

**BSc in Reproductive & Developmental Sciences &  
BSc in Surgery and Anaesthesia Project Outline 2011-2012**

**Project Title:** Analysis of force and trajectory patterns during internal examinations

**Academic Supervisor:** Dr Fernando Bello

**Division:** Surgery

**Section:** Surgical Technology

**Co-supervisor:** Dr Naomi Low-Beer / Dr Roger Kneebone / Mr Alejandro Granados

**Who will be responsible for day-to-day supervision?** Dr Fernando Bello will be responsible, aided by Dr Naomi Low-Beer and Mr Alejandro Granados

**Contact Details of Person whom Medical Student should contact for further details:**

**Name:** Dr Fernando Bello

**Email:** [F.Bello@imperial.ac.uk](mailto:F.Bello@imperial.ac.uk)

**Tel:** 0203 312 1788

**Group's Research Interest:** The Robotics and Imaging Research Group aims to address fundamental research issues related to the future development of minimally invasive surgery and promote a synergy in the areas of Surgical Technology, Medical Image Computing, Biomedical Engineering, Robotics, Man-Machine Interfacing, Virtual Reality and Bio-Medical Simulation. Our research can be subdivided into the following major topics: Image Guided Intervention and Robotic Surgery; Video Based Tracking, Modelling and Rendering; Bio-mechanical Modelling and Simulation; Visualisation and Augmented Reality; Implantable and Wearable Sensing.

(Double click the appropriate check box to indicate your choices below)

**Is this a clinical  or laboratory  project?**

**Suitable project for:**

**Reproductive and Development Sciences  
Surgery and Anaesthesia**

Yes  No   
Yes  No

**Synopsis of project (background/research question/methods to be used/relevant key references):**

**Background to Project:**

Un sighted examinations and procedures (UEP) such as rectal and vaginal examination are core to clinical practice. Findings can have a profound impact on diagnosis and clinical outcome (e.g. diagnosing prostate cancer, rectal disease or human appendicitis; managing normal and abnormal labour; diagnosing bovine pregnancy or equine colic). The techniques of UEP are uniquely challenging to learn and teach, since examinations are conducted almost entirely by feel. Visual cues are minimal, and a novice has to use their finger/s to build up a mental representation of the anatomy and recognise structures (normal or diseased) in order to perform a procedure or make a diagnosis. Crucially, a trainer is unable to feel what the novice is feeling, so cannot provide effective guidance or assess performance. The aim of the project is to determine and localise forces applied and trajectories followed using unobtrusive sensors during internal and external palpation. These data will advance understanding of the examinations, the learning process, including differences between experts and novices, as well as inform simulation development, enabling revision of the underlying mathematical models and facilitate training / enhance learning.

**Hypothesis Student will Investigate:**

- That it is possible to identify consistent patterns of force and trajectory during internal examinations performed by experienced clinicians
- That there exists a significant difference between the patterns of experts and the force distribution and trajectories followed by novices

**Methods/Techniques Student will use:**

After familiarising her/himself with the force measuring system, trajectory tracking device and acquisition software, the student will conduct a number of carefully designed studies where participants (expert clinicians and trainees) perform rectal and vaginal examinations on inanimate models. In addition, a small set of clinicians will conduct rectal and vaginal examinations on Rectal and Vaginal teaching Associates. Statistical analysis will measure the degree of association between force values and finger dynamics (location, orientation, velocity, acceleration) using Pearson or Spearman correlation coefficients. Analysis of variance (ANOVA) will be used to test if there is a significant difference in force and finger dynamics between patients with anatomical differences, and to examine inter-operator differences. Participants may also be asked to complete questionnaires.

Will the research involve work done under the Animals (Scientific Procedures) 1986 Act? Yes  No

**If YES,**

Will the student be required to undergo Home Office training? Yes  No

Are the appropriate project and personal licences in place? Yes  No

**Project licence:**

Licensee  
Date of issue  
Number

**Personal licence:**

Licensee  
Number

**Will the research involve the use of genetically modified tissue?** Yes  No

**If YES**

Has the work been approved by the relevant GM Committee Yes  No   
Date approval was granted  
Reference Number

**Will the project involve work on human subjects, human tissue or access to confidential patient information?** Yes  No

**If YES**

has ethical approval been obtained Yes  No   
Date approval was granted Sep 2009  
IC REC or IRAS REC number 09/H0701/68

**Note: Approval for any of the above MUST be in place before the student begins the project.**

**A risk assessment form will be required.**

**Project Payment:** I have an F account Yes  No

**If you have an F account please give full account code:** DSBT-F36651