bone tissue engineering applications

➤ **Lead researchers:** Dr Declan Devine & Dr Michael Nugent

➤ **Project goals:**

➤ Determine the optimum bioceramic type and concentration which imparts the greatest enhancement of compressive properties of the hydrogel.

➤ Examine the bioactivity and antimicrobial properties.

➤ **Outcomes:**

➤ Six peer-reviewed publications in leading biomedical journals.

➤ Fabricated polyethylene glycol based hydrogels with the incorporation of bioglasses, hydroxyapatite and tricalcium phosphate.

➤ Sustained drug release of vancomycin and dexamethasone for over two weeks.

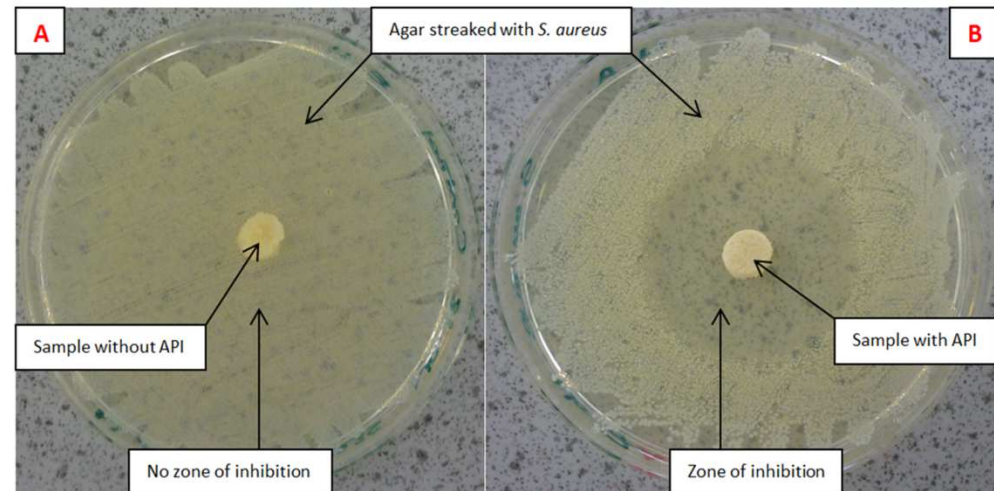
➤ Formation of apatite layer on each of the hydrogel based composites

Antimicrobial release from bone substitute materials

➤ **Lead researcher:** Dr Michael Nugent & Dr Declan Devine

➤ **Project goals:**

- Encapsulate and control the release of antimicrobial agents
- Illustrate that antimicrobial agent is effective at eliminating bacterial and preventing bacteria attachment



➤ **Outcomes:**

- Biofilm production was reduced in comparison to scaffold without antimicrobial agents incorporated.
- ZOI were recorded for samples containing antibacterial agents

Femoroplasty/Vertebroplasty

➤ **Lead researcher:** Dr. Declan Devine

➤ **Project goals:**

- Develop high strength polymer blends for use bone augmentation
- Incorporation of therapeutic agents
- Assess affect of procedure on surrounding tissue

➤ **Outcomes:**

- Study ongoing



➤ Hot melt extrusion:

- Twin screw and single screw
- Compounding: addition of additives fillers active pharmaceuticals etc.
- Super critical fluid assisted compounding: reduces melt temp. of polymers
- Profile, or film production: water or air cooled (for water soluble compounds)

➤ Injection:

- Micro moulding
- Coupon moulding for material property characterisation

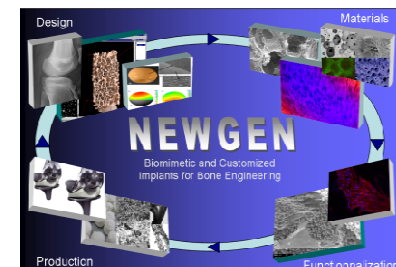
➤ Other thermal processing

- Blow moulding
- Thermoforming
- Rapid Prototyping



➤ 3D Printing

- 3D CAD Modelling
- Customised blends
- Filament 3D printers



Material characterisation

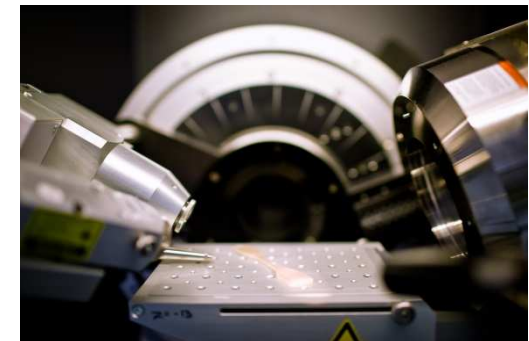
➤ Mechanical:

- Tensile, compression, flexural, 3 or 4 point bending
- Impact testing
- Hardness testing



➤ Thermal properties:

- Melting temperature, glass transition temperature, crystallisation temperature
- Melt flow rate
- Dynamic thermal analysis
- Thermogravimetric analysis
- Heat distortion testing



➤ Structural:

- FTIR, Raman, XRD



Miscellaneous

➤ Active pharmaceuticals

- Incorporation of API during synthesis or during processing
- Controlled release analysis

➤ Photo-initiation

- In situ polymerisation
- Coatings
- Crosslinking

➤ Force plate analysis and motion capture:

- Clinical outcome analysis

➤ Surface analysis

- Contact angle
- Scanning Electron Microscope

