2017/2018 Summer Studentship Project Application Form

Send to: Research Office, University of Otago Christchurch, PO Box 4345, Christchurch, by 5pm on 3 July 2017

Supervisor Information (First named supervisor will be the contact):	
First Supervisor's Name and Title: Mr Jonathan Michael Wells, Paediatric Surgeon	
Department - UOC &/or CDHB (if applicable): Paediatric Surgery	
First Supervisors Phone: 0210418510	Supervisors Email:jon.wells@cdhb.health.nz
First Supervisors Mailing Address: Dept Paediatric Surgery, Christchurch Hospital	
Co-Supervisors Name and Title(s): Dr Nick Cook and Professor Spencer Beasley	

Research Category (Choose one category only **– to be used for judging the students' presentations):**		
Clinical X	Laboratory	Community

Project Title (20 words MAXIMUM):
Development and validation of a three-Dimensional (3-D) printed thoracoscopic oesophageal atresia/tracheo-oesophageal fistula simulator

Project Description:

Introduction

Minimally invasive surgery (MIS) is beneficial for patients as it reduces post-operative pain and the need for large incisions, as well as providing a magnified operative view – a particular advantage in neonatal surgery. However, MIS is challenging within the neonatal thoracic cavity due to the small working space available.

Oesophageal atresia and tracheo-oesophageal fistula (OA/TOF) is a condition that occurs in approximately 1 in 3000 new-born babies. The options for surgical repair include an open operation via a thoracotomy or a thoracoscopic MIS approach.

The operative steps of the MIS approach can be practiced on a simulator. Simulation can be of low or high fidelity, which relates to how closely it resembles real life. To increase fidelity, developing a model of a baby ribcage (to scale) allows the procedure to be practiced in the actual space that it would be performed in real life.

This project aims to develop a simulator for thoracoscopic repair of OA/TOF. Our intention is also to assess how effective this model proves to be in the acquisition of the technical skills required for oesophago-oesophageal end-to-end anastomosis within the confines of the infantile thoracic cavity.

Aim

Develop a three-Dimensional (3-D) printed, validated simulator for thoracoscopic repair of oesophageal atresia and trachea-oesophageal fistula

Objectives

- Develop a high fidelity 3-D printed simulator for thoracoscopic OA/TOF repair
- Validate the simulator for its effectiveness in assisting skill acquisition, especially for oesophageal anastomoses
- Develop a collaboration between the departments of Paediatric Surgery and Medical Physics & Bioengineering at Canterbury District Health Board (CDHB)
- (in the longer term) to determine its applicability for other neonatal intra-thoracic procedures

Possible impact (in lay terms)

This project will develop a model paediatric surgeons can practice and acquire the skills for a difficult and challenging key-hole (thoracoscopic) operation in babies (neonates). The simulated operation is the repair of an oesophagus which has developed abnormally. This abnormality consists of a blind ending upper oesophageal pouch and the lower oesophagus abnormally attached to the main airway. The operation requires separation of the lower oesophagus from the airway and joining it to the upper oesophagus pouch within the small space of a baby's chest by the keyhole method (thoracoscopic oesophageal atresia and tracheo-oesophageal fistula repair).

Method

Iterative simulator design methodology

1. CT data of a neonatal thorax to extract ribcage data
2. Computer modelling of CT data to create a full ribcage model using simulated data
3. 3-D printing of standardised ribcage
4. Material for 'skin' coverage of ribcage
5. Iterative approach to development of 3-D printed internal structures
    - Oesophageal upper pouch and tracheo-oesophageal fistula
    - Investigate double layer materials and methods
    - Mediastinal components expected to be inserted for each use, and replaceable

Assessment of simulator

- Reliability of the simulator
- Expert review and appraisal of simulator – construct validity including: morphology, suture response, texture, elasticity, strength, etc
- Face validity
- Content validity
- Criterion validity – concurrent and predictive
- Cost-effectiveness

Further iterations of the simulator will be developed by using different materials to increase the fidelity of the simulated procedure.

The ongoing project will also assess how effectively the simulator allows acquisition of the skills needed for this complex procedure including dissection and suturing. This will be through a program of simulator training for a variety of different groups from medical students with limited surgical skills to experienced MIS surgeons. Initial training may be with an oversized thoracic model reducing to life-size as skills are acquired. Parameters of performance will include: time, appearance (of anastomosis), quality of suturing, and integrity of anastomosis

Student Prerequisites (eg. Medical Student) if applicable:

Medical Student

Administration Details

1. Is ethical approval required? /No

   If Yes: please circle or tick one of the following:

   a) Applied for (provide application #)

   b) Approved (attach a copy of the letter of approval from the ethics committee or application #)

   c) To be done

2. Are you able to provide the funding for this project (ie. $5,000 for the student, incidental expenses should be met from departmental or research funds) No

   If Yes: Please provide name of the funder _____

   If No: Please provide ideas of possible funding sources, including past funding agents and topics often associated with this research area, for the Research Office to contact.

   _____

   If Yes: You will be sent a request for more information.

3. Medical Records or Decision Support accessed No

4. Health Connect South or other DHB records No

5. Signatures:

   - I have read the 2017/2018 Summer Studentship programme handbook.
   - I am prepared to supervise the project and will be available to the student during the studentship (including Christmas/New Year break if the student is working during this time).
   - I agree to assume responsibility for the submission of the student's reports to the Research Office by the due date 29 January 2018.
   - I agree that the project lay report may be available to local media for publicity purposes.

Signature of Project Supervisor(s): J.M. Wells Jonathan Wells	Date: 03/7/2017

- I understand that I am responsible for hosting the Summer Student chosen for this project and will meet any costs incurred. I agree that incidental expenses will be met from departmental or research funds.

Signature of Head of Department: Spencer Beasley Professor Spencer Beasley	Date:03/07/2017

Signature of Clinical Director: (if applicable) Professor Spencer Beasley Spencer Beasley	Date: 03/07/2017