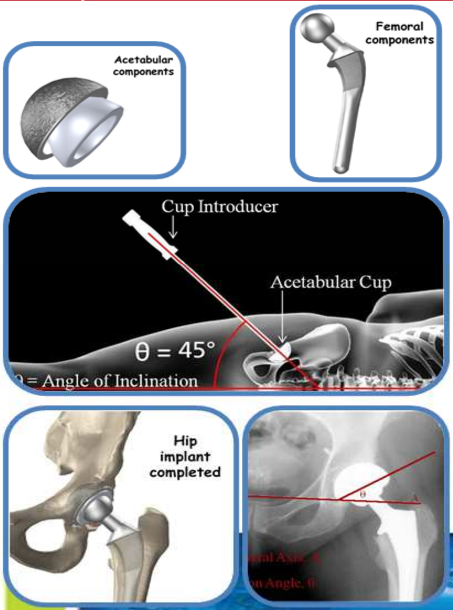
PhD: Optimisation of Acetabular and Femoral Component Placement in Total Hip Arthroplasty (THA)

Supervisors: Dr Alex Lennon, Dr. N Dunne, Prof D Beverland

DTC Healthcare Technology
School of Mechanical and Aerospace Engineering
Queen's University Belfast



- Background:
  - Accurate placement of acetabular and femoral components remains a big challenge in THA
    - Understanding interaction of biomechanics and failure processes is critical to <u>defining</u> optimal position
    - Monitoring and control of patient position during surgery is critical to <u>achieving</u> optimal position
- Aims
  - Improve understanding of the impact patient alignment and component placement have on THA success
  - Develop method and device to control patient alignment and component placement during surgery
- Opportunities
  - Placement in Musgrave Park Orthopaedic Hospital and collaboration with a world leading orthopaedics company via Belfast Arthroplasty Research Trust (BART)

For more information contact Dr. Alex Lennon: a.lennon@qub.ac.uk

To Apply: Applications are invited to be made electronically through the Queen's University Belfast online application portal at http://go.qub.ac.uk/pgapply

Doctoral Training Centre in Healthcare Technology (**DTC-HT**)

This PhD project is part of a newly established doctoral training centre within the School of Mechanical and Aerospace Engineering at Queen's University Belfast. This DTC brings together complementary expertise to provide a training programme to engineers and scientists which will prepare them for future challenges associated with design, manufacture and implementation of healthcare-related technologies. It will also provide a supportive and exciting environment for students, build relationships between teams in collaborating universities, and create links with industry.

Project Description:

Accurate acetabular cup placement is considered by many to be the biggest challenge in Total Hip Arthroplasty (THA). The most common measurable output to assess acetabular cup placement is radiographic inclination, which is measured on a post-operative X-ray, although measurement of anteversion (forward rotation) and restoration of joint centre are also important. Radiographic inclination depends on orientation of the cup and patient placement and, from recent research, it is now becoming apparent that the latter is the most important. Computer Aided Surgery (CAS), to assist the surgeon in achieving correct component placement and adequate joint stability, has been shown to be effective in reducing the number of outliers, but high costs prevent it from being used widely. To date there has been somewhat less emphasis on restoration of femoral head centre, with many surgeons templating an alternative femoral head centre to compensate for medialisation of the cup, which results in an increase in femoral offset.

<u>The aim of this study</u> is to (a) improve understanding of the impact of acetabular and femoral component placement on clinical outcome of THA and (b) find a reproducible, consistent method of controlling orientation and placement of both the acetabular cup and the femoral stem during surgery.

Biomechanical analysis of the cup and stem in varying alignments, offsets, and vertical heights will be carried out to determine the influence of alignment on stability (dislocation), wear, and loading of surrounding tissues. Combining this analysis with surveys of clinical outcome as a function of component position will improve understanding of optimal placement. Clinical studies will also be carried out in theatre. Findings from the biomechanical and clinical studies will be used to develop devices and procedures to optimise placement of the acetabular and femoral components.

Key Skills Required for the post:

Applicants should hold a 2.1 Hons (or equivalent) degree in a relevant discipline such as Mechanical Engineering or Biomedical Engineering.

It is essential that the candidate has an enthusiastic attitude towards undertaking research in the field of Healthcare Technology and is willing to travel to both academic and industrial collaborators for placements, training courses and dissemination activities.

It is particularly desirable that the candidate can demonstrate skills that complement undertaking research in computational modelling of orthopaedic biomechanics (e.g. finite element analysis and multi-body dynamics).

Key Transferable Skills that will be developed during the PhD:

The training approach utilised in this DTC will be targeted specifically towards PhD graduates securing employment in medical device companies, academic institutions, and national & international government agencies. Training areas will include four domains encompassing; knowledge & intellectual abilities, personal effectiveness, research governance & organisation, engagement influence & impact.

Stipend	Basic stipend of £13,863 with potential for enhancement to £18,500 (tax free), depending on the qualifications of the applicant, their commitment to graduate teaching assistant duties and recommendations of the interview panel.
Fees	Funding covers academic fees for candidates from within the EU only.
Duration	1^{st} October 2014 - 30^{th} September 2017
QUB Supervisors	Dr Alex Lennon, a.lennon@qub.ac.uk Dr Nicholas Dunne, n.dunne@qub.ac.uk
External Academic Collaborator:	Professor David Beverland, Orthopaedic Surgeon, Musgrave Park Hospital, Belfast
Industrial Collaborator(s):	Collaboration with industry will be leveraged via existing links between the Belfast Arthroplasty Research Trust (BART) and a world-leading orthopaedics company.
To Apply:	Applications are invited to be made electronically through the Queen's University Belfast online application portal at http://go.qub.ac.uk/pgapply **Application Deadline**: 31st July Interviews to be held in last two weeks of August