

SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Load Bearing Bioactive Scaffolds for Bone Tissue Engineering

Many scaffolds have been developed over the past decades, however none so far as fulfilled all the desirable requirements for bone tissue engineering. These requirements are both mechanical and biological. Mechanically the stiffness should be such as to encourage mechanical stimulation of bone cells and the materials needs to have sufficient initial strength to be load bearing. The implant must then degrade as the defect heals so the rate of degradation needs to be tailored to the application. Depending on the application either porous or solid materials are required, but for this proposed application in a skull defect, both porous and solid are required.

The aim is to produce a defect filling implant for the skull or jaw thus a combination of cortical and cancellous bone, in a complex shape, needs to be replaced.

The composite will be based on a degradable polymer or on collagen and will be reinforced with a bone mineral analogue in the form of hydroxyapatite. Electrospinning will be used to produce the porous and consideration needs to be given to methods of joining this to the load bearing solid phase. Bioactivity will be produced by the use of bioactive phases and protein absorption. Degradation will be assessed by soaking in saline and simulated body fluid and mechanical testing. Potential bioactivity will be assessed by simulated body fluid and cell culture studies.

Implant design will benefit from the input of Professor Donos. Professor Tanner and Dr Hing will be responsible for the material production and characterization phases of the project.

2. Project Scope

The three research project objectives are:

- Develop a load bearing bioactive degradable composite in both solid and porous form*
- Combine the solid and porous composites to produce an implant for fracture healing or bone defect treatment*
- Assess the mechanical and biological behaviour and degradation rate.*

3. Desired Skills from the Student

This project is suitable for a student with a background in Biomaterials, Biomedical Engineering, Materials or some areas of Biomedical Sciences.

They will develop skills in materials production with the addition of biological moities and both mechanical and biological characterization of solid and porous materials.

4. Supervisory Team

*Primary: **Professor Liz Tanner**, Bonfield Professor of Biomedical Materials. School of Engineering and Materials. e-mail k.e.tanner@qmul.ac.uk*

*Secondary: **Dr Karin Hing**, Reader in Biomedical Materials, School of Engineering and Materials. e-mail k.a.hing@qmul.ac.uk*

*Additional: **Professor Nikos Donos**,:Professor of Periodontology & Implant Dentistry, Institute of Dentistry, The Royal London Hospital, Whitechapel. E-mail: n.donos@qmul.ac.uk*