



Workshop: Focused Energy Delivery & Precision Intervention

Code: SAPM03 | Sunday, 23rd June
Royal Geographical Society

Co-Chairs and Organisers:

Neil Tolley, Imperial College Healthcare NHS Trust, UK
Burak Temelkuran, The Hamlyn Centre, Imperial College, UK

Mohamed E. M. K. Abdelaziz, The Hamlyn Centre, Imperial College, UK

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08:30-09:00 Registration and Coffee

09:00 **Opening: Welcome & Introduction**

Neil Tolley, Imperial College Healthcare NHS Trust, UK

09:10 **Minimally Invasive Prostate Therapies - a Decade of Change**

(Clinical Keynote) Hashim Ahmed, Imperial College Healthcare NHS Trust, UK

09:40 **Effect of Surgical Energy on Diagnostic Potential of the i-Knife Technology**

Zoltan Takats, Imperial College London, UK

10:00 **Magnetic Navigation for Remote Controlled Catheter Ablation of Cardiac Arrhythmias**

Ilaria Cazzoli, Royal Brompton and Harefield NHS Foundation Trust, UK

10:20 **A Pound of Flesh, Not a Drop of Blood**

Dipankar Nandi, Imperial College Healthcare NHS Trust, UK

10:40-11:15 Coffee Break

11:15 **Extensive Spectral Versatility with High Power Fibre Lasers**

(Technical Keynote) Joseph Roy Taylor, Imperial College London, UK

11:45 **Laser-assisted Stapedotomy: High Precision Surgery on the Smallest Human Bone**

Digna Kamalski, University Medical Centre Utrecht, Netherlands

12:05 **Development of a Real-Time Thermo-Acoustic Model for Interstitial Ultrasonic Conformal Ablation**

Katie Gandomi, Worcester Polytechnic Institute, USA

12:25 **Choice and Use of Energy Sources in Gynaecological Surgery**
Sadaf Ghaem-Maghani, Imperial College Healthcare NHS Trust, UK

12:45 **An Update on Bronchoscopic and CT-guided Treatments for Central and Peripheral Lung Cancers**
Justin Garner, Royal Brompton and Harefield NHS Foundation Trust, UK

13:05-14:00 **Lunch Break**

14:00 **Transoral Robotic Surgery: Rationale, Outcomes and Challenges**
Vinidh Paleri, The Royal Marsden NHS Foundation Trust, UK

14:20 **The Evolution of Colorectal Robotic Surgery: Past, Present and Future**
Asif Haq, Kings College Hospital NHS Foundation Trust, UK

14:40 **An Integrated HIFU Probe for Catheter Ablation**
Ayhan Bozkurt, Sabanci University, Turkey

15:00 **Multimaterial Fibres for Focused Laser Delivery and Integration to Medical Robotics**
Burak Temelkuran, Imperial College London, UK

15:15 **Panel Discussion**

15:30 **Closing Remarks**



Clinical Keynote Speaker:

Hashim Ahmed, Imperial College Healthcare NHS Trust, UK

Title:

Minimally Invasive Prostate Therapies - a Decade of Change

Abstract:

Biography:

Professor Hashim U. Ahmed qualified from the University of Oxford where he attended St Peter's College and Linacre College. Whilst he was a student, he was awarded the William Osler Prize in Medicine. He then held house office posts in Queen Elizabeth Hospital, Birmingham and University Hospital Manchester before returning to Oxford for an anatomy prosector post. Prof Ahmed then held senior house jobs in surgery on the Royal Free Hospital London rotation followed by specialist registrar posts at West Middlesex Hospital, Charing Cross Hospital and Imperial College London, University College Hospital and Watford General Hospital as part of the Imperial College urology rotation.

Professor Ahmed was a Pelican Cancer Foundation Research Fellow, this was followed by a Medical Research Council (MRC) Clinician Research Training Fellowship at University College London at which time a number of imaging and focal therapy trials began. His research interests are in health technology evaluation including multi-parametric magnetic resonance imaging (MRI), histoscanning, tissue type imaging, as well as therapeutic interventions such as high intensity focused ultrasound, irreversible electroporation, photodynamic therapy, cryotherapy and radiofrequency ablation.

He has completed numerous phase I/II clinical trials evaluating the role of focal therapy in prostate cancer and is lead principal investigator and co-principal investigator in a number of multicentre trials including the UK National Institute for Health Research-Health Technology Assessment (NIHR-HTA) funded National Cancer Research Network (NCRN) PROMIS study evaluating the role of multi-parametric MRI in men with a raised PSA using template prostate mapping as the reference standard. Also, for NCRN INDEX, a multicentre focal therapy study using high intensity focused ultrasound (HIFU) with three-year follow-up and NCRN FORECAST. He previously held a £1.2 million MRC Clinician Scientist Fellowship for five years and currently holds a £2 million Senior Clinical Research Fellowship from the Wellcome Trust.



Technical Keynote Speaker:

Joseph Roy Taylor, Imperial College London, UK

Title:

Extensive Spectral Versatility with High Power Fibre Lasers

Abstract:

The diversity of applications in the biomedical arena calls for equally diverse demands on wavelength, pulse duration and repetition rate for potentially deployable light sources. Although no single laser source can meet the exacting demands, nonlinear optical processes in fibres allows efficient wavelength flexibility. Rare-earth-doped silica fibre lasers have been widely commercially developed both in power scaling and ultrashort pulse generation, however, they are limited in their spectral operational windows. However, the integration of high-power fibre amplifiers in master oscillator power fibre amplifier (MOPFA) schemes with conventional and photonic crystal fibres has allowed broad spectral extension and underpinned various applications, exemplified by the supercontinuum source, operating from the continuous wave to the femtosecond regimes.

In this presentation the spectral and temporal versatility of various fibre-based nonlinear systems will be reviewed, highlighting some of their characteristics. Highly efficient sources will be described, based on stimulated Raman in fibres and their frequency doubling for visible generation, as well as parametric generation allowing wide tuneability at multi-watt average powers in the IR and MIR and mechanisms to allow high energy, ultrashort pulse generation with wavelength selectivity.

Biography:

Roy Taylor commenced his research career at the Queen's University in Belfast in 1971. In 1986, he established the Femtosecond Optics Group at Imperial College. He is widely acknowledged for his basic research and development of diverse laser systems, contributing extensively to advances in picosecond and femtosecond dye laser technology, compact diode-laser and fibre-laser pumped vibronic lasers and their wide-ranging applications. Roy is particularly noted for his fundamental studies of ultrafast nonlinear optics in fibres and their translation to commercial products, which have allowed extensive spectral and temporal versatility. He has contributed to over 850 scientific papers and conference presentations in these topical areas and has been fortunate to receive several international awards for his numerous contributions.

**Speaker:**

Ayhan Bozkurt, Sabanci University, Turkey

Title:

An Integrated HIFU Probe for Catheter Ablation

Abstract:

We demonstrate the design and implementation a fully integrated HIFU drive system on a chip to be placed on a 6 Fr catheter probe for intravascular applications. An 8-element capacitive micromachined ultrasound transducer (CMUT) ring array of 2 mm diameter was used as the ultrasound source. The driver chip was fabricated in 0.35 μm AMS high-voltage CMOS technology and comprises eight continuous-wave (CW) high-voltage CMUT drivers, an eight-channel digital beamformer and a phase locked loop with an integrated VCO as a tunable clock source (128–192 MHz.) IR thermography on ex-vivo experiments in sunflower oil revealed that temperature at the focus of the HIFU beam rises by 16.8°C in 11 seconds when the transducer is driven with 20 Vpp at 10 MHz. FEM based analysis showed that the outer surface temperature of the catheter is expected to remain below the 42°C tissue damage limit during therapy.

Biography:

Ayhan Bozkurt (M'91) received the B.Sc., M.Sc., and Ph.D. degrees in electrical and electronics engineering from Bilkent University, Ankara, Turkey, in 1992, 1994, and 2000, respectively. Currently, he is an Associate Professor in the Electronics Engineering Program, Faculty of Engineering and Natural Sciences, Sabanci University, Istanbul, Turkey. His research interests include ultrasonic transducer modeling and fabrication, and high-voltage CMOS integrated circuit design for transducer frontends. (*Based on document published on 19 May 2017*).

**Speaker:**

Ilaria Cazzoli, MD, PhD

Royal Brompton and Harefield Hospital Foundation Trust

Title:

Magnetic Navigation for Remote Controlled Catheter Ablation of Cardiac Arrhythmias

Abstract:**Abstract:**

Catheter ablation is considered gold standard treatment for cardiac arrhythmias, especially in those patients refractory or intolerant to anti-arrhythmic drugs. Remote navigation systems have been developed on the premise that the primary limitation of the conventional RF ablation catheter is the reliance on operator hand-skill. Nowadays, the latest innovations in this technology not only enables to overcome difficulties posed by complex anatomies and limited venous accesses, but also to successfully treat a wide spectrum of arrhythmic conditions in structurally normal heart or congenital cardiac disease. The integration with advanced mapping systems and 3D anatomy reconstruction allows to maximise the success of ablation, along with reducing radiation exposure and procedural risks.

Biography:

Ilaria Cazzoli qualified as specialist in Adult Cardiovascular Disease from Tor Vergata University of Rome, Italy, in 2015. She then trained as fellow in ACHD imaging at Royal Brompton Hospital, London, and since 2017 is clinical and research fellow in Cardiology and EP to Dr Sabine Ernst. Over the last 3 years she has received several grants and awards for the researches carried out with Dr Ernst. Her work is mainly focused on ACHD EP, image

integration and catheter ablation with advanced techniques, including robotics. She recently completed her PhD project on “Advanced technologies for catheter ablation in Fontan patients” under the mentorship of Dr Ernst. Along with being co-investigator in some clinical trials, she is currently undertaking certification in robotic ablation.



Speaker:

Katie Gandomi, Worcester Polytechnic Institute, USA

Title: *Development of a Real-Time Thermo-Acoustic Model for Interstitial Ultrasonic Conformal Ablation*

Abstract:

Achieving appropriate margins when surgically treating complex shaped tumors is vital for reducing remission. Treatment options that closely trace asymmetric tumor boundaries can conserve parenchymal tissue while removing cancerous cells. One procedure being researched for this purpose is targeted interstitial conformal ablation. Thermal ablation of deep brain tumors using an interstitial needle-based therapeutic ultrasonic (NBTU) probe has been studied in recent years as a minimally invasive cancer treatment option for clinical cases unsuited for conventional surgical intervention. In this session, we discuss the development of a real-time two dimensional (2D) model of ultrasonic energy delivery and thermal ablation propagation for an NBTU probe. The simulation was used to predict lesion shape for conformal ablation path planning by controlling probe rotation to simulate control by a surgical robot system.

Biography:

Katie Gandomi is a PhD student in the Automation and Interventional Medicine (AIM) Laboratory at Worcester Polytechnic Institute (WPI). Her current research is focused in MRI Compatible Robotic Neurosurgery, Motion Planning with Thermal Acoustic Modeling, and Data Science in Medicine. She has worked closely with neurosurgeons at the Albany Medical Center and members of GE Global Research in the design, development, and experimentation of these surgical systems. Katie's expertise lies in software architecture design and has prior experience working in industry.



Speaker:

Sadaf Ghaem-Maghami, Imperial College Healthcare NHS Trust, UK

Title:

Choice and Use of Energy Sources in Gynaecological Surgery

Abstract:

Biography:

Dr Sadah Ghaem-Maghani qualified from The London Hospital Medical School (University of London) in 1990 and was awarded a PhD in Immunology in 2001. She undertook specialist training in northwest Thames region in obstetrics and gynaecology which was accredited by the Royal College of Obstetricians and Gynaecologists in 2004. She undertook sub-specialist training in gynaecological oncology at the north west London gynaecological cancer centre. Dr Ghaem-Maghani has been a BSCCP accredited colposcopist since 2004. She has been a consultant in gynaecological oncology since 2006 at Imperial College Healthcare NHS Trust.



Speaker:

Justin Garner, Royal Brompton and Harefield NHS Foundation Trust, UK

Title:

An Update on Bronchoscopic and CT-guided Treatments for Central and Peripheral Lung Cancers

Abstract:

In this session, we will review the latest gadgets for the interventional pulmonologist with a focus on robotic assistance and hybrid CT-virtual navigation for targeting peripheral lesions.

Biography:

Justin qualified from Imperial College School of Medicine, UK, in 2008. He is training as a specialist respiratory registrar in the North West Thames deanery. He is currently undertaking a PhD in Interventional Bronchoscopy under Professor Pallav Shah and Dr Omar Usmani.



Speaker:

Asif Haq, Kings College Hospital NHS Foundation Trust, UK

Title:

The Evolution of Colorectal Robotic Surgery: Past, Present and Future

Abstract:

Biography:

Asif Haq is a Consultant Laparoscopic Colorectal and Minimal Access Surgeon at Kings College Hospital and Kings Health Partners, London. He graduated from the Royal College of Surgeons in Ireland. He completed his general surgical rotation in England and has obtained specialised colorectal training in London and Canada. He was awarded the Sir Ian Todd Fellowship and the New York travelling fellowship for research by the Royal College of Surgeons of England.

After completion of training he obtained two prestigious Laparoscopic Fellowships nationally and internationally (Canada). He is a trainer for the national training program for laparoscopic colorectal cancer surgery. He consults for both minimal invasive general and colorectal surgical problems with an interest in robotic surgery and endoscopy.

Mr Haq's expertise lies in bowel cancer and coloproctological conditions ranging from constipation, rectal bleeding, haemorrhoids, anal fistulae, rectal prolapse, inflammatory bowel disease (Crohns and

Ulcerative Colitis), complex pilonidal sinus and diverticular disease. He has expertise in revision abdominal surgery in particular: incisional hernia repair using the minimal access approach; abdominal wall reconstruction; and reversal surgery for stomas (ileostomy and colostomy). Simple hernias are repaired using the latest techniques and meshes to minimise pain and scarring.

Mr Haq is passionate about teaching and training both locally, nationally and internationally. He is a member of the charitable Network of Iranians for Knowledge and Innovation with whom he visits hospitals annually in Iran to train Medical Students and Doctors, through live surgery, training workshops, lectures and seminars.



Speaker:

Digna Kamalski, University Medical Centre Utrecht, Netherlands

Title:

Laser-assisted Stapedotomy: High Precision Surgery on the Smallest Human Bone

Abstract:

Laser-assisted Stapedotomy: High Precision Surgery on the Smallest Human Bone

In most cases, the solution to hearing loss is a hearing aid. However, in the case of otosclerosis, surgery on the smallest of the human bones, the stapes, can restore the hearing. It does not come without risks; invalidating vertigo, tinnitus, facial nerve paralysis and deafness. This talk will focus on the search for the safest device for this type of surgery. From the laboratory, animal testing, towards patient care.

Biography:

After medical school she started the Ear-Nose-Throat residency program in Utrecht. During her training, she combined patient care with fundamental research in the field of laser assisted surgery. In 2014 she successfully defended her thesis: "Laser-assisted Stapedotomy". From 2013 she is working as an otorhinolaryngologist in the University Medical Centre in Utrecht, The Netherlands. Her fields of specialty are rhinology and anterior skull base surgery. Teaching and research are also important parts of her daily tasks. Currently she is at maternity leave, after the birth of her second child.



Speaker:

Dipankar Nandi, Imperial College Healthcare NHS Trust, UK

Title:

A Pound of Flesh, Not a Drop of Blood

Abstract:

Neurosurgery is a branch of medicine that constantly demands improvements in precision and reduction of collateral risk. Technology plays a very important role in trying to deliver these goals. MRI-guided focussed ultrasound intracranial lesioning (MGFUS) is a recent introduction to the clinical field that provides a great example of the fascinating possible advances in patient care when cutting

edge technology is allied to a precise understanding of fundamental neuroanatomy and neuropathophysiology.

Biography:

Dipankar Nandi studied medicine in the All India Institute of Medical Sciences, New Delhi (AIIMS), arguably the premier medical educational and research establishment in South Asia. He went on to complete his residency in General Surgery and then Neurosurgery in AIIMS and was appointed to the Faculty in 1996. He came to the UK on the INLAKS Foundation Scholarship and engaged in research into the mechanisms of akinesia in advanced Parkinson's disease for a D. Phil. (Neuroscience, Pembroke College) in the University Laboratory of Physiology, Oxford (Professors Tipu Aziz and John Stein) on the Norman Collison Foundation Fellowship. Dipankar then completed his higher specialist training in neurosurgery in the Radcliffe Infirmary, Oxford (MRCS Ed, FRCS (SN)) and is now a Consultant neurosurgeon in the Charing Cross Hospital.

His clinical and research interests lie in the fascinating confluence of stereotactic functional neurosurgery (deep brain stimulation, DBS), the neurophysiology (local field potentials) of movement disorders (PD, essential tremor, MS tremor, dystonia), treatment resistant depression and chronic central pain (post-stroke pain, cluster headaches, other intractable neuropathic pain syndromes) and the electrical-brain interface generated by the DBS electrode in vivo.

Another area of clinical and research interest is the difficult field of primary malignant brain tumours. These tumours have resisted long years of extensive basic science and clinical studies aimed at improving the duration of survival and neurological functional outcome; the median survival after diagnosis of a primary high grade glial brain tumour today is about 12 - 15 months in spite of a combination of resective cranial surgery, radiotherapy and anti-neoplastic chemotherapy. The last three decades of scientific and technical sophistication have managed to enhance survival by barely 3-6 months. Dipankar is working on using the safer and highly accurate minimally-invasive deep intra-cerebral access provided by his functional stereotactic neurosurgical skills, to target deep-seated brain tumors and deliver anti-neoplastic agents locally within the tumour at concentrations not possible to achieve by systemic means. The tools which are expected to come into play in the foreseeable future include individual tumour-tailored chemotherapy, multi-agent therapy, viral-vector delivery and sustained brachytherapy.

Recently, Dipankar (PI) and the Imperial College Neuromodulation Group (ICNG) have been awarded an MRC Research Grant to perform a clinical study that looks at the effect of DBS of a brainstem nucleus (the pedunculopontine nucleus - PPN) on axial motor symptoms in Parkinson's disease (such as gait and postural control dysfunction). This could help in the treatment of these particularly difficult and debilitating problems of some patients with PD. The MRC award is further supplemented by an award from the Medtronic European Research Board that will provide some free hardware for the study for clinical use.

**Speaker:**

Vinidh Paleri, The Royal Marsden NHS Foundation Trust, UK

Title:

Transoral Robotic Surgery: Rationale, Outcomes and Challenges

Abstract:**Biography:**

Vin Paleri was appointed as Consultant Head and Neck Surgeon at The Newcastle upon Tyne Hospitals in 2005, and as Professor of Head and Neck Surgery at Newcastle University in 2015. In 2017, he took up the post of Consultant Head and Neck Surgeon at The Royal Marsden Hospitals, the world's first cancer hospital famed for its cutting-edge research. He is also Professor of Robotic and Endoscopic Head and Neck Surgery at the Institute of Cancer Research, London.

He is one of the few surgeons in the United Kingdom with expertise in Transoral Robotic Surgery and Transoral Laser Microsurgery for head and neck cancers and has accrued the largest experience in Transoral Robotic Surgery in the UK. He has pioneered a new robotic technique to remove radiorecurrent and radioresidual cancers and is the first surgeon in the UK to perform robotic free flap reconstructions.

His research interests are primarily on the processes of care, decision making and functional outcomes in head and neck oncology. He has published over 170 papers, reviews and book chapters on head and neck oncology. He is the chief investigator for the NIHR funded TUBE trial and contributes as co-investigator and principal investigator for several other national trials. Currently, he serves as Chairman of the research council for the British Association of Head and Neck Oncologists, and as member of several national bodies. He co-edited the fourth and fifth editions of the UK National Head and Neck Cancer Multidisciplinary Management Guidelines, and the section on "Head and Neck Disease" for the forthcoming 8th edition of Scott-Brown's Otolaryngology, the leading multi-volume multi-author textbook in the specialty in the world. He is an Associate Editor for Head and Neck, the top ranked journal in the field, Senior Reviews Editor for the Journal of Laryngology and Otology, one of the oldest journals in the field (est. 1887) and serves on the editorial board for several other leading journals in the specialty.

**Speaker:**

Zoltan Takats, Imperial College London, UK

Title:

Effect of Surgical Energy on Diagnostic Potential of the i-Knife Technology

Biography:

Professor Takats has obtained his PhD from Eötvös Loránd University, Budapest, Hungary. He has worked as a post-doctoral research associate at Purdue University, Indiana, USA. After returning to Hungary, he served as Director of Cell Screen Research Centre and also as Head of Newborn Screening and Metabolic Diagnostic Laboratory at Semmelweis University, Budapest.

Professor Takats was awarded the Starting Grant by the European Research Council in 2008 and he subsequently, became a Junior Research Group Leader at Justus Liebig University, Gießen, Germany. He moved to the United Kingdom in 2012 and currently works as a Professor of Analytical Chemistry at Imperial College London.

Professor Takats has pursued pioneering research in mass spectrometry and he is one of the founders of the field of 'Ambient Mass Spectrometry'. He is the primary inventor of six mass spectrometric ionization techniques and author of 78 peer reviewed publications. He was the recipient of the prestigious Mattauch-Herzog Award of the German Mass Spectrometry Society and the Hungarian Star Award for Outstanding Innovators. He is the founder of Prosolia Inc, Medimass Ltd and Massprom Ltd, all companies pursuing analytical and medical device development.



Speaker:

Burak Temelkuran, Imperial College London, UK

Title: *Multimaterial Fibres for Focused Laser Delivery and Integration to Medical Robotics*

Abstract:

At the beginning of the new millennium, a polymer sheet coated with a chalcogenide glass, rolled around a sacrificial mandrel and drawn into a fibre presented a number of novelties: A new way of guiding light, a waveguide not limited with its materials' optical properties and hence having the ability to transmit light at any chosen wavelength, nanometre scale control of features and geometries at kilometre length scales, and last but not the least, baby steps of the field of multimaterial fibres that changed the way we think about fibres. The resulting fibre found its immediate application in the medical field and helped a few hundred thousand patients to get better up to date in various surgical specialities as a precise optical scalpel.

The enriched choice of materials, together with the ability to achieve exotic geometries using technologies such as 3D printing, we have focused to explore further potential contribution of multimaterial fibres to medicine. The ability to integrate and miniaturize various functions on a single fibre underpins the fibrebot we are developing, a fibre robot that can navigate through the natural lumens of the body equipped with imaging, sensing and therapeutic capabilities.

Enabling the integration of focused energy delivery mechanisms with the fibre based robotic platforms, the multimaterial fibre technology forms the foundations of a new set of medical devices advancing therapeutic and diagnostic potential in precision surgery.

Biography:

Burak Temelkuran, PhD, is a Research Fellow at the Hamlyn Centre for Robotic Surgery, Imperial College London, UK. He received his MS (1996) and PhD (2000) degrees from Department of Physics at Bilkent University, Turkey. As a postdoctoral researcher at MIT (2000-2002), Dr. Temelkuran has contributed to the discovery of the 1D omnidirectional reflecting fiber that has been used in over 250,000 surgeries, and his research pioneered the field of multi-material fibers. Dr. Temelkuran has joined the Hamlyn Centre in 2016, and his research is targeting unmet needs in medicine, with his expertise in the field of multi-material fibres and his 15 years of experience in the industry bridging engineering and medical sciences.



Speaker:

Neil Tolley, Imperial College Healthcare NHS Trust, UK

Biography:

Professor Neil Tolley is a Consultant ENT – Head & Neck Surgeon. He began medical studies at The Welsh National School of Medicine, Cardiff in 1977 and graduated MB, BCh in 1982. He passed his DLO RCS (England) in 1987. In 1988 he was awarded his MD in nasal physiology before undertaking specialist training at the Royal National Throat, Nose & Ear Hospital, Great Ormond Street Hospital and the Royal Sussex County Hospital, Brighton. He has also spent time in overseas fellowships in San Diego, California, Cape Town, South Africa and Perth & Sydney, Australia. He became a Fellow of the Royal College of Surgeons of Edinburgh and England in 1988 and 1989 respectively. In 1994 he took up his position as Consultant ENT Surgeon at St Mary's and Ealing Hospitals where he has been lead clinician for eight years.

Professor Neil Tolley is a programme director for training in North Thames, Regional adviser to the Royal College of Surgeons (England) for North Thames West. He is also secretary and president elect to YCOHNS (Young Consultants Otolaryngology-Head & Neck surgery). He is a generalist with a special interest in Thyroid, Salivary gland and complex paediatric ENT problems.