

Picture: The STIFF-FLOP System

18 March 2015

Cavendish Conference Centre
London, United Kingdom

The 2015 Innovative Surgical Robotics Forum^{EU/RAS SIG}

Advancements in technology for clinical needs

Prof. Sir Alfred Cuschieri

Chief Scientific Advisor, Institute of Medical Science and Technology, UK

Title: ERC Robot for hydro-colonoscopy

Prof. Sir Alfred Cuschieri will talk about the latest development in his CODIR project which proposes a new configuration of fundamental and applied bio-medical and engineering multidisciplinary research to explore and characterise colon behavior necessary for the project and wider objectives. Scope and focus is on novel robotic hydro-colonoscopy (RHC), which stems from two considerations: (i) replacement of the flexible colonoscope with a patient-friendly system for inspection of the mucosal surface colon and (ii) the very recent concept of hydro-colonoscopy whereby water is used instead of traditional air insufflation. RHC can enable a breakthrough in patient-compliant complete endoscopic examination and biopsy of the colon for the further study of life threatening disorders of the colon commonly categorized as inflammatory bowel disease, all of unknown aetiology despite intensive research.



Prof. Prokar Dasgupta

Professor of Robotic Surgery and Urological Innovation, King's College London, UK

Title: Surgical robots and simulator training

Prof. Prokar Dasgupta will open his talk with a state-of-the-science view on how we should be training urologists to deal with innovations. Urology remains at the forefront of surgical evolution. It is vital that urology training constantly adapts to these changes in practice.



Dr. Alexandre Mottrie

Urologist, OLV Hospital, Aalst, Belgium

Title: Future of robotics in the OR: where are we now and where are we going

Surgical robots made their entrance in the OR in 1999. First, the da Vinci System was meant for cardiac surgery. Gradually, the system evolved and the indications have grown continuously and it is now routinely used in Urology, Gynecology, Thoracic and Abdominal Surgery. To date, only the da Vinci System from Intuitive Surgical is clinically available. It is foreseen that their monopoly will not last much longer and that other types will become available soon. The possibilities of robotics in medicine are numerous. Besides the implementation of robotics in several operative indications, robotic technology is now introduced in multiple other domains thanks to improvements in miniaturisation, tactile feedback, tissue recognition,...



Prof. Yoav Mintz

Director of Center for Innovative Surgery, Department of General Surgery, Israel

Title: New procedures demanding new robotic platforms: what are the developmental challenges?

Laparoscopic surgery was introduced into the general surgery armamentarium in the late 1980s following the incorporation of the video monitor to the laparoscope.

Over the past 30 years, many innovations and novel devices have been developed making MIS easier for physicians and improving patient safety. These innovations contributed to the increase of laparoscopic surgery and to the implementation of MIS into more sophisticated and complex procedures. Major limitations of MIS include 2D vision on a monitor, the lack of tactile feedback, and constraint of the instruments movements caused by the fulcrum point of their entry point into the abdomen. Robotic surgery was developed in order to overcome these limitations and by and large has succeeded, however new challenges arose. Since the introduction of the da Vinci surgical platform MIS has evolved into performing Single Port Surgery and NOTES, both of which are more difficult and demanding surgical tasks. As such, the current robotic platform was not intended to perform surgery in such a way and therefore is not well suited for these procedures. In his lecture, Professor Mintz will discuss the challenges and requirements the new generation of robots face in the realm of robotic surgery.



Prof. Giorgio Peretti

*Associate Professor, University of Genova's Medical and Postgraduate Schools
Director of Otorhinolaryngology, Genova's San Martino University Hospital, Italy*

Title: Is the transoral robotic surgery the really future perspective of the larynx cancer surgery?

In the last years, the current trend in managing laryngeal cancer is to perform organ preservation therapy, which improves quality of life and decreases treatment-related morbidity. The transoral laser microsurgery (TLM) is the most used endoscopic approach to larynx cancer, while transoral robotic surgery (TORS) is developing technique that promise to overcome the limit of „line of sight“ of the transoral laser microsurgery procedure. But is the current robotic surgery really the approach of the future for the surgery treatment of larynx cancer ?



Professor Guang-Zhong Yang

Director, Hamlyn Centre for Robotic Surgery, Imperial College London, UK

Title: From Whole Body Systems to Handheld Manipulators

With increasing emphasis clinically on improved surveillance, earlier diagnosis, and minimally invasive intervention, there is a growing demand on the development of micro-robotic platforms. The purpose of this talk is to provide an overview of the development of medical robot, from whole body systems to micro-manipulators and the future trend towards safer, smaller and smarter systems. It will also outline the evolving clinical demand, emerging technological trends, and the need to focus on economic impact and direct patient benefit when developing new generations of sophisticated yet low-cost and accessible robotic platforms.



Dr Ferdinando Rodrigues y Baena

Reader in Medical Robotics, Imperial College London, UK

Title: Surgical Robotics & Orthopaedics Perspective

The talk will cover the group's unique experience in robotic assisted orthopaedic surgery and the latest developments in percutaneous needle steering with a flexible needle inspired by the egg-laying channel of certain parasitic wasps. The talk will conclude with some final thoughts and an outlook on what may be some of the more exciting challenges in surgical robotics in years to come.



Prof. Darwin Caldwell

Research Director at the Italian Institute of Technology in Genoa, Italy

Title: Robotic Technologies to Enhance Medical Outcomes

Robotics has immense potential in applications spanning the medical domain: from surgery to rehabilitation, and from drug development/testing to training. This presentation will look at how core robotic technologies: advanced user interfaces, advanced actuation and sensing, soft robotic systems, control and dynamics, vision and image processing, mechanics and mechanical design, signal processing, AI and learning systems etc. can be united with medical demands to create the potential for innovation and exciting medical advances/procedures. But the processes of developing, testing and proving the value of these robotic technologies are generally more complex, and certainly very different from other more mainstream areas in which robots are applied. By considering innovations in the medical domain that have arisen at IIT in recent years, I shall try to identify the particular benefits of each technology and then consider the factors that influence the move from research lab to clinical lab and ultimately to the hospital where the robots can be used in processes that genuinely are of benefit to roboticists, medics and patients.



Dr Paula Gomes

Active Devices Expert, BSI Group, UK

Title: CE-marking a robotic medical device

Medical devices require a CE-mark before being placed on the European market. What are the expectations for a robotic device and what scrutiny will such medical devices be submitted to before they can be put into service and commercialised in Europe? What does compliant technical documentation look like? What clinical evaluation is expected to demonstrate safety, performance and the acceptability of benefit/risk ratio? This presentation will describe the existing regulatory framework and landscape. An overview of guidelines available to inform the legal manufacturer of the requirements will be provided. For research projects and early stage ventures aiming to get to market in the future, adopting documentation disciplines and structured development methods from the onset may pay off in the long term.

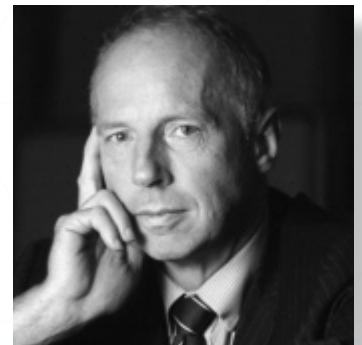


Dr Patrick A Finlay

Founder of MediMaton Ltd, UK

Title: Lessons from launching a new surgical robot

Innovative surgical robots are often developed by small entrepreneurial companies, which then have the challenge of launching and marketing their product internationally. This case study presents the experience of one company in tackling technical, commercial, IP and competitive pressures, leading eventually to a successful surgical robot product. There are plenty of similar examples from other companies to demonstrate that this is a very typical history. In sharing these experiences with other innovative medical technology companies the opportunity exists for exchanging insights that will enable them to achieve volume sales and profitability in a shorter time and with less risk.



Nick Tudor

Business Director, D-RisQ Ltd, UK

Title: Supplying Safe Surgical SoftwareSpeedily

We are likely to need to adapt surgical systems once we have used them in trials. This is normal for most systems as the requirements are never right first time. How can we provide the requisite safety assurance evidence for software surgical systems in an appropriate timescale? If we can do this quickly and assuredly we should be able to get systems into use much more quickly thus realising patient benefits much sooner than is perhaps currently envisaged. D-RisQ has automated mathematical techniques which provide proof that software systems are safe as a by-product of development. This proof supports a system safety case and can be used for decision making systems.



Rich Walker

Managing Director, Shadow Robot Company, UK

Title: Managing the innovation pipeline - lessons learned at a robotics SME

Rich will talk about how Shadow learned the fundamentals of product development, product lifecycle management, and innovation management, and how to take these and apply them to your own work with far less pain.



STIFFness controllable Flexible and Learnable Manipulator for surgical Operations

Prof. Kaspar Althoefer, *King's College London, UK*

In Minimally Invasive Surgery (MIS), tools go through narrow openings and manipulate soft organs that can move, deform, or change stiffness. There are limitations on modern laparoscopic and robot-assisted surgical systems due to restricted access through Trocar ports, lack of haptic feedback, and difficulties with rigid robot tools operating inside a confined space filled with organs. Also, many control algorithms suffer from stability problems in the presence of unexpected conditions.

Departing from current types of robots for MIS, EU project STIFF-FLOP proposes a new concept of modern, inherently safe robots for MIS, capable of morphing from a stiff to a soft state. Yet biological “manipulators”, like the octopus arm and the elephant trunk, can manipulate objects while controlling the stiffness of selected body parts and being inherently compliant when interacting with objects. The vision of the project is to develop a fully-integrated surgical robot system inspired by the octopus, combining soft and stiffness-controllable mechanisms, pneumatic and hydraulic actuation, tactile and force sensors, haptics as well as advanced control and learnable navigation techniques. The demonstration will give an impression of the STIFF-FLOP project, the advancements to date and the challenges that lie ahead.



MICRO-Technologies and systems for Robot-Assisted Laser Phonomicrosurgery

Dr Leonardo De Mattos, *Istituto Italiano di Tecnologia, Italy*

Lasers form an increasingly common tool for precision treatment of pathologies on delicate and vital human organs. Laser phonomicrosurgery is a particularly challenging example involving the vocal cords. Current issues relate to laser control, surgical site access and visualization, and to the ergonomics of the surgical setup. During the past three years, microRALP partners have tackled these challenges by developing technologies for a new robot-assisted surgical system; one that brings innovations in micro-robotic laser control, real-time fluorescence cancer imaging and 3D vision to the tip of a flexible endoscope. In association with a novel teleoperation interface enhanced by augmented reality, intraoperative planning capabilities and cognitive supervision algorithms, the new system not simply overcomes current technology limitations but also transforms the control of the surgical laser into a highly intuitive operation, allowing the achievement of micrometric laser aiming precision from simple hand-writing gestures. The results achieved by microRALP demonstrate great potential for improved quality, safety, and effectiveness in laser phonomicrosurgery. Their translation into clinical practice will enable new and safer minimally invasive laser microsurgeries, leading to a significantly enhanced capacity for cancer treatment in general.



Cognitive AutonomouS CAtheter operating in Dynamic Environments

Prof. Jos Vander Sloten, *Katholieke Universiteit Leuven, Belgium*



MIS offers patients undeniable benefits such as faster recovery and smaller scars. However, as instrument diameters go down, these instruments become more flexible and precise control thereof becomes a challenge. Endovascular catheters are especially difficult to handle. Improved control of this type of surgical instruments forms the core of the EU-funded CASCADE project. CASCADE develops a unified control framework for continuum robots and catheters that operate in complex and deformable environments, such as for example the human vasculature. CASCADE adopts general mathematical descriptions of the continuum robot and its surroundings, and ways to identify the parameters of these descriptions during operation. When fusing pre-operative data with intra-operatively acquired measurements does not provide sufficient information to allow reliable decision-making, active sensing techniques will be adopted. An intuitive interface to the supervising surgeon is foreseen to notify emergencies and request for assistance. The same interface is employed during learning phases and validation of techniques upon well-chosen benchmarks. The resulting development will allow the control of local (interaction force/stiffness) and global (shape) robot states with unprecedented level of detail. The tools developed in this project will be used to verify the achievable control performance of continuum robots in MIS. In particular they will advance the treatment of cardiovascular diseases (CVD) by providing a novel dexterous and intelligent instrument that will be tested on endovascular aortic valve replacement.

Remote Medical Diagnostician

Prof. Angelika Peer, *University of the West of England, UK*



In the frame of the project ReMeDi a robot system is designed that features medical tele-examination of patients. Successful medical treatment depends on a timely and correct diagnosis, but the availability of doctors of various specializations is limited, especially in provincial hospitals or after regular working hours. Use case scenarios targeted in ReMeDi feature a robot capable of performing a physical examination, specifically of the two most widespread examination techniques i) palpation, i.e. pressing the patients stomach with the doctor's hand and observing the stiffness of the internal organs and the patient's feedback (discomfort, pain) as well as ii) ultrasonographic examination. Beside quality teleconferencing, ReMeDi features a mobile robot (placed in a hospital) equipped with a lightweight and inherently safe manipulator with an advanced sensorized head and/or ultrasonic probe; and the remote interface (placed at the doctor's location) equipped with sophisticated force-feedback, active vision and locomotion capabilities. The system is incrementally built following a user-centered design approach, and its usability with respect to the patient and the examining doctor is extensively studied in real world scenarios of cardiac examination.

The 2015 Innovative Surgical Robotics Forum^{EU/RAS SIG}

- Programme at a Glance -

09:00	Registration and Coffee		
09:30	Welcome and Opening Address	Francesca Trotta Phil Williams Michel Brochard Prof. Kaspar Althoefer	Innovate UK, RAS SIG Innovate UK, RAS SIG European Commission King's College London
10:00	Innovate UK, UK Capabilities	Chris Sawyer	Innovate UK
10:15	Presentation Teaser: STIFF-FLOP CASCADE microRALP ReMeDi	Dr Helge A Wurdemann Dr Emmanuel Vander Poorten Dr Leonardo de Mattos Prof. Angelika Peer	King's College London KU Leuven IIT University of the West of England
10:45	Coffee Break and Demonstration		

Challenges of new Technology in Surgical Robotics – the Clinician Perspectives

11:30	ERC Robot for hydro-colonoscopy	Prof. Sir Alfred Cuschieri	University of Dundee
11:50	Surgical robots and simulator training	Prof. Prokar Dasgupta	King's College London
12:10	Future of robotics in the OR: where are we now and where are we going	Dr. Alexandre Mottrie	OLV Clinic in Aalst
12:30	New procedures demanding new robotic platforms: what are the developmental challenges?	Prof. Yoav Mintz	Hadassah Medical Center
12:50	Is the transoral robotic surgery the really future perspective of the larynx cancer surgery?	Prof. Giorgio Peretti	University of Genoa
13:10	Lunch and Demonstration		

Challenges of new Technology in Surgical Robotics – the Academic Perspectives

14.40	Surgical Robots – from whole body systems to hand-held manipulators	Prof. Guang-Zhong Yang	Imperial College London
15.00	Surgical Robotics & Orthopaedics Perspective	Dr Ferdinando Rodrigues y Baena	Imperial College London
15.20	Robotic Technologies to Enhance Medical Outcomes (From Surgery to Drug Development, Rehabilitation and Training)	Prof. Darwin Caldwell	IIT
15.40	Coffee Break and Demonstration		

Challenges of new Technology in Surgical Robotics – the Industrial Perspective

16.20	CE-marking a robotic medical device	Dr Paula Gomes	BSI Group
16.40	Supplying Safe Surgical SoftwareSpeedily	Nick Tudor	D-RisQ Ltd
17:00	Lessons from launching a new surgical robot	Dr Patrick Finlay	MediMaton Ltd
17:20	Managing the innovation pipeline - lessons learned at a robotics SME	Rich Walker	Shadow Robot Company
17:40	Networking		

Robotics & Autonomous Systems Community Survey:
www.surveymonkey.com/s/GQMYCR3