

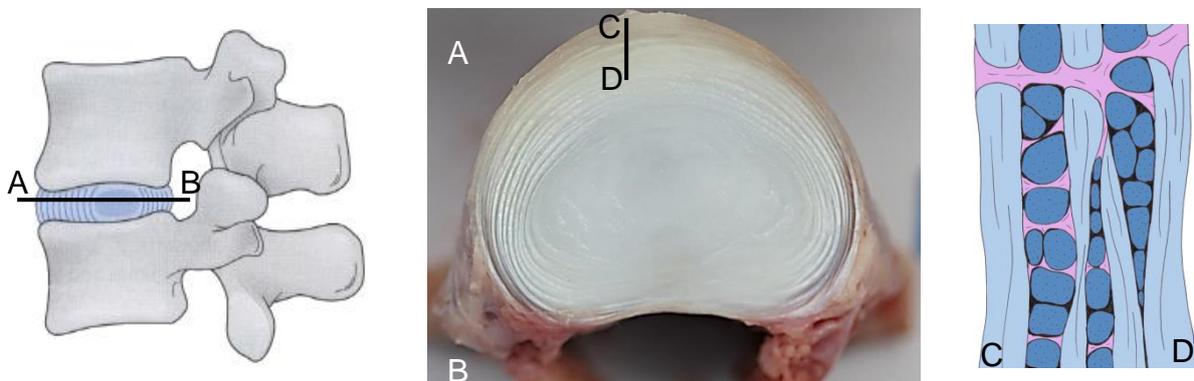
## Development of numerical models of the inter-vertebral disc

### TFE with a placement at the institute of Medical and Biological Engineering - University of Leeds (UK)

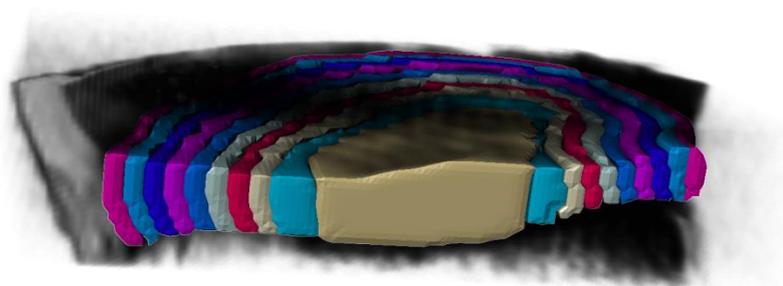
One of the clinical treatments for acute back pain due to disc prolapse developed nowadays is the injection of biomaterials into the inter-vertebral disc, either to replace or to reinforce the disc. This type of treatment involves puncturing the remaining disc with a needle, with the inconvenient that the micro-damage caused may lead to disc degeneration. The understanding of a micro-mechanics of the disc is crucial to assess the effect of a needle puncture.

This Master Thesis will consist into contributing to an inter-vertebral disc finite element model at the micro-structural level.

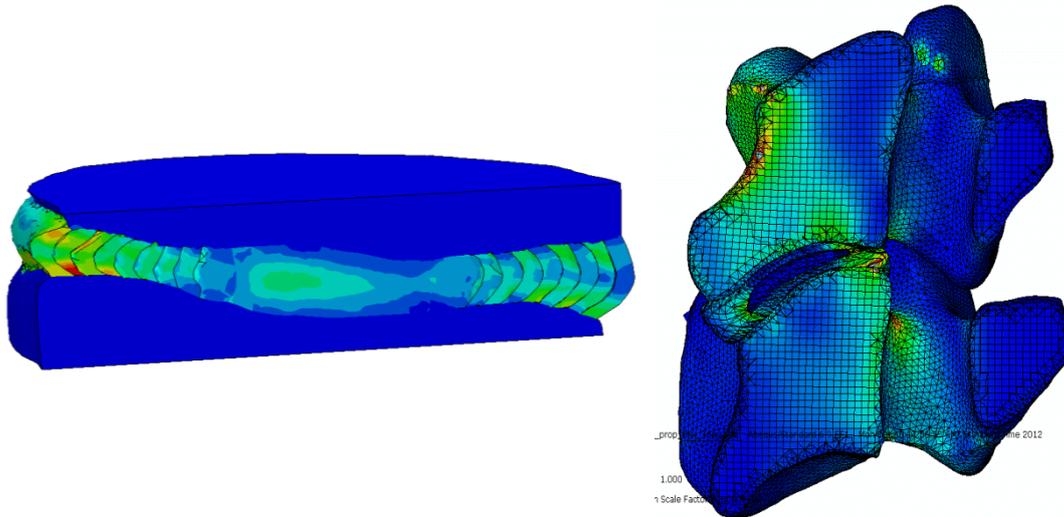
Working with medical image data (CT and/or MRI) of the spine and in particular the disc, several aspects of a mechanical models can be tackled: producing an image-specific finite element mesh, calibrating material models to existing experimental data, analysing the effect material behaviour assumptions at the micro-level have on the overall disc behaviour, modelling the needle puncture, modelling the long-term damage-like biological reaction around the puncture,...



Intervertebral disc: schematic of the different scales to look at.



Extraction of the disc constituents (nucleus and lamellar annulus) from MRI data



FE model of the disc and inclusion into a functional spine unit

**Background:**

The interested student must have passed a finite element course. Taking the “Large deformation of solids” course should be considered. Depending on the background, the work will be done using Metafor and/or Abaqus (a quick training will be done). If the candidate is interested some experimental work (with ovine tissue) can be considered.

The work will be carried out at the University of Leeds (UK) - institute of Medical and Biological Engineering with Dr Mengoni and Prof Wilcox.

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