Interventional Technologies Theme

John Windsor
Professor of Surgery
University of Auckland

Peter Xu
Professor of Mechatronics
University of Auckland
‘Interventional Technologies’

- Not just ‘surgical’ technologies
- Significant convergence of interventional technologies in medical care, including robotics
- Aim – less invasive and more cost-effective
Interventional Technology Projects

Flagship
1. Patient specific virtual organs for surgical planning and image guided surgery
2. Diagnosis and therapy of gastric dysrhythmias

Seed
1. Redesign of percutaneous drains
2. Wide peripheral imaging laparoscopic ultrasound to guide invasive probes for ablation treatments
Flagship Project #4

Patient specific virtual organs for surgical planning and image guided surgery
Principle investigators
- Peter Hunter (ABI)
- Adam Bartlett (Surgery ADHB)
- John Windsor (Surgery UOA)

Associate investigators
- Harvey Ho
- Jagir Hussan
- Martyn Nash
- Poul Nielsen

PhD students
- Peter Swan FRCS
- 2x PhD’s from International Research Training Group, Soft Tissue Doctoral Training Programme (Germany)
The need

- Improved preop **planning** for tumour resection
  - Mental 3D image from cross sectional 2D images
  - Relationship of the tumor to anatomical elements of the organ* is not readily apparent
  - Relationship of tumour to anatomical elements change when organ dissected, mobilized and distorted
  - Static images and no functional data (e.g. blood flow)

- Real time 3D image **guidance** of minimally invasive ablative treatments (e.g. thermo, cryo, RF, electroporation)

* liver, prostate, pancreas, thyroid
Consequences

- **Poor planning**
  - Too much tissue removed (organ failure)
  - Too little tissue removed (incomplete resection)

- **Poor guidance**
  - Incomplete ablation (recurrence)
  - Collateral damage (complications)
Preoperative image
Not minimally invasive
Need - minimally invasive ablation using real time 3D image guidance
The solution (1)

- Registration and fusion of **patient-specific data** (of organ and tumour) from multiple imaging modalities
  - Anatomy (geometry) from CT scan
  - Physiology (function) from MR and US scan
- Using existing and improved software for
  - Volume and surface rendering (anatomy)
  - Computational strategies for BP and flow (function)
- Improved interface allowing detailed preoperative (intraop) planning with full pan, rotate and zoom functions
- Form company for web-based 24 hour service to aid diagnosis, planning and education
Develop real-time 3D imaging to guide minimally invasive ablation technologies

- Use of fiducial markers to register distortion
- Improved 3D laparoscopic imaging
- To allow accurate deployment and monitoring

Wide application in laparoscopic and robotic surgery and interventional radiology