

# Programme



## **The Hamlyn Symposium** on Medical Robotics

24-27 June 2018, Imperial College London, UK

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*Monday 25<sup>th</sup> June 2018*

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Monday 25th June 2018

08:30	Registration and Coffee
09:15	Welcome: Guang-Zhong Yang
09:20	Opening Address: Ara Darzi
Session 1 – Miniaturized Robots for Targeted Therapy and Drug Delivery	
Chairs: Bradley Nelson and Zoltan Takats	
09:30	<b>Keynote Lecture: Mettin Sitti, Max Planck Institute for Intelligent Systems, Germany</b> <i>Untethered Mobile Milli/Microrobots for Medical Applications</i>
10:15	<b>Design and development of a miniaturized intra-abdominal flexible HIFU system: a proof of concept</b> C. Sozer, A. Cafarelli, M. Brancadoro, A. Menciassi <i>The Bio Robotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy</i>
10:30	<b>A system for in vitro evaluation of magnetic and manual catheter navigation for cardiac ablations</b> Q. Boehler <sup>1</sup> , C. Chautems <sup>1</sup> , L. Sabbatini <sup>2</sup> , F. Duru <sup>2</sup> , B.J. Nelson <sup>1</sup> <sup>1</sup> <i>Multi-Scale Robotics Lab, ETH Zurich</i> <sup>2</sup> <i>Department of Cardiology, University Hospital Zurich</i>
10:45	<b>Towards an Optimized Path Planner for the EDEN2020 Neurosurgical Steerable Needle</b> Marlene Pinzi, Stefano Galvan, Wenbo Zhan, Daniele Dini, and Ferdinando Rodriguez Baena <i>The Mechatronics in Medicine Laboratory, Mechanical Engineering Department, Imperial College London, UK</i>
11:00	<b>Automatic air bubble detection based on bio-impedance for safe drug delivery in retinal veins</b> L. Schoevaerds, L. Esteveny, G. Borghesan, M. Ourak, D. Reynaerts, and E. Vander Poorten <i>Mechanical Department, KU Leuven University, Leuven, Belgium 3001</i>
11:15-11:45	Coffee Break

*Chairs: Pierre DuPont and Leonardo Mattos*

- P1 **AUTOFocus: Reaching a target in the prostate with a 3D-ultrasound image-based control law**  
 R. Chalard<sup>1</sup>, D. Reversat<sup>1</sup>, G. Morel<sup>1</sup>, and M.A. Vitrani<sup>1</sup>  
<sup>1</sup>*Sorbonne Université, CNRS UMR 7222, INSERM U1150, Institut des Systèmes Intelligents et Robotique (ISIR), F-75005, Paris, France*
- P2 **A Miniature Wirelessly Actuated Magnetic Surgical Tool for Minimally Invasive Grasping**  
 A. Lim<sup>1</sup>, S. Salmanipour<sup>2</sup>, O. Onaizah<sup>2</sup>, C. Forbrigger<sup>2</sup>, T. Looi<sup>1</sup>, J. M. Drake<sup>1</sup>, E. Diller<sup>2</sup>  
<sup>1</sup>*Centre for Image Guided Innovation and Therapeutic Intervention (CIGITI), The Hospital for Sick Children, Toronto, Canada*  
<sup>2</sup>*Department of Mechanical and Industrial Engineering, University of Toronto*
- P3 **Toward Endobronchial Intervention: A Pre-Curved Continuum Robot with Large Deflection and Linear Elasticity**  
 A. Gao<sup>1</sup>, N. Liu<sup>1</sup>, Guang-Zhong Yang<sup>1</sup>  
<sup>1</sup>*The Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
- P4 **Kinematics and Workspace Analysis of a Contact-Aided Continuum Robot with Laser Profiling**  
 L. Ros-Freixedes<sup>1</sup>, A. Gao<sup>1</sup>, N. Liu<sup>1</sup>, G. Z. Yang<sup>1</sup>  
<sup>1</sup>*Hamlyn Centre for Robotic Surgery, Imperial College London*
- P5 **A Systematic Modelling Approach for Joint-Cable-Motor Kinematics of Coupled Tendon-Driven Surgical Instrument**  
 X. Y. Chu<sup>1</sup>, H. W. Yip<sup>1</sup>, T. Y. Chung<sup>1</sup>, and K. W. Samuel Au<sup>1, a</sup>  
<sup>1</sup>*Department of Mechanical and Automation, The Chinese University of Hong Kong*
- P6 **Impact of Jaw Orientation on Grip Force Estimation for a da Vinci EndoWrist Surgical Tool**  
 T.K. Stephens<sup>1</sup>, J.J. O'Neill<sup>2</sup>, N.J. Kong<sup>1</sup>, T.M. Kowalewski<sup>1</sup>  
<sup>1</sup>*Department of Mechanical Engineering, University of Minnesota*  
<sup>2</sup>*University College London, UK*
- P7 **Self-Collision Detection for Dual Arm Concentric Tube Robots**  
 S. Sabetian<sup>1</sup>, T. Looi<sup>1</sup>, E. Diller<sup>2</sup>, J. Drake<sup>1</sup>  
<sup>1</sup>*Centre for Image-Guided Innovation and Therapeutic Intervention, Sick Kids Hospital*  
<sup>2</sup>*Department of Mechanical and Industrial Engineering, University of Toronto*
- P8 **Mechanics Modelling of Eccentrically Arranged Concentric Tubes**  
 Z. Mitros<sup>1</sup>, M. Khadem<sup>1</sup>, C. Seneci<sup>1</sup>, L. DaCruz<sup>1,2\*</sup>, and C. Bergeles<sup>1,2\*</sup>  
<sup>1</sup>*Wellcome/EPSRC Centre for Interventional and Surgical Sciences, UCL, London*  
<sup>2</sup>*UCL Institute of Ophthalmology*



- P9 Design of an Extensible Colonoscopy Robot**  
T. Altinsoy, B. Baydere, S. K. Talas, O. M. Erkan, C. Tutcu, and E. Samur  
*Department of Mechanical Engineering, Boğaziçi University, Turkey*
- P10 Design of a Novel Compliant Robotic Instrument for Organ Retraction by Exploiting the Buckling Principle of a Continuum Bending Beam**  
Yuanpei Cai<sup>1</sup>, K. W. Samuel Au<sup>1</sup>, H. W. Yip<sup>1</sup>, T. Y. Chung<sup>1</sup>, Jason Y. K. Chan<sup>1</sup>, and Stuart Moran<sup>2</sup>  
<sup>1</sup>*Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong,*  
<sup>2</sup>*Retraction. Inc, Hong Kong, China*
- P11 Interactive Wound Segmentation and Automatic Stitch Planning**  
Giuseppe Andrea Fontanelli<sup>1</sup>, Lin Zhang<sup>2</sup>, Guang-Zhong Yang<sup>2</sup>, and Bruno Siciliano<sup>1</sup>  
<sup>1</sup>*ICAROS Centre, University of Naples, Federico II*  
<sup>2</sup>*The Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
- P12 Designing a Flexible Instrument for Confined Workspace Suturing - A Feasibility Study Base on a Simulated Suturing Task**  
Y. Hu<sup>1</sup>, L. Zhang<sup>1</sup>, Y. Gu<sup>1</sup>, and G.-Z. Yang<sup>1</sup>  
<sup>1</sup>*The Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
- P13 Transfer Learning for Surgical Suturing Segmentation**  
Ya-Yen Tsai<sup>1</sup>, Bidan Huang<sup>1</sup>, and Guang-Zhong Yang<sup>1</sup>  
<sup>1</sup>*The Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
- P14 Enhancing Dexterity with a 7-DoF Laparoscopic Suturing Tool**  
M. Selvaggio<sup>1</sup>, G. A. Fontanelli<sup>1</sup>, F. Ficuciello<sup>1</sup>, L. Villani<sup>1</sup>, and B. Siciliano<sup>1</sup>  
<sup>1</sup>*University of Naples, Federico II*
- P15 High Speed Fluorescence Endomicroscopy with Structured Illumination for Robot Assisted Minimally Invasive Surgery**  
Haojie Zhang and Guang-Zhong Yang  
*The Hamlyn Centre for Robotic Surgery, Imperial College London, UK*
- P16 Building robust confocal endomicroscopy mosaics despite image losses**  
B. Rosa<sup>1</sup>, K. Rabenorosoa<sup>2</sup>, B. Tamadazte<sup>2</sup>, P. Rougeot<sup>2</sup>, P. Renaud<sup>1</sup>, and N. Andreff<sup>2</sup>  
<sup>1</sup>*ICube, UDS-CNRS-INSa, 300 bd Sébastien Brant - Illkirch, 67000 Strasbourg, France,*  
<sup>2</sup>*FEMTO-ST, University of Bourgogne Franche-Comté, CNRS, 25000 Besançon, France*
- P17 Intraoperative Optical Characterisation of Thermal Ablation**  
N.T. Clancy<sup>1,2,3</sup>, K. Gurusamy<sup>5</sup>, G. Jones<sup>1,2,3</sup>, B. Davidson<sup>5</sup>, M.J. Clarkson<sup>1,2,4</sup>, D.J. Hawkes<sup>1,2,4</sup>, D. Stoyanov<sup>1,2,3</sup>  
<sup>1</sup>*Wellcome/EPsRC Centre for Interventional & Surgical Sciences (WEISS)*  
<sup>2</sup>*Centre for Medical Image Computing (CMIC),* <sup>3</sup>*Department of Computer Science*  
<sup>4</sup>*Department of Medical Physics and Biomedical Engineering, University College London, UK*  
<sup>5</sup>*Division of Surgery and Interventional Science, UCL Medical School, Royal Free Hospital, University College London, UK.*

- P18 Towards intraoperative hyperspectral imaging: design considerations for neurosurgical applications**  
 J. Shapey<sup>1,2</sup>, Y. Xie<sup>1</sup>, E. Nabavi<sup>1</sup>, D. Ravi<sup>1</sup>, S Saeed<sup>2,3,4</sup>, R Bradford<sup>2</sup>, S Ourselin<sup>1</sup>, T. Vercauteren<sup>1</sup>  
<sup>1</sup>Wellcome / EPSRC Centre for Interventional and Surgical Science, UCL, UK  
<sup>2</sup>The National Hospital for Neurology and Neurosurgery, UK  
<sup>3</sup>The Ear Institute, UCL, UK  
<sup>4</sup>The Royal National Throat, Nose and Ear Hospital, London, UK
- P19 Abdominal Aortic Aneurysm Segmentation with a Small Number of Training Subjects**  
 Jian-Qing Zheng<sup>1</sup>, Xiao-Yun Zhou<sup>1</sup>, Qing-Biao Li<sup>1</sup>, Celia Riga<sup>2,3</sup> and Guang-Zhong Yang<sup>1</sup>  
<sup>1</sup>The Hamlyn Centre for Robotic Surgery, Imperial College London, UK  
<sup>2</sup>Academic Division of Surgery, Imperial College London, UK  
<sup>3</sup>Regional Vascular Unit, St Marys Hospital, London, UK
- P20 Scene-preserving Contrast and Color Enhancement for Miniature Flexible Endoscopes in Fetoscopy**  
 D.I. Shakir<sup>1</sup>, S. Ourselin<sup>1</sup>, J. Deprest<sup>1,2,3</sup>, T. Vercauteren<sup>1,2</sup>  
<sup>1</sup>Wellcome / EPSRC Centre for Interventional and Surgical Sciences, University College London, United Kingdom  
<sup>2</sup>Academic Department of Development and Regeneration, Cluster Woman and Child and Department of Obstetrics and Gynaecology, University Hospitals Leuven, KU Leuven, Belgium  
<sup>3</sup>Institute for Women's Health, University College London, United Kingdom
- P21 Estimation of Tissue Oxygen Saturation from RGB Images based on Pixel-level Image Translation**  
 Qing-Biao Li<sup>1,3</sup>, Xiao-Yun Zhou<sup>1</sup>, Jianyu Lin<sup>1,3</sup>, Jian-Qing Zheng<sup>1</sup>, Neil T. Clancy<sup>2</sup>, Daniel S. Elson<sup>1,3</sup>  
<sup>1</sup>The Hamlyn Centre for Robotic Surgery, Imperial College London, London, UK  
<sup>2</sup>Centre for Medical Image Computing, University College London, London, UK  
<sup>3</sup>Department of Surgery and Cancer, Imperial College London, London, UK
- P22 Role of Contextual Information in Skill Evaluation of Minimally Invasive Surgical Training Procedures**  
 Anna French<sup>1</sup>, Kristy Seidel<sup>2</sup>, Thomas S. Lendvay<sup>2,3</sup>, Timothy M. Kowalewski<sup>1</sup>  
<sup>1</sup>Dept. of Mechanical Engineering, University of Minnesota  
<sup>2</sup>C-SATS Inc, <sup>3</sup>Dept. of Urology, University of Washington, Seattle Children's Hospital
- P23 Stress Resilience in Surgeons: A Neurophysiological Perspective**  
 H. N. Modi, H. Singh, G. Z. Yang, A. Darzi, D.R. Leff  
 The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
- P24 Toward Real-time Control of Assistive Robots: A Comparison of State-of-the-Art Methods**  
 Daniel Freer<sup>1</sup>, Yu Ma<sup>1,2</sup>, Guang-Zhong Yang<sup>1</sup>  
<sup>1</sup>The Hamlyn Centre for Robotic Surgery, Imperial College London, UK,  
<sup>2</sup>Fudan University

- P25 **Comparison of Bio-Inks for Free-Hand 3D Bioprinting Directly Onto Moving Human Anatomy**  
 Reed A. Johnson<sup>1</sup>, John J. O'Neill<sup>1</sup>, Rodney L. Dockter<sup>1</sup>, Carl J. Modl<sup>1</sup>, Daniel Sorby<sup>2</sup>, Angela Panoskaltsis-Mortari<sup>2</sup>, Timothy M. Kowalewski<sup>1</sup>  
<sup>1</sup>*Department of Mechanical Engineering, University of Minnesota*  
<sup>2</sup>*Department of Pediatrics, University of Minnesota*
- P26 **Patient Satisfaction and PROMs in Computer Navigated vs. Non-navigated Total Knee Replacements (TKR)**  
 K. Deep<sup>1</sup>, K. K. Dash<sup>1</sup>, S. Shankar<sup>2</sup>, A. Ewen<sup>1</sup>  
<sup>1</sup>*Golden Jubilee National Hospital, Clydebank, Glasgow, UK*  
<sup>2</sup>*Queen's Hospital, Romford, UK*
- P27 **The learning curve associated with robotic-arm assisted unicompartmental knee arthroplasty**  
 B Kayani, S Konan, J Tahmassebi, FS Haddad  
*University College London Hospital, UK*

**13:00-14:00 Lunch**

## **Session 2 – Intraluminal Intervention**

*Chairs: Paolo Fiorini and Russell Taylor*

**14:00 Keynote Lecture: Alberto Arezzo, University of Torino, Italy**  
***The Road Ahead for Endoluminal Intervention***

**14:45 Luminal Robots Small Enough to Fit Through Endoscope Ports: Initial Tumor Resection Experiments in the Airways**  
 Margaret Rox<sup>1\*</sup>, Katherine Riojas<sup>1\*</sup>, Maxwell Emerson<sup>1</sup>, Kaitlin Oliver-Butler<sup>2</sup>, Caleb Rucker<sup>2</sup>, and Robert J. Webster III<sup>1</sup> *\*shared first author*  
<sup>1</sup>*Vanderbilt University, Nashville, TN*, <sup>2</sup>*University of Tennessee, Knoxville, TN*

**15:00 Safety and feasibility clinical trial of a novel single port flexible robot for Transoral Robotic Surgery**  
 Jason Y K Chan<sup>1</sup>, Raymond K Tsang<sup>2</sup>, F. Christopher Holsinger<sup>3</sup>, Michael C F Tong<sup>1</sup>, Philip W Y Chiu<sup>4</sup>, Simon S M Ng<sup>4</sup>, Eddy W Y Wong<sup>1</sup>  
<sup>1</sup>*Department of Otorhinolaryngology, Head and Neck Surgery, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong SAR*  
<sup>2</sup>*Department of Surgery, The University of Hong Kong, Pok Fu Lam, Hong Kong SAR*  
<sup>3</sup>*Department of Otorhinolaryngology, Head and Neck Surgery, Stanford University, Palo, Alto, USA*, <sup>4</sup>*Department of Surgery, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong SAR*

**15:15 Computational Inverse Design of Anatomy-Specific Soft Robot Actuators with Physically-Realizable Material Conditions**  
 Mark D. Gilbertson<sup>1</sup>, Gillian J. McDonald<sup>1</sup>, Chaitanya Awasthi<sup>1</sup>, Rumi Faizer<sup>2</sup>, and Timothy M. Kowalewski<sup>1</sup>  
<sup>1</sup>*Department of Mechanical Engineering, University of Minnesota*, <sup>2</sup>*Department of Vascular Surgery, University of Minnesota*

- 15:30**                    **Development of thin double-arm device for bladder tumor resection**  
U. Yagyu<sup>1</sup>, E. Kobayashi<sup>2</sup>, K. Nakagawa<sup>1</sup>, Y. Komai<sup>3</sup>, M. Ito<sup>4</sup>, I. Sakuma<sup>1</sup>  
<sup>1</sup>*School of Engineering, the University of Tokyo*  
<sup>2</sup>*Institute of Advanced Biomedical Engineering and Science, Tokyo Women's Medical University*  
<sup>3</sup>*Cancer Institute Hospital,*  
<sup>4</sup>*National Cancer Center Japan*

**15:45-16:15**        **Coffee Break**

### **Session 3 – Deep Learning and Surgical Vision**

*Chairs: Stamatia Giannarou and Pierre Jannin*

- 16:15**                    **Unsupervised Learning of Depth Estimation from Video for Bronchoscopic Navigation**  
Mali Shen<sup>1</sup>, Yun Gu<sup>1</sup>, and Guang-Zhong Yang<sup>1</sup>  
<sup>1</sup>*The Hamlyn Centre for Robotic Surgery, Imperial College London*
- 16:30**                    **Autonomous image-based ultrasound probe positioning via deep learning**  
G. Toporek, H. Wang, M. Balicki, H. Xie  
*Philips Research North America, Cambridge, MA, USA*
- 16:45**                    **Unsupervised Learning of Surgical Smoke Removal from Simulation**  
L. Chen<sup>1</sup>, W. Tang<sup>1</sup>, and N. W. John<sup>2</sup>  
<sup>1</sup>*Department of Creative Technology, Bournemouth University*  
<sup>2</sup>*School of Computer Science, University of Chester*
- 17:00**                    **Towards Concentric Tube Robots for Microsurgery: First Results in Eye-to-hand Visual Servoing**  
Vincent Modes<sup>1</sup>, Sontje Ihler<sup>2</sup>, Tobias Ortmaier<sup>2</sup>, Arya Nabavi<sup>3</sup>, Lüder A. Kahrs<sup>2</sup>, and Jessica Burgner-Kahrs<sup>1</sup>  
<sup>1</sup>*Laboratory for Continuum Robotics, Leibniz Universität Hannover*  
<sup>2</sup>*Institute for Mechatronic Systems, Leibniz Universität Hannover*  
<sup>3</sup>*International Neuroscience Institute, Hannover*
- 17:15**                    **Fused MRI-ultrasound Augmented-Reality Guidance System for Robot-Assisted Laparoscopic Radical Prostatectomy**  
G. Samei<sup>1</sup>, K. Tsang<sup>1</sup>, J. Lobo<sup>1</sup>, C. Kesch<sup>2</sup>, S. Chang<sup>3</sup>, P. Black<sup>2</sup>, S. Salcudean<sup>1</sup>  
<sup>1</sup>*Robotics and Control Laboratory, UBC Vancouver, Canada*  
<sup>2</sup>*Department of Urological Sciences, UBC Vancouver, Canada*  
<sup>3</sup>*Department of Radiology, UBC Vancouver, Canada*



*Chairs: Christopher Payne and Robert J. Webster III*

**Sponsored by:**



- P28 Visual-Kinematic Monocular SLAM using a Magnetic Endoscope**  
 Samuel L. Charreyron<sup>1</sup>, Quentin Boehler<sup>1</sup>, Alexander J. Millane<sup>2</sup>, and Bradley J. Nelson<sup>1</sup>  
<sup>1</sup>*Multi Scale Robotics Lab, ETH Zurich*  
<sup>2</sup>*Autonomous Systems Lab, ETH Zurich*
- P29 Validation of Kinematic Registry and MRI Compatibility for Pediatric Surgical Robot with Modular Tooling for Bone Biopsy**  
 Alexander N. Alvara<sup>1,2</sup>, Thomas Looi<sup>1</sup>, Rami Saab<sup>1</sup>, Amanda Shorter<sup>1</sup>, Andrew Goldenberg<sup>2</sup>, James Drake<sup>1</sup>  
<sup>1</sup>*The Hospital for Sick Children, CIGITI Lab*  
<sup>2</sup>*Engineering Services Inc*
- P30 Sunram 5: An MR Safe Robotic System for Breast Biopsy**  
 V. Groenhuis<sup>1</sup>, F.J. Siepel<sup>1</sup>, M.K. Welleweerd<sup>1</sup>, J. Veltman<sup>2</sup>, S. Stramigioli<sup>1,3</sup>  
<sup>1</sup>*Robotics and Mechatronics, University of Twente, The Netherlands*  
<sup>2</sup>*Ziekenhuisgroep Twente, Almelo, The Netherlands*, <sup>3</sup>*ITMO, Russia*
- P31 Pressure-sensitive Bio-compatible Skin Sleeve for Millimetre-Scale Flexible Instruments**  
 P. Wasylczyk<sup>1\*</sup>, F. Ozimek<sup>2</sup>, M. Tiwari<sup>1</sup>, L. Da Cruz<sup>1,3</sup>, C. Bergeles<sup>1</sup>  
<sup>1</sup>*Wellcome/EPSRC Centre for Interventional and Surgical Sciences, UCL, UK*  
<sup>2</sup>*Mullard Space Science Laboratory, UCL, UK*  
<sup>3</sup>*Moorfields Eye Hospital, UK*
- P32 A Novel Cannula Brain Biopsy Device with Pressure Control**  
 Minxin Ye<sup>1,2</sup>, Danny T.M. Chan<sup>1,3</sup>, Philip W.Y. Chiu<sup>1,2</sup> and Zheng Li<sup>1,2</sup>  
<sup>1</sup>*Department of Surgery, the Chinese University of Hong Kong (CUHK)*  
<sup>2</sup>*Chow Yuk Ho Technology Centre for Innovative Medicine, CUHK*  
<sup>3</sup>*Otto Wong Brain Tumor Centre, CUHK*
- P33 Robot-Assisted Subretinal Surgery: initial in-vivo animal validation**  
 J. Smits<sup>1\*</sup>, A. Gijbels<sup>1\*</sup>, K. Willekens<sup>2,3</sup>, B. Stanzel<sup>3,4</sup>, D. Reynaerts<sup>1,5</sup>  
<sup>1</sup>*Dept. of Mechanical Engineering, KU Leuven - University of Leuven*  
<sup>2</sup>*Dept. of Ophthalmology, KU Leuven - University Hospitals Leuven*  
<sup>3</sup>*Knappschaft Eye Hospital, Sulzbach/Saar*  
<sup>4</sup>*Fraunhofer Institute for Biomedical Technology, Sulzbach/Saar*  
<sup>5</sup>*Member Flanders Make, Belgium*

- P34     **A Modular Robotic Catheter Driver for Programmable Bevel-tip Steerable Needles**  
R. Secoli, E. Matheson, F. Rodriguez y Baena<sup>1</sup>  
<sup>1</sup>*The Mechatronics in Medicine Laboratory, Imperial College, London, UK*
- P35     **Versatile, Force Range-Adjustable, Tri-axial Force Sensor with Integrated Micro Camera for the Tip of Endoscopic Devices**  
I. Sušić<sup>1</sup>, P. Cattin<sup>2</sup>, A. Zam<sup>3</sup>, G. Rauter<sup>1</sup>  
<sup>1</sup>*BIROMED-Lab, <sup>2</sup>CIAN, <sup>3</sup>BLOG, Dept. of Biomed. Engineering, University of Basel, CH*
- P36     **The variable stiffness catheter: third-generation magnetic catheters**  
C. Chautems<sup>1</sup>, A. Tonazzini<sup>2</sup>, Q. Boehler<sup>1</sup>, S. Charreyron<sup>1</sup>, A. Zemmar<sup>3</sup>, D. Floreano<sup>2</sup>, B.J. Nelson<sup>1</sup>  
<sup>1</sup>*Multi-Scale Robotics Lab, ETH Zurich*  
<sup>2</sup>*Laboratory of Intelligent System, EPF Lausanne*  
<sup>3</sup>*Hernesniemi Center, Henan Provincial People's Hospital, Zhengzhou University*
- P37     **Analysis of Concentric Tube Manipulator Workspace Improvements Using Anisotropic Pattern Tube Cutting**  
K. Ai Xin Jue Luo<sup>1</sup>, S. Sabetian<sup>1</sup>, T Looi<sup>1</sup>, J. Drake<sup>1</sup>  
<sup>1</sup>*Centre for Image-Guided Innovation and Therapeutic Intervention, Sick kids Hospital*
- P38     **Synthesis of biodegradable microrobots for biomedical applications**  
Xiaopu Wang<sup>1</sup>, Xiao-Hua Qin<sup>2</sup>, Chengzhi Hu<sup>1</sup>, Xiang-Zhong Chen<sup>1</sup>, Salvador Pané<sup>1</sup>, Katharina Maniura<sup>2</sup>, Bradley J. Nelson<sup>1</sup>  
<sup>1</sup>*Multi-Scale Robotics Lab, Institute of Robotics and Intelligent Systems, ETH Zurich*  
<sup>2</sup>*Laboratory for Biointerfaces, Empa-Swiss Federal Laboratories for Materials Science and Technology*
- P39     **Towards Robotic Bioprinting Directly onto Moving, Stretching Anatomy**  
Rebecca G. Smith<sup>1</sup>, Reed A. Johnson<sup>1</sup>, Gabriella Shull<sup>2</sup>, Daniel Sorby<sup>3</sup>, Carl J. Modl<sup>1</sup>, Angela Panoskaltsis-Mortari<sup>3</sup>, Timothy M. Kowalewski<sup>1</sup>  
<sup>1</sup>*Department of Mechanical Engineering, University of Minnesota*  
<sup>2</sup>*Department of Biomedical Engineering, University of Minnesota*  
<sup>3</sup>*Department of Pediatrics, University of Minnesota*
- P40     **Cobra-type robotic arm for tissue traction attachable to robotized endoscopy system (EasyEndo)**  
D.H Lee, M. Hwang, D.-S. Kwon  
*Korea Advanced Institute of Science and Technology (KAIST)*
- P41     **Translational and Rotational Arrow Cues (TRAC) Outperforms Triplanar Display for use in 6-DOF IGS Navigation Tasks**  
David E. Usevitch and Jake J. Abbott  
*Department of Mechanical Engineering and the Robotics Center, University of Utah*

- P42 **An Ergonomic Interaction Workspace Analysis Method for the Optimal Design of a Surgical Master Manipulator**  
D.D. Zhang<sup>1</sup>, J. Liu<sup>1</sup>, G.Z. Yang<sup>1</sup>  
<sup>1</sup>*The Hamlyn Centre for Robotic Surgery, IGHL, Imperial College London, UK*
- P43 **Affordable Mobile-based Simulator for Robotic Surgery**  
Piyamate Wisanuvej<sup>1</sup>, Petros Giataganas<sup>1</sup>, Paul Riordan<sup>1</sup>, Jean Nehme<sup>1</sup>, and Danail Stoyanov<sup>1</sup>  
<sup>1</sup>*Digital Surgery Limited, London, UK*
- P44 **Gravity Compensation Control for Magnetic Capsule Colonoscopy**  
L. Barducci<sup>1</sup>, G. Pittiglio<sup>1</sup>, J. W. Martin<sup>1</sup>, J. Norton<sup>1</sup>, K. L. Obstein<sup>2</sup>, C. A. Avizzano<sup>3</sup>, and P. Valdastri<sup>1</sup>  
<sup>1</sup>*STORM Lab UK, University of Leeds*  
<sup>2</sup>*STORM Lab, Vanderbilt University*  
<sup>3</sup>*PERCRO, Scuola Superiore Sant'Anna*
- P45 **Data mining using a soft robotic balloon catheter: sizing idealised aortic annular phantoms**  
Andrea Palombi<sup>1</sup>, Giorgia M Bosi<sup>1</sup>, Sara Di Giuseppe<sup>2</sup>, Elena De Momi<sup>2</sup>, Shervanthi Homer-Vanniasinkam<sup>1</sup>, Gaetano Burriesci<sup>1,3</sup>, Helge A Wurdemann<sup>1</sup>  
<sup>1</sup>*UCL Mechanical Engineering, University College London, UK.*  
<sup>2</sup>*Electronic Information and Bioengineering Department, Politecnico di Milano, Italy*  
<sup>3</sup>*Bioengineering Group at Ri.MED Foundation, Italy*
- P46 **Comparison of Master-Slave Mapping Strategies for Efficient Robotic Endoscopy**  
J. Ahn<sup>1</sup>, M. Hwang<sup>1</sup>, D. Baek<sup>1</sup>, H. Kim<sup>1</sup>, D.S. Kwon<sup>1</sup>  
<sup>1</sup>*Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology (KAIST)*
- P47 **Image-based Estimation of Contact Forces on Catheters for Robot-assisted Cardiovascular Intervention**  
Amir Hooshier<sup>1,3</sup>, Naghmeh M. Bandari<sup>1,2,3</sup>, and Javad Dargahi<sup>1</sup>  
<sup>1</sup>*Robotic Surgery Lab., Concordia University, Montreal, Canada*  
<sup>2</sup>*Optical Bio-Microsystems Lab., Concordia University, Montreal, Canada*  
<sup>3</sup>*Surgical Innovation Program, McGill University, Montreal, Canada*

**18:15 Drinks Reception and Poster Session**

Tuesday 26th June 2018

08:30 Registration and Coffee

**Session 4 – Emerging Platforms and Clinical Applications**

*Chairs: Cameron Riviere and Richard Satava*

- 09:00 A Simulation Study of Robotic In Utero Repair of Myelomeningocele**  
Thomas Looi<sup>1,2</sup>, Francis Lebouthillier<sup>3</sup>, Tim Van Mieghem<sup>4</sup>, Greg Ryan<sup>4</sup>, James M. Drake<sup>1,2</sup>  
<sup>1</sup>*The Hospital for Sick Children, Canada*  
<sup>2</sup>*University of Toronto, Canada*  
<sup>3</sup>*Ontario College of Art and Design, Canada*  
<sup>4</sup>*Mount Sinai Hospital, Canada*
- 09:15 An Innovate Robot-Assisted Endoscope Holder for Sinus, Skull Base and Otoendoscopic Surgery – From Preclinical Evaluation to First Clinical Use**  
D.T. Friedrich, R. Grässlin, A. Leichtle, M.O. Scheithauer, T.K. Hoffmann, P.J. Schuler  
*Department of Otorhinolaryngology, Head and Neck Surgery, Ulm University Medical Center, Germany*
- 09:30 Sand Blasting Inside a Patient: A CRISP Robot for Spraying Powder inside the Chest Cavity to Preclude Lung Collapse**  
P. L. Anderson<sup>1,3</sup>, T. E. Ertop<sup>1,3</sup>, A. Kuntz<sup>4</sup>, F. Maldonado<sup>2,3</sup>, R. Alterovitz<sup>4</sup>, and R. J. Webster III<sup>1,3</sup>  
<sup>1</sup>*Department of Mechanical Engineering, Vanderbilt University*  
<sup>2</sup>*Division of Pulmonary Medicine, Vanderbilt University Medical Center*  
<sup>3</sup>*Vanderbilt Institute for Surgery and Engineering*  
<sup>4</sup>*Department of Computer Science, University of North Carolina at Chapel Hill*
- 09:45 Automation of the "Big Bubble" Hydro-Dissection Method for DALK Cornea Transplant Surgery**  
N.R. Sarfaraz<sup>1</sup>, S. Guo<sup>2</sup>, T. Schroeder<sup>1</sup>, W. Gensheimer<sup>3</sup>, J Kang<sup>2</sup>, A. Krieger<sup>1</sup>  
<sup>1</sup>*Medical Robotics and Equipment Lab, University of Maryland, College Park,*  
<sup>2</sup>*Department of Electrical and Computer Engineering, Johns Hopkins University, Baltimore*  
<sup>3</sup>*Warfighter Eye Center, Malcolm Grow Medical Clinics and Surgery Center, Joint Base Andrews*
- 10:00 Robotic-arm assisted total knee arthroplasty improves early functional recovery and time to hospital discharge compared to conventional jig-based total knee arthroplasty: A prospective cohort study**  
B Kayani, S Konan, J Tahmassebi, FS Haddad, *University College London Hospital, UK*

10:15 Keynote Lecture: Fred Moll, Auris Surgical Robotics, USA

*Interventional Robotics: Just Getting Started*



**11:00-11:30 Coffee Break**

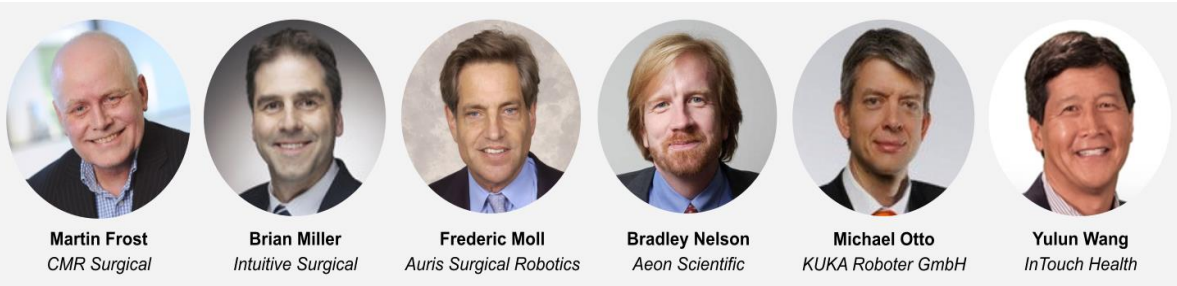
**Session 5 – From BCI to Smart Manipulation**

*Chairs: Simon DiMaio and Rajni Patel*

- 11:30 Expertise Related Disparity in Prefrontal-Motor Brain Connectivity**  
F. Deligianni<sup>1</sup>, H. Singh<sup>2</sup>, H.N. Modi<sup>2</sup>, Darzi A, D.R. Leff<sup>2</sup>, G.Z Yang<sup>1</sup>  
<sup>1</sup>*Hamlyn Centre for Robotic Surgery, Imperial College London*  
<sup>2</sup>*Department of Surgery and Cancer, Imperial College London*
- 11:45 Response Times of a Tactile Motion Intent Recognition System**  
T. Stefanou<sup>1</sup>, G. Chance<sup>2</sup>, T. Assaf<sup>2</sup>, S. Dogramadzi<sup>2</sup>  
*Bristol Robotics Laboratory, University of Bristol, UWE*
- 12:00 Evaluation of High-Speed Dynamic Motions for Robotic Guidewire Crossing Techniques**  
Young-Ho Kim, Ankur Kapoor, Rodolfo Finocchi, and Erin Girard  
*Siemens Healthineers, Medical Imaging Technologies, Princeton, NJ, USA*
- 12:15 A hand-held robot for safe and automatic PIVC**  
Zhuoqi Cheng<sup>1</sup>, Brian L. Davies<sup>1,2</sup>, Darwin Caldwell<sup>1</sup>, Leonardo S. Mattos<sup>1</sup>,  
<sup>1</sup>*Department of Advanced Robotics, Istituto Italiano di Tecnologia, Genova, Italy*  
<sup>2</sup>*Department of Mechanical Engineering, Imperial College London, UK*
- 12:30 A Preliminary Study on Customizable Origami Grippers with Elastic Hinges for Minimally Invasive Surgery**  
Jongwoo Kim<sup>1</sup>, Sun-Pill Jung<sup>1</sup>, Chunwoo Kim<sup>2</sup>, Kyu-Jin Cho<sup>1</sup>  
<sup>1</sup>*Biorobotics Laboratory, Department of Mechanical and Aerospace Engineering, Seoul National University*  
<sup>2</sup>*Center for Medical Robotics, Korea Institute of Science and Technology (KIST)*

**12:45-14:00 Lunch**

**14:00 CEO and Founder's Forum**



**15:30-16:00 Coffee Break**

**16:00**      **Karl Storz - Harold Hopkins Lecture: Adrian Park, Johns Hopkins University School of Medicine, USA**  
*Surgical Visualization – An Evolution*

*Chairs: Ara Darzi and Guang-Zhong Yang*

**16:45**      **Surgical Robot Challenge Highlights**

*Chairs: Robert Merrifield and Hong Xing Shen*

**17:15**      **Closing Remarks**

**18:30**      **Programme Committee Dinner (Invitation only)**

# Workshops



24 & 27 June 2018, Imperial College London, UK



## Competition: Surgical Robot Challenge 2018

An international competition for academia and industry

**Sunday, 24th June**

**Royal Geographical Society**

### **Organiser:**

*Robert Merrifield, Hamlyn Centre, Imperial College, UK*

### **Co-Chair:**

*Shen Hong Xing, Renji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China*

### *Surgical Robot Challenge 2018 Finalists*

#### **ScorpiUS - Collaborative robotics for ultrasound (US) guided needle targeting**

Johann Berger, Michael Unger, Johannes Keller, Richard Bieck, Lisa Landgraf, Thomas Neumuth, Andreas Melzer

*Innovation Center Computer Assisted Surgery, Universitat Leipzig*

#### **Dexterous Endo-Otosopic Multi-Tool**

Gloria Wu, Marko Mikic, Alexander Alvara, Kevin Ai Xin Jue Luo, Saba Sabetian, Andrew Lim, Alex Gordon, Giuseppe Grossi, Sakoon Jhamb, Ashley Deonarain, Luke MacLean, Arushri Swarup, Kyle Eastwood, Kyprianos Antzoulidis, Abraham Brath, Daniel Esser, Mohamad Aref Dergham, Jenny Yang, Louise Xie, Thomas Looi, James Drake

*CIGITI, Hospital for Sick Children, University of Toronto*

#### **Sunram 5: An MR Safe Robotic System for Breast Biopsy**

Vincent Groenhuis<sup>1</sup>, Françoise J. Siepel<sup>1</sup>, Marcel K. Welleweerd<sup>1</sup>, Jeroen Veltman<sup>2</sup>, Stefano Stramigioli<sup>1,3</sup>

<sup>1</sup>*University of Twente, Enschede, The Netherlands*

<sup>2</sup>*Ziekenhuisgroep Twente, Almelo, The Netherlands*

<sup>3</sup>*ITMO, Saint Petersburg, Russia*

#### **Galen Surgical Platform**

David Levi, Paul Wilkening

*Galen Robotics, Johns Hopkins University*

#### **EL.I.S.A. : Electric Impedance Sensing for Surgical Applications**

Diego Dall'Alba<sup>1</sup>, Zhuoqi Cheng<sup>2</sup>, Thibaudjean Chupin<sup>3</sup>, Simone Foti<sup>3</sup>, Elena De Momi<sup>3</sup>, Giancarlo Ferrigno<sup>3</sup>, Darwin Caldwell<sup>2</sup>, Leonardo Mattos<sup>2</sup> and Paolo Fiorini<sup>1</sup>

<sup>1</sup>*Altair Robotics Lab, Department of Computer Science, University of Verona, Italy*

<sup>2</sup>*Istituto Italiano di Tecnologia – Genova, Italy*

<sup>3</sup>*Near Lab, Department of Electronics, Information and Bioengineering, Politecnico di Milano – Milano, Italy*

#### **Development of 5mm Articulating Wristed Instrument for Micro-laparoscopy**

Chunwoo Kim, Jongwoo Kim, Sungchul Kang

*Center for Medical Robotics, Korea Insitute of Science and Technology*



**Flexible Endoscopic Surgery Robot, K-FLEX**

M. Hwang<sup>1</sup>, D. H. Lee<sup>1</sup>, J. Ahn<sup>1</sup>, J. You<sup>1</sup>, D. Baek<sup>1</sup>, H. Kim<sup>1</sup>, R. R. Kirchmeier<sup>2</sup>, and D. S. Kwon<sup>1</sup>

<sup>1</sup>*Korea Advanced Institute of Science and Technology (KAIST)*

<sup>2</sup>*Radboud University Medical Center*

**Robotic Cochlear Implantation**

Daniel Schneider, Fabian Müller, Jan Hermann

*IGT team, ARTORG Center, University of Bern*

**RObotic NeuroNAvigation RONNA**

Bojan Jerbić, Bojan Šekoranja, Josip Vidaković

*Faculty of Mechanical Engineering and Naval Architecture*

*University of Zagreb*

**09:00-14:00 Surgical Robot Challenge Demos**  
Hamlyn Centre Level 4, Imperial College London

**16:00-18:00 Surgical Robot Challenge Presentations and Judging Panel**  
Ondaatje Theatre, Royal Geographical Society



## Workshop: Advances in Image-Guided Ophthalmic Interventions

Sunday, 24th June

*Royal Geographical Society*

### **Co-Chairs and Organisers:**

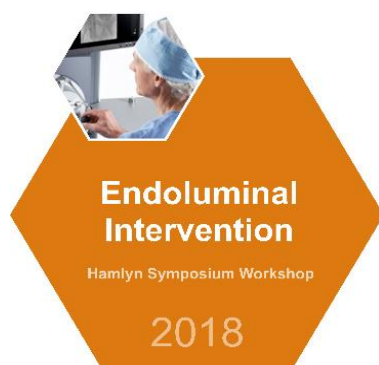
*Christos Bergeles, University College London, UK*

*Raphael Sznitman, ARTORG, University of Bern, CH*

*Emmanuel Vander Poorten, KU Leuven, BE*

### *Workshop Schedule*

<b>09:00-09:20</b>	<b>Registration and Coffee</b>
<b>09:20</b>	<b>Regenerative Therapies for the Treatment of Age-Related Macular Degeneration</b> Lyndon da Cruz, Moorfields Eye Hospital, London, UK
<b>09:45</b>	<b>Enabling Technology for Safe Robot-Assisted Vitreoretinal Surgery</b> Iulian Iordachita, Johns Hopkins University, MD, USA
<b>10:05</b>	<b>Force Sensing Instruments for Ophthalmology Using Fabry-Perot Interferometry</b> Sebastian Fifanski, École Polytechnique Fédérale de Lausanne, CH
<b>10:25</b>	<b>Optical Coherence Tomography for High Precision Distance and Displacement Measurements in Robotic Navigation</b> Gereon Huttman, Medizinisches Laserzentrum Lübeck, Germany
<b>10:45-11:15</b>	<b>Coffee Break</b>
<b>11:15</b>	<b>Developments in Assisted Ophthalmic Surgery</b> Abu Zhar, Carl Zeiss Meditec AG, Germany
<b>11:35</b>	<b>Fighting Age-Related Blindness - Automated Injections into the Eye</b> Franziska Ullrich, Ophthorobotics AG, Germany
<b>12:00</b>	<b>How to Deal with Safety in Robotic Eye Surgery: Experience from EurEyeCase</b> Gernot Kronreif, Austrian Center for Medical Innovation and Technology, Austria
<b>12:20</b>	<b>Round Table Discussion and Concluding Remarks</b>
<b>13:00</b>	<b>Lunch</b>



## Workshop: Endoluminal Intervention

Sunday, 24th June

*Royal Geographical Society*

### **Co-Chairs and Organisers:**

*Philip Chiu, Chinese University Hong Kong, Hong Kong, China*

*Sabine Ernst, Imperial College London, UK*

*Thomas Looi, Hospital for Sick Children, Toronto, Canada*

*Robert J. Webster III, Vanderbilt University, TN, USA*

*Giulio Dagnino, Hamlyn Centre, Imperial College, UK*

*Anzhu Gao, Hamlyn Centre, Imperial College, UK*

*Ning Liu, Hamlyn Centre, Imperial College, UK*

*Mali Shen, Hamlyn Centre, Imperial College, UK*

### **Sponsored by:**



Surgical MedTech  
Co-operative



### *Workshop Schedule*

#### **09:00-09:20 Registration and Coffee**

**09:20 Bio-Inspired Surgical Instruments**  
Paul Breedveld, TU Delft, Netherlands

**09:45 Development and Clinical Application of Robotic Endoscope for Endoscopic Submucosal Dissection**  
Philip Chiu, The Chinese University of Hong Kong, Hong Kong, China

**10:05 Capsule Robots for Endoluminal Inspection and Intervention**  
Pietro Valdastri, University of Leeds, UK

**10:25 Robotics and Image-Guidance for Endovascular Intervention: Clinical Need and Future Direction**  
Celia Riga, Imperial College London, UK

#### **10:45-11:15 Coffee Break**

**11:15 A Physician's Perspective on The Future of Robotic Lung Surgery**  
Fabien Maldonado, Vanderbilt University, TN, USA

**11:35 An Engineer's Perspective on the Future of Robotic Lung Surgery**  
Robert J. Webster III, Vanderbilt University, TN, USA

**11:55**      **Neuro-Endoscopy and Middle-Ear Surgery**  
Thomas Looi, Hospital for Sick Children, Toronto, Canada

**12:15**      **Panel Discussion and Concluding Remarks**

**13:00**      **Lunch**





## Workshop: Learning and Autonomy for Medical Robotics

Sunday, 24th June

*Royal Geographical Society*

### **Co-Chairs and Organisers:**

*Paolo Fiorini, University of Verona, Italy*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

*Andrea Fontanelli, Hamlyn Centre, Imperial College London, UK*

*Hanifa J.A Koguna, Hamlyn Centre Imperial College London, UK*

### **Sponsored by:**

**Science Robotics**  
AAAS

### *Workshop Schedule*

#### **09:00-09:15 Registration and Coffee**

**09:15**

#### **Welcome**

Paolo Fiorini, University of Verona, Italy

Guang-Zhong Yang, Imperial College London, UK

**09:30**

#### **A Discussion About Possible Definitions and Implementations of Medical Robot Autonomy**

(Technical keynote) Jocelyne Troccazz, French National Centre for Scientific Research, Paris, France

**10:00**

#### **Robotic Surgical Assistants: A Three-Way Partnership Between Surgeons, Technology, and Information**

Russell Taylor, Johns Hopkins University, MD, USA

**10:20**

#### **Surgeon-Patient Trust and Surgical Autonomy**

Bruno Siciliano, University of Naples Federico II, Napoli, Italy

#### **10:40-11:10 Coffee Break**

**11:10**

#### **Learning Procedural Skills**

Pierre Jannin, University of Rennes, France

**11:30**

#### **From Autonomous Driving to Autonomous Surgery: Challenges and Opportunities**

Mahdi Azizian, Intuitive Surgical, USA

**11:50**

#### **Microsurgical Robot Interface for Surgical Autonomy**

Emanuele Ruffaldi and Giuseppe Prisco, Medical Micro-Instruments SpA (MMI), Italy

<b>12:10</b>	<b>Introducing Autonomy to Medical Robots</b> Gurvinder Virk, Innovative Technology & Science Limited (InnoTecUK), UK
<b>12:30-13:30</b>	<b>Lunch</b>
<b>13:30</b>	<b>Quantitative Neurodynamic Modeling of Team Performance in Complex Surgery</b> (Medical keynote) Marco Zenati, Harvard University, MA, USA
<b>14:00</b>	<b>Automated Skull Base Drill</b> William T. Couldwell, University of Utah, USA
<b>14:20</b>	<b>The Shift in Responsibility during Robotic Surgery</b> Stefan Weber, University of Bern, CH
<b>14:40</b>	<b>The Shift in Responsibility during Robotic Surgery</b> Andreas Muller, University of Bern, CH
<b>14:50</b>	<b>Panel Discussion</b>
<b>15:25</b>	<b>Closing Remarks</b>
<b>15:30</b>	<b>Close</b>



## Workshop: Soft and Continuum Robots across Scale

Sunday, 24th June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Rebecca Kramer-Bottiglio, The Faboratory, Yale University, USA*

*Bobak Mosadegh, Weill-Cornell Medicine, Cornell University, USA*

*Chris Payne, Wyss Institute, Harvard University, USA*

*Pierre Berthet-Rayne, Hamlyn Centre, Imperial College London, UK*

### **Sponsored by:**



### *Workshop Schedule*

#### **08:30-09:05 Registration and Coffee**

**09:05**

#### **Mathematical Models for Guiding Pneumatic Soft Actuator Design**

Fionnuala Connolly, Wyss Institute for Biologically-Inspired Engineering, School of Engineering and Applied Sciences, Harvard University, USA

**09:35**

#### **Robotic Skins that Turn Inanimate Objects into Multifunctional Robots**

Rebecca Kramer-Bottiglio, The Faboratory, Yale School of Engineering and Applied Sciences, Yale University, USA

**10:05**

#### **Computational Mechanics of Soft Robots - from Design, Control to Sensing**

Ka-Wai Kwok - Group for Interventional Robotics and Imaging Systems, University of Hong Kong, HK, China

#### **10:35-11:05 Coffee Break**

**11:05**

#### **Optogenetic Skeletal Muscle-Powered Adaptive Biological Machines**

Ritu Raman, Langer Lab, Massachusetts Institute of Technology, USA

**11:35**

#### **Using Soft Robotic Technology to Fabricate a Patient-Specific Left Atrial Appendage Occluder**

Bobak Mosadegh, Weill-Cornell Medicine, Cornell University, USA

**12:05**

#### **Soft Mechanosensing Approaches for Soft Robotics and Wearable Systems**

Lucia Beccai, Center for Micro-BioRobotics, Istituto Italiano di Tecnologia of Genoa, Italy

**12:35**      **High Resolution Multi-Material Additive Manufacturing: 3D Fabrication of Biologically Inspired Structures**  
James C. Weaver, Wyss Institute for Biologically-Inspired Engineering, Harvard University, USA

**13:05-14:05**    **Lunch**

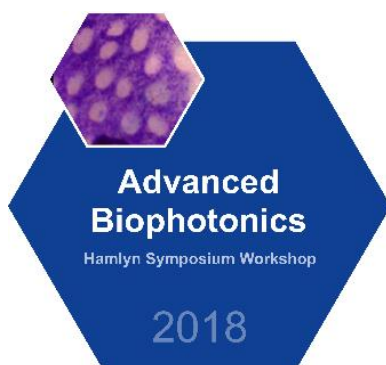
**14:05**      **Programming the Response of Fluidic Soft Actuators by Harnessing Nonlinearities**  
Bas Overvelde, Soft Robotic Matter Group, AMOLF, Holland

**14:35**      **Achieving Variable Stiffness – Soft Skins for Continuum Robots**  
Jessica Burgner-Kahrs, Leibniz Universität Hannover, Germany

**15:05**      **Advancements in Transcatheter Aortic Valve Replacement (TAVR) – Data Mining Using Soft Robotic Balloon Catheters**  
Helge Wurdemann – Soft Haptics Lab, Mechanical Engineering, University College London, UK

**15:25**      **Closing Remarks**

**15:30**      **Close**



## Workshop: Advanced Biophotonics

Sunday, 24th June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Michael Hughes, University of Kent, UK*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

*Jang Ah Kim, Hamlyn Centre, Imperial College London, UK*

*Alex Thompson, Imperial College London, UK*

*Khushi Vyas, Hamlyn Centre, Imperial College London, UK*

### **Sponsored by:**



### *Workshop Schedule*

#### **08:30-09:00 Registration and Coffee**

#### **09:00 Opening Remarks**

Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK

#### **09:10 Imaging with Photonics: Deeper, Wider, Faster**

(Keynote) Kishan Dholakia, University of St. Andrews, Scotland, UK

#### **09:40 Optical Coherence Tomography: from Qualitative to Quantitative Imaging**

Adrian Podoleanu, University of Kent, UK

#### **10:00 Multidimensional Fluorescence Imaging for Preclinical and Clinical Applications**

Paul French, Imperial College London, UK

#### **10:20 New Frontiers in Near Infrared Spectroscopy**

Clare Elwell, University College London, UK

#### **10:40-11:15 Coffee Break**

#### **11:15 Rapid Fiber-Optic Raman Endoscopy Technique: Immediate Medical Diagnosis in Gastrointestinal Tracts**

(Keynote) Zhiwei Huang, National University of Singapore, Singapore

#### **11:45 Advanced Optical Fibres for Medical Imaging and Diagnosis**

Jonathan Knight, University of Bath, UK

#### **12:05 Molecular Probes and In Vivo Imaging in the Lung**

Mark Bradley, University of Edinburgh, UK

- 12:25**      **Advances in Infrared Based Spectral Pathology: Steps Towards Clinical Translation**  
Peter Gardner, University of Manchester, UK
- 12:45**      **Strategies of Linear and Nonlinear Raman Spectroscopy for Intraoperative Applications**  
Christoph Krafft, Jena University, Germany

**13:05-14:00**   **Lunch**

- 14:00**      **Developing the Infrastructure for Translational Biophotonics: Mixing Molecules, Processes and People**  
Kevin Dhaliwal, University of Edinburgh, UK
- 14:20**      **Imaging the Barrier Defect in The Damaged Small Intestine**  
John Louis-Auguste, Queen Mary University of London, UK
- 14:40**      **Towards Robotic Assisted Endoscopic OCT**  
Michalina Gora, French National Center for Scientific Research, Paris, France

**15:00**      **Panel Discussion**

**15:25**      **Closing Remarks**

**15:30**      **Close**



## Workshop: Brain-Computer Interfacing

Wednesday, 27<sup>th</sup> June

*Royal Geographical Society*

**Co-Chairs and Organising Committee:**

*Daniel Leff, Hamlyn Centre, Imperial College London, UK*

*Fani Deligianni, Hamlyn Centre, Imperial College London, UK*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

**Sponsored by:**



### Workshop Schedule

**08:30-09:00 Registration and Coffee**

**09:00 Toward Dexterous Manipulation with Brain-Computer-Interfaces**

Andrew Schwartz, University of Pittsburgh, PA, USA

**09:40 An Associative Brain-Computer-Interface for the Rehabilitation of Lost Motor Function**

Natalie Mrachacz-Kersting, Aalborg University, Denmark

**10:10 Myoelectric Control with Abstract Decoders**

Kianoush Nazarpour, Newcastle University, UK

**10:40-11:00 Coffee Break and Brainstorming**

**11:00 BCI for Decoding Dexterous Hand and Finger Movements**

Nitish Thakor, John Hopkins University, MD, USA - Presenting via "GoToMeeting"

**11:30 Brain Computer Interfaces for Communication and Rehabilitation**

Ujwal Chaudhary (Niels Birbaumer's group), University of Tübingen, Germany

**12:00 Brain-Computer Interface (BCI) for Preventive, Treatment, Rehabilitation and Assistive Technologies**

Yodchanan Wongsawat, Mahidol University, Thailand

**12:30 Integrating an Adaptive EEG-EMG based BCI and Hand Exoskeleton for Personalized Post-stroke Hand Motion Recovery**

Girijesh Prasad, Ulster University, N. Ireland, UK

**12:55 Closing Remarks**

**13:00 Lunch**





## Workshop: Deep Learning for Medical Robotics

Wednesday, 27<sup>th</sup> June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Stamatia Giannarou, Hamlyn Centre, Imperial College London, UK*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

*Lin Zhang, Hamlyn Centre, Imperial College London, UK*

*Xiao-Yun Zhou, Hamlyn Centre, Imperial College London, UK*

### *Workshop Schedule*

**08:30-08:55 Registration and Coffee**

**08:55 Welcome and Introduction**

**09:00 Deep Learning for Real-time Predictions from Endoscopic Videos**

Nicolas Padoy, University of Strasbourg, France

**09:30 InnerEye - Assistive AI for Cancer Treatment**

Aditya Nori, Microsoft Research Cambridge, UK

**10:00 Learning Less to Learn Better: Dropout for Effective Semantic Segmentation of Medical Images and Uncertainty Modelling**

Guoyan Zheng, University of Bern, CH

**10:30 Panel Discussion**

**10:45-11:15 Coffee Break**

**11:15 Artificial Intelligence for Medical Image Quantification, Diagnosis and Prediction**

Ivana Isgum, UMC Utrecht, Netherlands

**11:45 Deep Reinforcement Learning for Robotics: Progress & Challenges**

Shane Gu, University of Cambridge, UK

**12:15 Deep Learning for Robot Manipulation via Simulation**

Edward Johns, Imperial College London, UK

**12:45 Panel Discussion & Concluding Remarks**

**13:00 Lunch**



## Workshop: Implantable Sensors and Robotics

Wednesday, 27<sup>th</sup> June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Pierre Dupont, Boston Children's Hospital, Harvard Medical School, MA, USA*

*Salzitsa Anastasova, Hamlyn Centre, Imperial College London, UK*

*Bruno Gil Rosa, Hamlyn Centre, Imperial College London, UK*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

### **Sponsored by:**



### *Workshop Schedule*

#### **08:30-08:55 Registration and Coffee**

#### **08:55 Welcome**

Guang-Zhong Yang, Imperial College London, UK

#### **09:00 In Vivo Tissue Regeneration of Tubular Organs**

(Keynote) Pierre Dupont, Boston Children's Hospital, Harvard Medical School, MA, USA

#### **09:30 Designing Soft Biomaterials with Unprecedented Mechanical Properties for Biomedical Applications**

Jianyu Li, McGill University, Montreal, Canada

#### **09:55 Optimising Medical Care in Remote, Austere Environments Using Emerging Biosensor Technologies**

Mike Smith/ Natalie Taylor, Royal Centre for Defence, UK

#### **10:20 Polymer-Based Brain-Machine Interfacing Implant**

Sohee Kim, Daegu Gyeonbuk Institute of Science and Technology (DGIST), S Korea

#### **10:45-11:15 Coffee Break**

#### **11:15 Biomechatronic Implantable Devices for Urinary and Pancreatic Diseases**

Arianna Menciassi, The BioRobotics Institute, Pontedera, Italy

<b>11:40</b>	<b>Multifunctional Nanofibers for Implantable Biosensors</b> Wenhui Song, Division of Surgery & Interventional Science, University College London, UK
<b>12:05</b>	<b>Real-Time Continuous Measurement of Heart Wall Strain Using Implantable Flexible Sensors</b> Nikolay V. Vasilyev, Boston Children's Hospital, Assistant Professor of Surgery Harvard Medical School, MA, USA
<b>12:30</b>	<b>Lunch</b>



## Workshop: Materials Science for Medical Robotics

Wednesday, 27<sup>th</sup> June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Peer Fischer, University of Stuttgart, Germany*

*Bradley Nelson, ETH Zurich, CH*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

*Burak Temelkuran, Hamlyn Centre, Imperial College London, UK*

*Mohamed E K Abdelaziz, Hamlyn Centre, Imperial College London, UK*

### **Sponsored by:**



### *Workshop Schedule*

- |                                 |                                                                                                                                                        |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>14:00</b>                    | <b>Shape-Memory Polymer Actuators for Soft Robotics</b><br>(Keynote) Andreas Lendlein, Helmholtz-Zentrum Geesthacht, Germany                           |
| <b>14:25</b>                    | <b>Walking Up A Human Hair</b><br>Diederik Wiersma, European Laboratory for Non-Linear Spectroscopy (LENS), Sesto Fiorentino FI, Italy                 |
| <b>14:50</b>                    | <b>Biomedical Applications of Microbots</b><br>Peer Fischer, Max Planck Institute for Intelligent Systems and University of Stuttgart, Germany         |
| <b>15:10</b>                    | <b>Bioinspired Soft Electronics and Machines</b><br>Martin Kaltenbrunner, Johannes Kepler University Linz, Austria                                     |
| <b>15:30-16:00 Coffee Break</b> |                                                                                                                                                        |
| <b>16:00</b>                    | <b>Hydrogel Bioelectronics and Biorobots</b><br>(Keynote) Xuanhe Zhao, Massachusetts Institute of Technology, MA, USA                                  |
| <b>16:25</b>                    | <b>Multimaterial Optical Fibres for Bioengineering Applications</b><br>Fabien Sorin, École Polytechnique Fédérale de Lausanne, CH                      |
| <b>16:45</b>                    | <b>Multifunctional Fibres for Electrical, Optical and Chemical Interrogation of Neural Circuits</b><br>Xiaoting Jia, Virginia Tech University, VA, USA |

**17:05      Panel Discussion**

**17:25      Closing Remarks**

**17:30      Close**



## Workshop: Micro-Robotics and Drug Delivery

Wednesday, 27<sup>th</sup> June

Royal Geographical Society



### Co-Chairs and Organising Committee:

Sylvain Martel, Polytechnique Montréal, Canada

Joseph Wang, University California San Diego, USA

Antoine N Barbot, Hamlyn Centre, Imperial College London, UK

Florent Seichepine, Hamlyn Centre, Imperial College London, UK

### Workshop Schedule

#### 08:30-09:15 Registration and Coffee

#### 09:15 Artificial Micro Robot for Drug Delivery

Joseph Wang, University California San Diego, USA

#### 09:35 Soft-Microbots and Hard-Nanobots for Drug Delivery

Bradley Nelson, ETH Zurich, CH

#### 09:55 Latest Advances on Miniature Soft Robots

Metin Sitti, Carnegie Mellon University, PA, USA

#### 10:15 Reconfigurable Magnetic Swarm for Microrobotic Delivery

Li Zhang, The Chinese University of Hong Kong, China

#### 10:35-11:00 Coffee Break

#### 11:00 Micro and Milli-Scale Magnetic Mechanisms for Manipulation and Cargo Delivery

Eric Diller, University of Toronto, Canada

#### 11:20 Protein Based Microrobots

David Gracias, John Hopkins University, MA, USA

#### 11:40 Soft Hydrogel Microrobots for Drug Delivery

Sukho Park, Daegu Gyeongbuk Institute of Science and Technology (DGIST), S Korea

#### 12:00 Bacteria based Micro Robot for Drug Delivery

Sylvain Martel, Polytechnique Montréal, Canada

#### 12:20 Debate: Artificial Versus Natural Micro/Nano Robots

#### 13:00 Lunch



## Workshop: Surgical Robotics: First in Human – What does it take?

Wednesday, 27<sup>th</sup> June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Pierre Dupont, Boston Children's Hospital, Harvard Medical School, MA, USA*

*Russell Taylor, Johns Hopkins University, MD, USA*

*Christos Bergeles, University College London, UK*

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### *Workshop Schedule*

- |                    |                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>14:00</b>       | <b>How could I be so wrong... so many times!!</b><br>Yulun Wang, Founder, InTouch Health and Computer Motion, CA, USA                                                                                              |
| <b>14:30</b>       | <b>Why should you choose an easier way to success rather than bringing a robot to the operating room?</b><br>Moshe Shoham, Israel Institute of Technology and Founder, Mazor Robotics, Jezreel Valley Area, Israel |
| <b>15:00</b>       | <b>Robotic Cochlea Implantation - From Real to Ideal</b><br>Stefan Weber, University of Bern, CAScination, CH                                                                                                      |
| <b>15:30-16:00</b> | <b>Coffee Break</b>                                                                                                                                                                                                |
| <b>16:00</b>       | <b>Adoption of High-Tech Solutions in Low-Tech Environments</b><br>Brian Miller, Intuitive Surgical, CA, USA                                                                                                       |
| <b>16:30</b>       | <b>Navigating the river of medical product development – from quiet waters to raging rapids</b><br>William Peine, Medtronic, MA, USA                                                                               |
| <b>17:00</b>       | <b>It's not about the robots any more....</b><br>David Mintz, Auris Robotics, CA, USA                                                                                                                              |
| <b>17:25</b>       | <b>Closing Remarks</b>                                                                                                                                                                                             |
| <b>17:30</b>       | <b>Close</b>                                                                                                                                                                                                       |





## Workshop: Wearable and Assistive Robots

Wednesday, 27<sup>th</sup> June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Kamal Deep, Glasgow University, UK*

*Venky Dubey, Bournemouth University, UK*

*Benny P L Lo, Hamlyn Centre, Imperial College London, UK*

*Dinesh Nathwani, Imperial College Healthcare NHS Trust, UK*

*Jackrit Suthakorn, Mahidol University, Thailand*

*Oliver Wells, Devices for Dignity MedTech Co-operative, UK*

*Shane Xie, University of Leeds, UK*

*Zhiqiang Zhang, University of Leeds, UK*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

*Daniel Freer, Hamlyn Centre, Imperial College London, UK*

### **Sponsored by:**



### *Workshop Schedule*

- |              |                                                                                                                                                                      |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>14:00</b> | <b>Robotics for Spinal Surgery and Rehabilitation</b><br>(Keynote) Shen Hong Xing, Renji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China |
| <b>14:30</b> | <b>Robotics for Motor Rehabilitation</b><br>Rui Loureiro, University College London, UK                                                                              |
| <b>14:50</b> | <b>What Exoskeleton Design is Fit for Stroke Rehabilitation and Does It Help?</b><br>Venky Dubey, Bournemouth University, UK                                         |
| <b>15:10</b> | <b>Robot Assisted Training for the Upper Limb after Stroke (RATULS): Patient Trials</b><br>Helen Bosomworth, Newcastle University, UK                                |
| <b>15:30</b> | <b>Poster Introductions</b>                                                                                                                                          |

**15:40-16:00 Coffee Break**

*Translational Highlight - 2 prominent UK voices give their input about the importance of Wearable and Assistive Robots:*

- |              |                                                                                                |
|--------------|------------------------------------------------------------------------------------------------|
| <b>16:00</b> | <b>System Usability and Commercial Considerations</b><br>Oliver Wells, Devices for Dignity, UK |
|--------------|------------------------------------------------------------------------------------------------|

<b>16:10</b>	<b>Potential for Developing Wearable/Assistive Devices in Orthopaedics: Ideas and Future Direction</b> Kamal Deep, Glasgow University, UK
<b>16:20</b>	<b>Soft Robotics for Rehabilitation</b> Samia Nefti-Meziani, University of Salford, Manchester, UK
<b>16:40</b>	<b>Design of the BART LAB LL-EXO</b> Jackrit Suthakorn, Mahidol University, Thailand
<b>17:00</b>	<b>CARR: A Compliant Ankle Rehabilitation Robot for Patients with Neurological Disease</b> Shane Xie, University of Leeds, UK
<b>17:20</b>	<b>Closing Remarks</b>
<b>17:30</b>	<b>Close</b>



## Workshop: Image Guided Therapy

Wednesday, 27<sup>th</sup> June

*Royal Geographical Society*

### **Co-Chairs and Organising Committee:**

*Kamal Deep, Glasgow University, UK*

*Venky Dubey, Bournemouth University, UK*

*Dinesh Nathwani, Imperial College Healthcare NHS Trust, UK*

*Jackrit Suthakorn, Mahidol University, Thailand*

*Oliver Wells, Devices for Dignity MedTech Co-operative, UK*

*Shane Xie, University of Leeds, UK*

*Guang-Zhong Yang, Hamlyn Centre, Imperial College London, UK*

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### *Workshop Schedule*

<b>14:00</b>	<b>Monitoring of Skin Cancer Treatment in vivo by Optical Coherence Tomography and Reflectance Confocal Microscopy</b> Mette Mogensen, University of Copenhagen, Denmark
<b>14:30</b>	<b>Hyperspectral Endoscopy for Early Cancer Detection</b> Sarah Bohndiek, University of Cambridge, UK
<b>15:00</b>	<b>Ultrasound and MR guided Focused Ultrasound Therapy: SonoRay</b> Andreas Melzer, University of Dundee, UK
<b>15:30</b>	<b>Coffee Break</b>
<b>16:00</b>	<b>MR Safe Guide Wires</b> Mari Nieves Velasco Forte, King's College London, UK
<b>16:30</b>	<b>Real-time Quantitative Optical Imaging for Surgical Guidance</b> Sylvain Gioux, ICube laboratory, University of Strasbourg, France
<b>17:00</b>	<b>Tracking Medical Devices using Time-Correlated Single-Photon Counting (TCSPC) Imaging</b> Robert Thomson, Heriot Watt University, UK
<b>17:25</b>	<b>Closing Remarks</b>
<b>17:30</b>	<b>Close</b>

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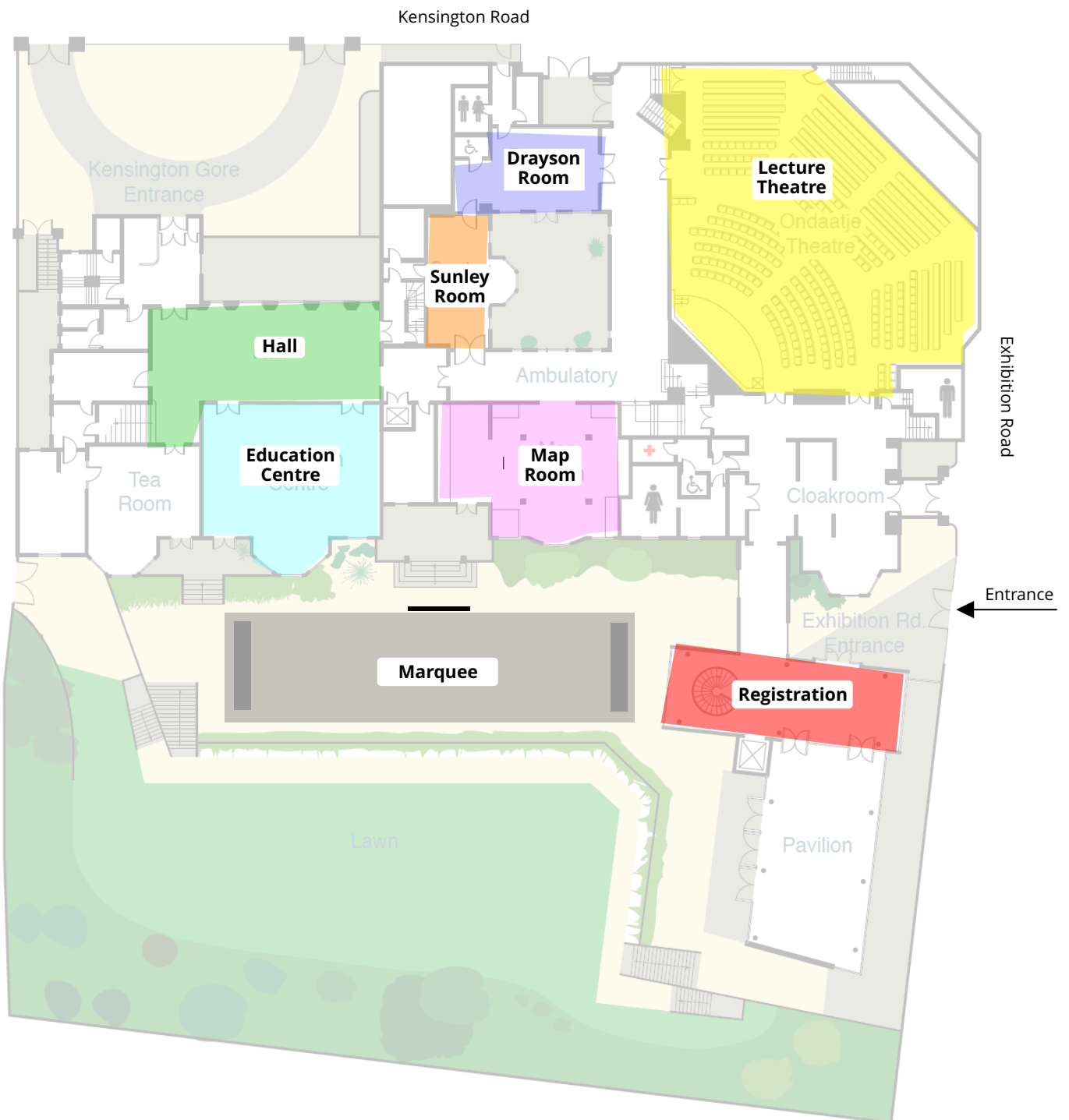


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# **The Hamlyn Symposium** on Medical Robotics

24-27 June 2018, Imperial College London, UK