### Programme at a Glance

**1 Hamlyn Symposium on Medical Robotics Programme**

**Monday 24th June 2019**

- Session 1 – Soft and Bioinspired Robot
- Poster Teaser Session 1
- Session 2 – Clinical Translation and Challenges
- Karl Storz -Harold Hopkins Lecture
- Session 3 – Wearable Robotics and VR in Surgical Training

**Tuesday 25th June 2019**

- Session 4 – Imaging and Emerging Surgical Systems
- Session 5 – Smart Handheld devices
- Translational Keynote
- The Leaders’ Forum on Technology Application in Clinical Practice
- Challenge & Highlights

**2 Hamlyn Symposium on Medical Robotics Workshops Programme**

**Sunday 23rd June 2019**

- Surgical Robot Challenge 2019
- SAM01 | Endovascular Intervention
- SAPM02 | e-skins and Advanced Materials for Soft Robotics
- SAPM03 | Focused Energy Delivery & Precision Intervention
- SAPM04 | Towards Robotic Autonomy in Surgery

**Wednesday 26th June 2019**

- WAM05 | Bionic Technologies & Implantable Robot
- WAM06 | Wearable & Assistive Robots
- WPM07 | Medical Robotics: First in Human – What does it take?
- WPM08 | Micro and Nanorobotics towards in vivo applications
- WAPM10 | From BCI to Human Robot Augmentation
- WAPM11 | Advanced Biophotonics: from bench to bedside
- WAPM12 | Emerging Learning Techniques for Robotics

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1. **Accredited by the Royal College of Surgeons of England for up to 12 CPD points**

3. **Sponsors**
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<tr>
<td>08:30 - 09:00</td>
<td>Coffee</td>
<td>Session 1: Soft &amp; Bioinspired Robot</td>
<td>Keynote 1: Paolo Dario</td>
<td>Workshop Bionic &amp; Wearable Robots</td>
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<tr>
<td>09:00 - 09:30</td>
<td>Surgical Robot Challenge Demos at Hamlyn</td>
<td>Coffee (11:30 - 12:00)</td>
<td>Coffee (11:15 - 11:45)</td>
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<td>09:30 - 10:00</td>
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<td>Session 5: Smart handheld Devices</td>
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<td>10:00 - 10:30</td>
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<td>Registration</td>
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<td>Surgical Challenge Presentations at RG5</td>
<td>Coffee (15:45 - 16:15)</td>
<td>Session 3: Wearable Robotics &amp; VR in Surgical Training</td>
<td>Coffee New Robot Applications (17:15)</td>
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<td>Session 2: Clinical Translation &amp; Challenges</td>
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Poster Teaser & Drinks Reception

PC Dinner (Invitation Only)
Monday 24th June 2019

08:30 Registration and Coffee

09:15 Welcome Address: Guang-Zhong Yang

Session 1 – Soft and Bioinspired Robots

Chairs: Pierre DuPont and Rick Satava

09:30 Keynote Lecture 1: Paolo Dario, The Scuola Superiore Sant’Anna, Pisa, Italy

*Bionics and Bioinspired Systems for Robotics*

10:15 Variable Contraction Timing for a Soft Robotic Cardiac Assist Device
C.J. Payne¹,², D. Van Story¹,², D. Bautista-Salinas², M. Saeed², T. Thalhofer¹, P.J. del Nido², C.J. Walsh¹, N.V. Vasilyev²
¹Wyss Institute for Biologically Inspired Engineering, Harvard University, USA
²Department of Cardiac Surgery, Boston Children’s Hospital, USA

10:30 Evaluation of a Soft Helical Actuator Performance with Hard and Soft Attachments for Tissue Regeneration
Eduardo Perez-Guagnelli, Joanna Jones and Dana Damian
Sheffield Biomedical Robotics Lab, Automatic Control and Systems Engineering Department, University of Sheffield, UK

10:45 SoftSwitch: A Soft Implantable Device for on/off Drug Release
Keegan Mendez¹,², William Whyte²,³, Garry P. Duffy³,⁴, Ellen T. Roche¹,²,⁵
¹Health Sciences and Technology, Massachusetts Institute of Technology, USA
²Institute for Medical Engineering and Science, Massachusetts Institute of Technology, USA
³Advanced Materials and Bio Engineering Research Centre, Trinity College Dublin, Ireland
⁴School of Medicine, National University of Ireland Galway, Ireland
⁵Department of Mechanical Engineering, Massachusetts Institute of Technology, USA

11:00 Eversion-type Soft Overtube for Minimally Invasive Surgery
F. Putzu, T. Abrar, J. Konstantinova, K. Althoefer
Centre for Advanced Robotics @ Queen Mary, UK

11:15 Design of a Robotic Balloon-catheter Endoscope for Sinus Procedures
Yingtian Li¹, Reza Rahbar², Pierre E. DuPont¹
¹Cardiovascular Surgery, Boston Children’s Hospital, Harvard Medical School, USA
²Department of Otolaryngology, Boston Children’s Hospital, Harvard Medical School, USA
11:30-12:00  Coffee Break

12.00  Poster Teaser Session 1

**Chairs: Thomas Looi and Leonardo Mattos**

**P1** Robotic Intravascular Suturing for Endovascular Repair
Estevan H. Murai\(^1\), Daniel Martins\(^1\), Pierre G. Silveira\(^2\), Jian S. Dai\(^3\), Shervanthi Homer-Vanniasinkam\(^4\), Helge A. Wurdemann\(^4\)
\(^1\)Mechanical Engineering, Federal University of Santa Catarina, Florianópolis, Brazil
\(^2\)Surgery Department, Federal University of Santa Catarina, Florianópolis, Brazil
\(^3\)Department of Informatics, King's College London, UK
\(^4\)Department of Mechanical Engineering, University College London, UK

**P2** Automatic Bone Extraction from Depth Images in Robotic Assisted Knee Replacement
He Liu, Ferdinando Rodriguez y Baena
*Mechatronics in Medicine Laboratory, Imperial College London, UK*

**P3** From Benchtop to Operating Room: The Evolution of the Galen Platform
Y. Sevimli\(^1\), D. Levi\(^1\), A. Bhat\(^1\), O. Puleo\(^1\), R.H. Taylor\(^2\), D. Saunders\(^1\)
\(^1\)Galen Robotics, Inc., USA
\(^2\)Laboratory for Computational Sensing and Robotics, Johns Hopkins University, USA

**P4** How to Enhance Learning of Robotic Surgery Gestures? A Tactile Cue Saliency Investigation for 3D Hand Guidance
Gustavo D. Gil\(^1\), Julie M. Walker\(^2\), Nabil Zemiti\(^1\), Allison M. Okamura\(^2\), Philippe Poignet\(^1\)
\(^1\)LIRMM, University of Montpellier, CNRS, Montpellier, France
\(^2\)Department of Mechanical Engineering, Stanford University, Stanford, USA

**P5** Autonomous Pick-and-place of Pneumatically Attachable Flexible Rail
C. D’Ettorre\(^1\), A. Stilli\(^1\), G. Dwyer\(^1\), M. Tran\(^2\) and D. Stoyanov\(^1\)
\(^1\)Wellcome/ EPSRC Centre for Interventional and Surgical Science (WEISS), UCL, UK
\(^2\)Research Department of Surgical Biotechnology, University College London, UK

**P6** Design of the MUSHA Hand II for Robotic-assisted Laparoscopic Surgery
H. Liu\(^1\), P. Ferrentino\(^1\), M. Selvaggio\(^1\), S. Pirozzi\(^2\), F. Ficuciello\(^1\)
\(^1\)University of Naples Federico II, Italy
\(^2\)University of Campania “Luigi Vanvitelli”, Italy

**P7** Toward an Ontology for Automation in Surgery: Application to Peg-and-ring Task
Hirenkumar Nakawala, Paolo Fiorini
*Department of Computer Science, University of Verona, Verona, Italy*

**P8** Deployable Shape Sensors for Minimally Invasive Surgery Using Frequency Division Multiplexed Electrical Impedance Tomography
J Avery\(^1\), M Runciman\(^2\), G Mylonas\(^2\), A Darzi\(^1\)
Real-time Prediction of Breast Lesions Displacement during Ultrasound Scanning Using a Position-based Dynamics Approach
D. Dall’Alba\textsuperscript{1}, E. Tagliabue\textsuperscript{1}, E. Magnabosco\textsuperscript{1}, C. Tenga\textsuperscript{1}, P. Fiorini\textsuperscript{1}
\textsuperscript{1}Dept. of Computer Science, University of Verona, Italy

Needle Segmentation in 3D Ultrasound Volumes Based on Machine Learning for Needle Steering
G. Lapouge\textsuperscript{1,2}, H. Younes\textsuperscript{1}, P. Poignet\textsuperscript{2}, S. Voros\textsuperscript{1}, J. Troccaz\textsuperscript{1}
\textsuperscript{1}Univ. Grenoble Alpes, CNRS, Grenoble INP, TIMC-IMAG, F-38000 Grenoble, France
\textsuperscript{2}Univ. Montpellier, CNRS, LIRMM, F-34090 Montpellier, France

Robotically Assisted Electrical Bio-impedance Measurements for Soft Tissue Characterization: a Feasibility Study
Kim L. Schwaner\textsuperscript{1}, Diego Dall’Alba\textsuperscript{2}, Zhuoqi Cheng\textsuperscript{3}, Leonardo S. Mattos\textsuperscript{3}, Paolo Fiorini\textsuperscript{1} and Thiusius R. Savarimuthu\textsuperscript{1}
\textsuperscript{1}The Maersk Mc-Kinney Møller Institute, University of Southern Denmark, Denmark
\textsuperscript{2}Department of Computer Science, University of Verona, Italy
\textsuperscript{3}Department of Advanced Robotics, Istituto Italiano di Tecnologia, Italy

Surgical Action Recognition with Spatiotemporal Convolutional Neural Networks
Giacomo De Rossi\textsuperscript{1}, Nicola Piccinelli\textsuperscript{1}, Francesco Setti\textsuperscript{1}, Riccardo Muradore\textsuperscript{1}, Fabio Cuzzolin\textsuperscript{2}
\textsuperscript{1}University of Verona, Italy
\textsuperscript{2}Oxford Brookes University, UK

Deep Q Reinforcement Learning for Autonomous Navigation of Surgical Snake Robot in Confined Spaces
S. Athiniotis, R. A. Srivatsan and H. Choset
Robotics Institute, Carnegie Mellon University, USA

Autonomous Detection of C. diff Toxins in Clinical Stool Using A Magnetic Microrobotic System
Lidong Yang, Yabin Zhang, and Li Zhang
Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong (CUHK), Shatin NT, Hong Kong SAR, China

Gaze-contingent Robotic Flexible Endoscopy
A. A. Kogkas\textsuperscript{1}, B. Glover\textsuperscript{3}, N. Patel\textsuperscript{3}, A. Darzi\textsuperscript{2}, G. P. Mylonas\textsuperscript{1}
\textsuperscript{1}HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK
\textsuperscript{2}Department of Surgery and Cancer, Imperial College London, UK
\textsuperscript{3}Department of Gastroenterology, Imperial College London, UK

Wave-shape Notched Compliant Joint with High Rigidity
Seunguk Kim\textsuperscript{1}, Seongbo Shim\textsuperscript{1}, Daekeun Ji\textsuperscript{1} and Jaesung Hong\textsuperscript{1}
\textsuperscript{1}DGIST, Daegu, Korea
Estimating the Complete Shape of Concentric Tube Robots via Learning
A. Kuntz, A. Sethi, R. Alterovitz
Department of Computer Science, University of North Carolina at Chapel Hill, USA

Design and Modelling of a Multi-segment Steerable Sheath for Single-port Endoscopic Procedures
Jiaole Wang¹, Pierre E. Dupont¹
¹Boston Children’s Hospital, Harvard Medical School, Boston, USA

Vessel Reconstruction Using Multiple Forward-looking Sensors in a Steerable Needle
Vani Virdyawan¹, and Ferdinando Rodriguez y Baena¹
¹Department of Mechanical Engineering, Imperial College London, UK

Semi-analytical Orientation Alignment with Joint Limit Constraints for Teleoperated Surgical System
Yuanpei Cai¹, C. W. Vincent Hui¹, and K. W. Samuel Au¹
¹Dept. of Mechanical & Auto. Eng., The Chinese University of Hong Kong, China

Soft, Deployable, Cable Driven Robot for Minimally Invasive Surgery
Mark Runciman¹, James Avery², Ming Zhao¹, Ara Darzi², George Mylonas¹
¹HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK
²Department of Surgery and Cancer, Imperial College London, UK

Design of Non-circular Joint Contour for Continuum Robots
Z. Jin¹, A. Gao¹, N. Liu¹, Z. Wu¹, G. Z. Yang¹
¹The Hamlyn Centre for Robotic Surgery, Imperial College London, UK

Ultrasound-based Safety Assessment during Moving Organ Tracking Towards In vivo Focused Ultrasound Therapy
A. Mariani¹, L. Morchi¹, A. Diodato, A. Cafarelli, S. Tognarelli, A. Menciassi
The BioRobotics Institute, Sant’Anna School of Advanced Studies, Pisa, Italy

Identification of the Electrocautery State to Enable Spatially Navigated Intraoperative Mass Spectrometry Tissue Analysis
M. Asselin¹, A. Jamzad¹, A. Lasso¹, T. Ungi¹, J. Rudan², G. Fichtinger¹,²
¹Laboratory for Percutaneous Surgery, School of Computing, Queen’s University, Canada
²Department of Surgery, School of Medicine, Queen’s University, Canada

Preliminary Validation of Urethral Transection Simulation during RARP
Julien Abinahed¹, Nikhil Navkar¹, Georges Younes¹, Shidin Balakrishnan¹, Abdulrahman Alfayad¹, Waseem Palliyali¹, Gorune Ohannessian², Zherong Pan³, Dinesh Manocha⁴, George Turkiyyah², and Abdulla Al-Ansari¹
¹Department of Surgery, Hamad Medical Corporation, Qatar
²Department of Computer Science, American University of Beirut, Lebanon
³Department of Computer Science, University of North Carolina, USA
⁴Department of Computer Science, University of Maryland, USA
Towards Smart Oxygenation Sensing Implants Using Soft Robotics and Diffuse Reflectance Spectroscopy
J Avery¹, M Runciman², A J Thompson¹, G Mylonas², A Darzi¹
¹Department of Surgery and Cancer, Imperial College London, London, UK,
²HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK

Layer Jamming Pneumatic Actuator for Medical Robotics
Michele Ibrahimi, Linda Paternò, Leonardo Ricotti, Arianna Menciassi
The BioRobotics Institute, Scuola Superiore Sant’Anna, Pisa, Italy

Gaze-contingent Robotic Nurse Assistant
A. A. Kogkas¹, A. Ezzat¹, R. Thakkar³, A. Darzi², G. P. Mylonas¹
¹HARMS Lab, Department of Surgery and Cancer, Imperial College London, UK
²Department of Surgery and Cancer, Imperial College London, UK
³St George’s, University of London, UK

Towards Semi-automated Mechanical Thrombectomy: Path Planning Considerations for a Double Articulated Microcatheter
Colette Abah¹, Giuseppe Del Giudice¹, Neel Shihora¹, Rohan Chitale⁵, Nabil Simaan¹
¹Department of Mechanical Engineering, Vanderbilt University, Nashville TN, USA
²Department of Neurological Surgery, Vanderbilt University Medical Centre, USA

A Low-cost Draw-wire Sensor for Kinematic Sensing in Wearable Assistive Robots
R. J. Varghese, R. K. Singh, J. Liu, G-Z. Yang
The Hamlyn Centre, Institute for Global Health Innovation, Imperial College London, UK

A Novel Hybrid Master-slave Control Interface for Surgical Robot Remote Control
Junhong Chen¹, Dan-Dan Zhang¹, Wuzhou Hong², Jindong Liu¹, Guang-Zhong Yang¹
¹Hamlyn Centre for Robotic Surgery, Imperial College London, UK
²Shanghai Jiao Tong University, China

Design of Master Device Featured Redundant Joint for 4-DOFs Slave of Flexible Surgery Robot
Jeongdo Ahn¹, Dong-Soo Kwon¹
¹Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Korea

13:00-14:00 Lunch

Session 2 – Clinical Translation and Challenges

Chairs: Russ Taylor and Paolo Fiorini

14:00 Karl Storz-Harold Hopkins Golden Telescope Lecture: Dinesh Nathwani, Imperial College London, UK
An Orthopaedic Journey from Navigation to Robotics: Is this Finally the Moment for Surgical Revolution?

14:45
Jimmy Da Silva¹,², Thibault Chandanson¹, Guillaume Morel²
¹SpineGuard, Vincennes, France
²Sorbonne Université, CNRS, INSERM, ISIR – Paris, France

15:00
Intraoperative Robotics for Patient Specific Instrument Manufacture: a Cadaver Trial
A. Darwood¹, S. Hurst¹, G. Villatte², R. Fenton³, F. Tatti¹, H. El-Daou¹, P., Reily¹, R. Emery¹, F. Rodriguez y Baena¹
¹Imperial College London, UK
²Centre Hospitalier Universitaire de Clermont-Ferrand, France
³Desoutter Medical Ltd, UK

15:15
Simulation-based Adaptive Training for Robot-assisted Surgery: A Feasibility Study on Medical Residents
A. Mariani¹,², E. Pellegrini¹, A. Menciassi², and E. De Momi¹
¹Department of Electronics, Information and Bioengineering, Politecnico di Milano, Italy
²The BioRobotics Institute, Sant’Anna School of Advanced Studies, Pisa, Italy

15:30
Robot-assisted Surgical Training Over Several Days in a Virtual Surgical Environment with Divergent and Convergent Force Fields
Y. A. Oquendo¹, Z. Chua¹, M. M. Coad¹, I. Nisky², A. Jarc³, S. Wren¹, T. S. Lendvay⁴, A. M. Okamura¹
¹Stanford University, USA
²Ben-Gurion University of the Negev, Israel
³Intuitive Surgical, USA
⁴University of Washington, USA

15:45-16:15 Coffee Break

Session 3–Wearable Robotics and VR in Surgical Training

Chairs: Simon DiMaio and Gabor Fichtinger

16:15
Keynote Lecture 2: Conor Walsh, Harvard University, USA
Soft Wearable Robots for Everyday Wear

17:00
A Musculoskeletal Modelling-based Prototyping Platform for a Tremor Suppression Exo-Glove
X. Chen*, R. J. Varghese*, A. Barbot, S. Anastasova, G-Z. Yang
The Hamlyn Centre, Institute for Global Health Innovation, Imperial College London, UK
17:15 Assisting Hand Movement of TBI Patients Through Robotic Orthoses
T. Meier¹, P. A. Carvalho¹, K. Y. Gandomi¹, G. S. Fischer¹, and C. J. Nycz¹*
¹Automation and Interventional Medicine Lab, WPI, Worcester, MA, USA

17:30 Reciprocal Kinematic Control: Using Human-robot Dual Adaptation to Control Upper Limb Assistive Devices
M. Legrand¹, E. de Montalivet¹, F. Richer¹, N. Jarrassé¹, G. Morel¹
¹Sorbonne University, CNRS, UMR7222 / INSERM, ISIR- Agathe, Paris, France

17:45 Virtual Reality Training in Robot-assisted Surgery: A Novel Experimental Setup for Skill Transfer Evaluation
Guido Caccianiga¹,², Andrea Mariani², Elena De Momi², Jeremy D. Brown¹
¹Johns Hopkins University, Baltimore, Maryland, USA
²Politecnico di Milano, Milano, Italy

18:00 SlicerVR for image-guided Therapy Planning in Immersive Virtual Reality
Csaba Pinter¹, Andras Lasso¹, Mark Asselin¹, Jean-Christophe Fillion-Robin², Jean-Baptiste Vimort², Ken Martin², Gabor Fichtinger¹
¹Laboratory for Percutaneous Surgery, Queen’s University, Kingston, Canada
²Kitware Incorporated, Carrboro, North Carolina, USA

18:15 dVRK-XR: Mixed Reality Extension for Da Vinci Research Kit
Long Qian, Anton Deguet and Peter Kazanzides
Laboratory for Computational Sensing and Robotics, Johns Hopkins University, USA

18:30 Drinks Reception and Poster Session

19:15 Programme Committee Dinner (Invitation Only)
Venue: 170 Queen’s Gate, Kensington, London
Tuesday 25th June 2019

**Session 4 – Imaging and Emerging Surgical Systems**

Chairs: Bradley Nelson and Ichiro Sakuma

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| 09:00 | Feasibility of Volumetric OCT Imaging Using Continuum Robots with Equilibrium Modulation | Giuseppe Del Giudice¹, Jin-Hui Shen², Karen Joos², Nabil Simaan¹  
¹Department of Mechanical Engineering, Vanderbilt University, Nashville TN, USA  
²Vanderbilt Eye Institute, Vanderbilt University Medical Centre, Nashville TN, USA |
| 09:15 | A Flexible Endoscopic Robotic Suturing System for Gastrointestinal Perforations: Animal Study | L. Cao¹, X. Li¹, P. T. Phan¹, A. M. H. Tiong¹, H. L. Kaan²  
²Department of Surgery, National University Hospital, Singapore  
³Yong Loo Lin School of Medicine, National University of Singapore, Singapore |
| 09:30 | Development of a Robotic Endoscope Automated via Laryngeal Imaging for Tracheal Intubation (REALITI) | Q. Boehler¹, P. Hofmann, D. Gage², A. Gehring, C. Chautems¹, P. Biro³, B.J. Nelson¹  
¹Multi-Scale Robotics Lab, ETH Zurich, Switzerland  
²University of Zurich, Switzerland  
³Institute of Anaesthesiology, University Hospital Zurich, Switzerland |
| 09:45 | Towards Robotic Cleft Palate Repair: Teleoperated Suturing with a 3mm Pin-jointed Wrist on the da Vinci Research Kit | G. Wu¹, D. Podolsky², N. Hussein¹, M. Mikic¹, T. Looi¹, C.R. Forrest², J.M. Drake¹  
¹Center for Image Guided Innovation and Therapeutic Intervention, Sick Kids Hospital, Canada  
²Institute of Biomaterials and Biomedical Engineering, Department of Surgery, University of Toronto, Canada |
| 10:00 | Prototype Designs of a Cable-driven Parallel Robot for Transoral Laser Surgery | M. Zhao, T.J.C. Oude Vrielink, A.A. Kogkas, D.S. Elson, G.P. Mylonas  
Department of Surgery and Cancer, Imperial College London, UK |
Department of Computer Science, University of Verona, Italy |
10:30 Keynote Lecture 3: Alexander Meining, University of Würzburg, Germany
   *Future Trends in Interventional Gastrointestinal Endoscopy*

11:15-11:45 Coffee Break

**Session 5 – Smart Handheld devices**

*Chairs: Howie Choset and Dennis Fowler*

11:45 **Hand-held Stiffness Measurement Device for Tissue Analysis**
T. A. Zodage¹, A. N. Chaudhury², R. A. Srivatsan², N. Zevallos², H. Choset²
  ¹Mechanical Engineering, BITS Pilani, India
  ²Robotics Institute, Carnegie Mellon University, USA

12:00 **Admittance Control of a Handheld Microsurgical Instrument**
G. Russo¹, S. Moccia²,³, J. N. Martel⁴, A. Perin⁵, R. F. Sekula⁶, L. Bascetta¹,
  E. De Momi¹, C. N. Riviere⁷
  ¹Dept. of Electronics, Information and Bioengineering, Politecnico di Milano, Milan, Italy
  ²Department of Advanced Robotics, Istituto Italiano di Tecnologia, Genoa, Italy
  ³Department of Information Engineering, Università Politecnica delle Marche, Ancona, Italy
  ⁴Department of Ophthalmology, University of Pittsburgh, Pittsburgh, USA
  ⁵Besta NeuroSim Center, IRCCS Istituto Neuroligico C. Besta, Milan, Italy
  ⁶Department of Neurological Surgery, University of Pittsburgh, Pittsburgh, USA
  ⁷The Robotics Institute, Carnegie Mellon University, Pittsburgh, USA

12:15 **Tremor Reduction Using Time Delay Estimation on Handheld Microsurgical Device**
Jintaek Im, Sukho Park, Cheol Song
Department of Robotics Engineering, DGIST, Daegu, Korea

12:30 **Development of 5-DOFs Master-slave System with Intentional Adjustment of Hysteresis Based on Antagonistic Tendon Control**
Hansoul Kim¹, Joonhwan Kim², Minho Hwang², Dong-Soo Kwon³*
  ¹Robotics Program, KAIST, Daejeon, 305-701, Korea
  ²Department of Mechanical Engineering, KAIST, Daejeon, 305-701, Korea

12:45 **Quantifying the Benefits of Robotic Assistance in Various Microsurgical Procedures**
Olivia Puleo¹, Yunus Sevimli¹, David Levi¹, Ashwin Bhat¹, David Saunders¹, Russell H. Taylor²
  ¹Galen Robotics, Inc., USA
  ²Laboratory for Computational Sensing and Robotics, Johns Hopkins University, USA

13:00-14:00 Lunch
14:00-14:30 Translational Keynote: Moshe Shoham, Technion – Israel Institute of Technology, Israel
   *On the Horizon of Medical/Surgical Robots*

14:30 The Leaders’ Forum on Technology Application in Clinical Practice

15:30-16:00 Coffee Break

**Challenge & Highlights**

*Chairs: Bob Webster and Robert Merrifield*

16:00 Surgical Robot Challenge Highlights

16:30 Closing Keynote Lecture: John Rogers, Northwestern University, USA
   *Soft Electronics for the Human Body*

17:15 Best Paper Rewards

*Chairs: Prof Guang-Zhong Yang and Prof Ara Darzi and representatives of the Helen Hamlyn Trust*
The Hamyn Symposium on Medical Robotics

Workshop
23rd - 26th June 2019
Competition: Surgical Robot Challenge 2019

An international competition for academia and industry

Sunday, 23rd June

The Hamlyn Centre & Royal Geographical Society

Organiser:
Marianne Knight, The Hamlyn Centre, Imperial College, UK

Co-Chair:
Guang-Zhong Yang, The Hamlyn Centre, Imperial College, UK

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Surgical Robot Challenge 2019 Finalists

**SC1**
A Surgical Cockpit for Minimally Invasive Surgery
Mario Aricó, Lucas Joseph, Jimmy Da Silva, Ignacio Avellino, Jesus Mago, Philippe Gauthier, Eleonore Ferret-Barbut, Guillaume Morel, Marie-Aude Vitrani

*ISIR – AGATHE, Sorbonne Université, France*

**SC2**
3.5 mm Robotic Forceps with 4 DoF for Minimally Invasive Surgery
Sanjaya V. Bandara¹, Wu Zongpeng¹, Wataru Kajihara¹, Kazuo Kiguchi¹, Murilo Marinho², Kanako Harada², Mamoru Mitsuishi², Jumpei Arata¹

¹System Engineering Laboratory, Kyushu University, Japan
²The University of Tokyo, Japan

**SC3**
Robotic Suturing for Flexible Endoscopic Surgery
Lin Cao

*Robotics Research Center, Nanyang Technological University, Singapore*

**SC4**
NeuroRobot: An Image Guided MRI Compatible Robotic Platform for Thermal Ablation of Brain Tumors
Gregory Fischer¹, Katie Gandomi¹, Paulo Carvalho¹, Tess Meier¹, Laurie Fischer²

¹Automation and Interventional Medicine Lab, Worcester Polytechnic Institute, USA
²Salem State University

**SC5**
MURAB: MRI and Robotic Assisted Biopsy
Vincent Groenhuis, Marcel Welleweerd, Françoise Siepel, Stefano Stramigioli

*Robotics and Mechatronics, University of Twente, Netherlands*

**SC6**
Multi-purpose Micro Surgery Robot System, EasyMicro
Joonhwan Kim¹, Un-Je Yang¹, Duk Sang Kim¹, Dukyoo Kong¹, Jeongdo Ahn¹, Jung Min Han²

¹Center for Future Medical Robotics, Korea Advanced Institute of Science and Technology, Korea
²EasyEndo Surgical

**SC7**
A Versatile MR Safe Robotic Platform for Image Guided Endovascular Interventions
Dennis Kundrat¹, Mohamed E. M. K. Abdelaziz¹, Giulio Dagnino¹, Wenqiang Chi¹, Trevor M. Y. Kwok², Celia Riga²

¹The Hamlyn Centre for Robotic Surgery, Imperial College London, UK
²Department of Surgery and Cancer, Imperial College London, UK

---

Sunday 23rd June 2019
SC8  Multitool for Stent Deployment in Endobronchial Tumour Resection
Claudia Lutfallah, Mary Margaret Scheunert, Thomas Looi, James Drake
CIGITI, The Hospital for Sick Children, Canada

SC9  SPID – A Soft Pneumatic Inchworm Double balloon for a low cost and painless colonoscopy
Luigi Manfredi¹, Elisabetta Capoccia¹, Gastone Ciuti²
¹Institute for Medical Science and Technology, School of Medicine, University of Dundee, UK
²The BioRobotics Institute, Pisa, Italy

SC10 Master of Masters’ using AMBF
Adnan Munawar, Greg Fischer
AIMLab, Worcester Polytechnic Institute, USA

SC11 Magnetic Flexible Endoscope for Robotic Colonoscopy
Bruno Scaglioni, Pietro Valdastri, Joseph Norton, James Martin, Samwise Wilson
STORM Lab, University of Leeds, UK

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

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

Two locations for the Surgical Robot Challenge 2019: RGS & the Hamlyn Centre:
Workshop: Endovascular Intervention  
Code: SAM01 | Sunday, 23rd June  
Royal Geographical Society

Co-Chairs and Organisers:  
Bradley Nelson, ETH Zurich, Switzerland  
Celia Riga, Imperial College Healthcare, NHS Trust, UK  
Giulio Dagnino, The Hamlyn Centre, Imperial College, UK

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<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08:30-09:00</td>
<td>Registration and Coffee</td>
</tr>
<tr>
<td>09:00</td>
<td>Robots, Robots, everywhere! in a cardiovascular operating room?</td>
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<tr>
<td></td>
<td>(Clinical Keynote) Alan Lumsden, Houston Methodist, Weill Cornell Medical College, USA</td>
</tr>
<tr>
<td>09:40</td>
<td>New Technologies for MR guided Endovascular Procedures: Cardiac Biopsy, Aortic Coarctation Stenting, Heart Valve Prosthesis and Thrombolysis</td>
</tr>
<tr>
<td></td>
<td>Andreas Melzer, University of Leipzig, Germany</td>
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<tr>
<td>10:05</td>
<td>Robotic Assistance to Reduce Embolisation and Stroke during Endovascular Interventions</td>
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<td></td>
<td>Mohamad Hamady, Imperial College London, UK</td>
</tr>
<tr>
<td>10:30</td>
<td>Poster Session</td>
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<tr>
<td>10:45-11:15</td>
<td>Coffee Break &amp; Poster Session</td>
</tr>
<tr>
<td>11:15</td>
<td>Brain and Otolaryngology (Head &amp; Neck) Applications</td>
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<tr>
<td></td>
<td>Thomas Looi, Sick Kids Hospital, Toronto, Canada</td>
</tr>
<tr>
<td>11:40</td>
<td>Origami Engineering for the Brain – The Oxford Endovascular Spinout Journey</td>
</tr>
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<td></td>
<td>Mike Karim, Oxford Endovascular, UK</td>
</tr>
<tr>
<td>12:05</td>
<td>Magnetically Guided Devices for Endovascular Procedures</td>
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<tr>
<td></td>
<td>Quentin Boehler (on behalf of Bradley Nelson), ETH Zurich, Switzerland</td>
</tr>
<tr>
<td>12:30</td>
<td>Spotlight Session: Frontiers of Robot-Assisted Endovascular Intervention</td>
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<tr>
<td>12:50</td>
<td>Concluding Remarks</td>
</tr>
<tr>
<td>13:00</td>
<td>Lunch &amp; Poster Session</td>
</tr>
</tbody>
</table>
**Workshop: e-skins and Advanced Materials for Soft Robotics**

**Code: SAPM02 | Sunday, 23rd June**

**Royal Geographical Society**

**Co-Chairs and Organisers:**
Salzitsa Anastasova-Ivanova, The Hamlyn Centre, Imperial College, UK
Panagiotis Kassanos, The Hamlyn Centre, Imperial College, UK
Florent Seichepine, The Hamlyn Centre, Imperial College, UK

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<td>08:30-09:00</td>
<td>Registration and Coffee</td>
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<tr>
<td>09:00</td>
<td>Opening: Welcome &amp; Introduction</td>
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<tr>
<td></td>
<td>Guang-Zhong Yang, The Hamlyn Centre, Imperial College London, UK</td>
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<tr>
<td>09:10</td>
<td>Triboelectric Nanogenerators for Soft-Robotics and Self-Powered Sensors (Keynote)</td>
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<td></td>
<td>Zhong Lin Wang, Georgia Institute of Technology, USA</td>
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<tr>
<td>09:55</td>
<td>Wearable Sweat Sensors for Personalized Health Monitoring</td>
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<td>Wei Gao, California Institute of Technology, USA</td>
</tr>
<tr>
<td>10:20</td>
<td>Stretchable Triboelectric Nanogenerators as Self-powered Robotic Skins: Toward Actively Perceiving and Responsive Soft Robots</td>
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<td>Ying-Chih Lai, National Chung Hsing University, Taiwan</td>
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<tr>
<td>10:45-11:15</td>
<td>Coffee Break &amp; Poster Session @ The Marquee*</td>
</tr>
<tr>
<td>11:15</td>
<td>Encoding Tissue Mechanics in Silicone</td>
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<td></td>
<td>Sergei Sheiko, University of North Carolina at Chapel Hill, USA</td>
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<tr>
<td>11:45</td>
<td>Novel Ultrathin and DNA Shape Change Materials</td>
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<td>David Gracias, Johns Hopkins University, USA</td>
</tr>
<tr>
<td>12:10</td>
<td>Artificial Muscles for a New Generation of Lifelike Robots</td>
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<td>Christoph Keplinger, University of Colorado Boulder, USA</td>
</tr>
<tr>
<td>12:35</td>
<td>Soft Robots for Invisible Intuitive Interactions</td>
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<td></td>
<td>Jamie Paik, Swiss Federal Institute of Technology, Switzerland</td>
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<td>Time</td>
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<tr>
<td>14:00</td>
<td><strong>Optoelectronic Sensing of the Deformation of Continuum Structures</strong></td>
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<tr>
<td>14:25</td>
<td><strong>Ferromagnetic Soft Continuum Robots</strong></td>
</tr>
<tr>
<td>14:50</td>
<td><strong>A Vision for the Future of Soft Electronics and Robotics</strong></td>
</tr>
<tr>
<td>15:25</td>
<td><strong>Closing Remarks</strong></td>
</tr>
</tbody>
</table>

*Posters presented in our:

1. **Active Perceiving, Self-healable, and Transparent Triboelectric Skin for a Soft Robotic Hand**
   Yung-Chi Hsiao, Hsing-Mei Wu, Ying-Chih Lai
   Department of Materials Science and Engineering, National Chung Hsing University, Taiwan.

2. **Wearable sensor reliability in continuous vital sign monitoring from acutely unwell hospital admissions,**
   Meera Joshi¹, Mansour Sharabiani¹, Hutan Ashrafian¹, Sadia N Khan², Kenny McAndrew², Sonal Arora¹, Richard Kwasnici¹, Graham S Cooke³, Ara Darzi¹
   ¹Department of Surgery and Cancer, Imperial College London, UK ²West Middlesex University Hospital, Twickenham Road, UK ³Division of Infectious Diseases, Imperial College London, UK

3. **Monolithic Solder-on Nanoporous Si-Cu Contacts for Stretchable Silicone Composite Sensors**
   Michael Kasimatis¹, Estefania Nunez-Bajo¹, Max Grell¹, Yasin Cotur¹, Giandrin Barandun¹, Ji-Seon Kim², Fırat Güder¹
   ¹Department of Bioengineering, Imperial College London, UK ²Department of Physics, Imperial College London, UK

4. **An Active Reconfigurable Surface for Prosthetic Socket**
   Mehmet Kelleci, Harshal Sonar and Jamie Paik
   ReconfigurableRoboticsLab(RRL), École Polytechnique Fédérale de Lausanne, Switzerland

5. **Ultrathin Hybrid Graphene Skins for Biosensing and Actuation**
   Weinan Xu¹, SantoshK. P aidi², Zhao Qin³, Qi Huang¹, Markus J. Buehler¹, Ishan Barman², David H. Gracias¹
   ¹Department of Chemical and Biomolecular Engineering, Johns Hopkins University, Baltimore, Maryland 21218, USA,
   ²Department of Mechanical Engineering, Johns Hopkins University, Baltimore, Maryland 21218, USA,
   ³Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA.

6. **Development of artificial blood pump using dielectric elastomers**
   H Godaba¹,², CH Yap³, J Zhu¹, K Althoefer²
   ¹Department of Mechanical Engineering, National University of Singapore
   ²Centre for Advanced Robotics @ Queen Mary, Queen Mary University of London, UK
   ³Department of Biomedical Engineering, National University of Singapore.

7. **Magnetic floating microrobot with preferred magnetisation direction for electronic wet transfer**
   Antoine Barbot, Haijie Tan, Florent Seichepine, Guang-Zhong Yang
   The Hamlyn Centre, Imperial College London, UK

8. **Shape memory alloy driven micro-tentacle actuator**
   Hyun-Taek Lee, Florent Seichepine, Guang-Zhong Yang
   The Hamlyn Centre, Imperial College London, UK
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 London, UK
Mohamed E. M. K. Abdelaziz, The Hamlyn Centre, Imperial College London, UK

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<td>Registration and Coffee</td>
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<tr>
<td>09:00</td>
<td>Opening: Welcome &amp; Introduction</td>
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<tr>
<td></td>
<td>Neil Tolley, Imperial College Healthcare NHS Trust, UK</td>
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<tr>
<td>09:10</td>
<td>Minimally Invasive Prostate Therapies - a Decade of Change</td>
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<td>(Clinical Keynote) Hashim Ahmed, Imperial College Healthcare NHS Trust, UK</td>
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<tr>
<td>09:40</td>
<td>Effect of Surgical Energy on Diagnostic Potential of the i-Knife Technology</td>
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<td>Zoltan Takats, Imperial College London, UK</td>
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<tr>
<td>10:00</td>
<td>Magnetic Navigation for Remote Controlled Catheter Ablation of Cardiac Arrhythmias</td>
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<td>Ilaria Cazzoli, Royal Brompton and Harefield NHS Foundation Trust, UK</td>
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<tr>
<td>10:20</td>
<td>A Pound of Flesh, Not a Drop of Blood</td>
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<td>Dipankar Nandi, Imperial College Healthcare NHS Trust, UK</td>
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<tr>
<td>10:40-11:15</td>
<td>Coffee Break</td>
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<tr>
<td>11:15</td>
<td>Extensive Spectral Versatility with High Power Fibre Lasers</td>
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<td>(Technical Keynote) Joseph Roy Taylor, Imperial College London, UK</td>
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<tr>
<td>11:45</td>
<td>Laser-assisted Stapedotomy: High Precision Surgery on the Smallest Human Bone</td>
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<td>Digna Kamalski, University Medical Centre Utrecht, Netherlands</td>
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<tr>
<td>12:05</td>
<td>Development of a Real-Time Thermo-Acoustic Model for Interstitial Ultrasonic Conformal Ablation</td>
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<tr>
<td>12:25</td>
<td>Choice and Use of Energy Sources in Gynaecological Surgery</td>
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<tr>
<td>12:45</td>
<td>An Update on Bronchoscopic and CT-guided Treatments for Central and Peripheral Lung Cancers</td>
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<tr>
<td>13:05-14:00</td>
<td>Lunch Break</td>
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<tr>
<td>14:00</td>
<td>Transoral Robotic Surgery: Rationale, Outcomes and Challenges</td>
</tr>
<tr>
<td>14:20</td>
<td>The Evolution of Colorectal Robotic Surgery: Past, Present and Future</td>
</tr>
<tr>
<td>14:40</td>
<td>An Integrated HIFU Probe for Catheter Ablation</td>
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<tr>
<td>15:00</td>
<td>Multimaterial Fibres for Focused Laser Delivery and Integration to Medical Robotics</td>
</tr>
<tr>
<td>15:15</td>
<td>Panel Discussion</td>
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<tr>
<td>15:25</td>
<td>Closing Remarks</td>
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<td>15:30</td>
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</table>
Workshop: Towards Robotic Autonomy in Surgery

Code: SAPM04 | Sunday, 23rd June
Royal Geographical Society

Co-Chairs and Organisers:
Paolo Fiorini, University of Verona, Italy
Riccardo Muradore, University of Verona, Italy
Francesco Setti, University of Verona, Italy

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<td>08:30-08:50</td>
<td>Registration and Coffee</td>
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<tr>
<td>08:50</td>
<td>Opening: Welcome &amp; Introduction</td>
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<tr>
<td></td>
<td>Riccardo Muradore, University of Verona, Italy</td>
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<tr>
<td>09:00</td>
<td>New Robots, Connectivity and AI in Robotic Surgery</td>
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<tr>
<td></td>
<td>Prokar Dasgupta, King’s College London, UK</td>
</tr>
<tr>
<td>09:20</td>
<td>Robot-assisted Surgery or Human-assisted Robot?</td>
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<td></td>
<td>Alessandro Larcher, Ospedale San Raffaele, Italy</td>
</tr>
<tr>
<td>09:40</td>
<td>Real-Time Assessment of Surgical Team Dynamics and Mental Workload with</td>
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<td>Computer Vision and Psycho-Physiological Data</td>
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<td></td>
<td>Marco Zenati, Harvard University, USA</td>
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<tr>
<td>10:00</td>
<td>Impact of the Increasing Level of Autonomy on the Industry</td>
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<tr>
<td></td>
<td>Stephan Nowatschin, Medineering, Germany</td>
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<tr>
<td>10:20</td>
<td>Training and Evaluation of Autonomous Medical Robots</td>
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<tr>
<td></td>
<td>Gernot Kronreif, ACMIT, Austria</td>
</tr>
<tr>
<td>10:40-11:15</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11:15</td>
<td>Robotic Solutions to Remote Trauma Care</td>
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<td></td>
<td>Juan Wachs, Purdue University, USA</td>
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<tr>
<td>11:35</td>
<td>Predicting Future Events in Laparoscopic Surgery</td>
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<td>Fabio Cuzzolin, Oxford Brookes University, UK</td>
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<tr>
<td>11:55</td>
<td>End-to-End Safe Reinforcement Learning for Autonomous Robotic Surgery</td>
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<td>Joel Burdick, Caltech, USA</td>
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<tr>
<td>12:15</td>
<td>Towards Autonomy in OR: Complementing Surgeons with Data-driven Situation</td>
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<td>Awareness</td>
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<tr>
<td>12:35</td>
<td>Technology Elements for Autonomy in Robotic Surgery</td>
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<td>13:00</td>
<td>Lunch Break</td>
</tr>
<tr>
<td>14:00</td>
<td>Perceptually-enabled Robotic Assistance in the Smart OR</td>
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<tr>
<td>14:15</td>
<td>The Role of Human Robot Interaction for Autonomous Small-scale Surgical</td>
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<td>Robots</td>
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<tr>
<td>14:30</td>
<td>Towards Increasing Autonomy in Surgical Robotics. Application Related Technical</td>
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<tr>
<td>14:45</td>
<td>Machine Learning for Deep Comprehension of the Surgical Site</td>
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<td>15:00</td>
<td>A Robust Teleoperation Architecture for Shared Control in Surgical Applications</td>
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<td>Robots</td>
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<td>15:30</td>
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</tbody>
</table>
Workshop: Bionic Technologies & Implantable Robots
Code: WAM05 | Wednesday, 26th June
Royal Geographical Society

Co-Chairs and Organisers:
Pierre E. Dupont, Boston Children’s Hospital, Harvard Medical School, USA
Arianna Menciassi, The BioRobotics Institute, Scuola Superiore Sant’Anna, Pisa, Italy

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<td>Opening: Welcome &amp; Introduction</td>
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<tr>
<td></td>
<td>Pierre Dupont, Boston Children’s Hospital, Harvard Medical School, USA</td>
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<td></td>
<td>Arianna Menciassi, The BioRobotics Institute, Scuola Superiore Sant’Anna, Pisa, Italy</td>
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<tr>
<td>09:10</td>
<td>Therapeutic Strategies for Cardiac Disease Using Soft Materials, Structures and Devices (Keynote) Ellen T. Roche, Massachusetts Institute of Technology, USA.</td>
</tr>
<tr>
<td>09:45</td>
<td>Wireless Epidermal Fingertip Devices for Human Sense Restoration and Augmentation Gaetano Marrocco, University of Roma Tor Vergata, Italy</td>
</tr>
<tr>
<td>10:20</td>
<td>Ultra-thin Freestanding Polymeric Films Technologies for Soft and Conformable Electronics Virgilio Mattoli, Italian Institute of Technology, Italy</td>
</tr>
<tr>
<td>10:55-11:15</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11:15</td>
<td>Soft Bioelectronic Implants</td>
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<tr>
<td></td>
<td>John A. Rogers, Northwestern University, USA</td>
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<tr>
<td>11:50</td>
<td>Bionic Humanoid - An Elaborate Human Model for Medical Innovation</td>
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<tr>
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<td>Fumihito Arai, Nagoya University, Japan</td>
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<tr>
<td>12:25</td>
<td>Round Table</td>
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<td>13:00</td>
<td>Lunch</td>
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Workshop: Wearable and Assistive Robots
Code: WAM06 | Wednesday, 26th June
Royal Geographical Society

Co-Chairs and Organisers:
Shane Xie, University of Leeds, UK
Zhiqiang Zhang, University of Leeds, UK
Benny Lo, The Hamlyn Centre, Imperial College London, UK
Guang-Zhong Yang, The Hamlyn Centre, Imperial College London, UK

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<td>09:00</td>
<td>Opening: Welcome &amp; Introduction</td>
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<tr>
<td>09:10</td>
<td>Sensing and Understanding for Wearable and Assistive Systems (Keynote) Honghai Liu, University of Portsmouth, UK</td>
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<tr>
<td>09:40</td>
<td>Wearables for Position Tracking and Motion Intent Recognition           Sanja Dogramadzi, UWE Bristol, UK</td>
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<tr>
<td>10:10</td>
<td>Musculoskeletal Mechanics and Mechatronics: Biomechanical Engineering from Human and for Human (Keynote) Lei Ren, University of Manchester, UK</td>
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<td>10:40-11:15</td>
<td>Coffee Break</td>
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<td>11:15</td>
<td>Smart Lower Limb Prosthetics                                            Abbas Dehghan, University of Leeds, UK</td>
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<td>11:45</td>
<td>A Wearable Device for Ankle Sprain Prevention and Rehabilitation        Daniel Fong, Loughborough University, UK</td>
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<td>12:15</td>
<td>Wearable Technology to Transform Patient Care in Hospital and Home Environments Delarm Jarchi, University of Essex, UK</td>
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<tr>
<td>12:35</td>
<td>Panel Discussion</td>
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<tr>
<td>13:00</td>
<td>Lunch</td>
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Workshop: Medical Robotics: First in Human - What does it take?

**Code: WPM07 | Wednesday, 26th June**

*Royal Geographical Society*

**Co-Chairs and Organisers:**
Christos Bergeles, King’s College London, UK
Pierre Dupont, Boston Children’s Hospital, Harvard Medical School, MA, USA
Russell Taylor, John Hopkins University, USA

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*This workshop will be filmed*

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<tr>
<td>13:00-14:00</td>
<td>Lunch</td>
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<tr>
<td>13:30</td>
<td>A 30-year Journey in Surgical Robotics, from Research to Exit</td>
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<td></td>
<td>Stéphane Lavallée, Surgivision, France</td>
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<td>14:00</td>
<td>Experiences with the Commercial Translation of a Lower Limb Exoskeleton</td>
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<td>Michael Goldfarb, Vanderbilt University, USA</td>
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<td>14:30</td>
<td>Endovascular Robotics – A Review of the Approaches, Challenges and</td>
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<td>Opportunities Ahead</td>
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<td>David Leo Fischel, Stereotaxis, USA</td>
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<tr>
<td>15:00</td>
<td>From Surgeon to Wannabe Entrepreneur</td>
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<td>Dennis Fowler, KARL STORZ Endoscopy-America, USA</td>
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<tr>
<td>15:30-16:00</td>
<td>Coffee Break</td>
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<tr>
<td>16:00</td>
<td>$0 to $5.75 billion: Making a Medtech Unicorn</td>
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<td></td>
<td>Christopher Velis, Miraki Innovation, USA</td>
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<td>16:30</td>
<td>Let’s Start a Medical Robot Company Together</td>
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<td>Jian Zhang, Noah Medical, USA</td>
</tr>
<tr>
<td>17:00</td>
<td>Closing Remarks</td>
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<td>17:10</td>
<td>Close</td>
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</tbody>
</table>
Workshop: Micro and Nanorobotics towards in vivo applications
Code: WPM08 | Wednesday, 26th June
Royal Geographical Society

Co-Chairs and Organisers:
Veronica Iacovacci, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy
Bradley Nelson, Multi-Scale Robotics Lab, ETH Zurich, Switzerland
Salvador Pané, Multi-Scale Robotics Lab, ETH Zurich, Switzerland

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<tr>
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<td>Lunch</td>
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<tr>
<td>13:40</td>
<td>Opening: Welcome &amp; Introduction</td>
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</table>
| 13:50    | Enzyme-powered Nanorobots Towards their Applications in vivo: Enhanced Delivery, Sensing and Imaging
          | Samuel Sanchez, Barcelona Institute of Science and Technology (BIST), Barcelona, Spain |
| 14:10    | Wireless Actuation of Micro and Nanorobotic Systems in Real Organs      |
          | Peer Fischer, Max Planck Institute for Intelligent Systems, Stuttgart, Germany |
| 14:30    | Microrobots for Cell Transplantation                                     |
          | Hongsoo Choi, DGIST, Daegu, Korea                                        |
| 14:50    | Sperm Microrobots and its Potential to Improve Reproductive Health      |
          | Mariana Medina-Sanchez, Leibniz-Institut fur Festkorper- und Werkstoffforschung Dresden, Germany |
| 15:10    | Magnetolectric Stimulation of Cells with Small-scale Robots             |
          | Salvador Pané, ETH Zurich, Switzerland                                  |
| 15:30-15:45 | Coffee Break                                                             |
| 15:45    | SPECT-based Imaging of Soft Magnetic Microrobots                        |
          | Veronica Iacovacci, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy |
| 16:05    | Magnetic Microrobots for Cell Delivery                                  |
          | (Keynote) Dong Sun, City University of Hong Kong, Hong Kong, China       |
16:25  Magnetic-based Targeted Therapy: from Accumulation to Retrieval  
Arianna Menciassi, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy

16:45  Microrobots: From the Bench, to in vivo, to the Clinic  
Bradley Nelson, ETH Zurich, Switzerland

17:05  Closing Remarks

17:10  Close
# Workshop: From BCI to Human Robot Augmentation

**Code: WAPM10 | Wednesday, 26th June**

**Royal Geographical Society**

**Co-Chairs and Organisers:**
- Fani Deligianni, The Hamlyn Centre, Imperial College London, UK
- Shamas Khan, The Hamlyn Centre, Imperial College London, UK
- Daniel Leff, The Hamlyn Centre, Imperial College London, UK

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<td>08:30-09:00</td>
<td>Registration and Coffee</td>
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<tr>
<td>09:00</td>
<td><strong>Brain-Computer Interfaces: Beyond Decoding</strong> (Keynote) Jose del R Millan, Swiss Federal, Switzerland</td>
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<tr>
<td>09:40</td>
<td>Current Trends in Brain-Computer Interfaces – From Neurogaming to Disorders of Consciousness</td>
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<td></td>
<td>Damian Coyle, Ulster University, UK</td>
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<tr>
<td>10:10</td>
<td><strong>Brain-Computer Interface for Mental Workload Assessment</strong></td>
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<td>Fabio Babiloni, Rome Sapienza, Italy (Work realized with the contribution of the Italian Minister of University and Research, project BrainSafeDrive between Italy and Sweden)</td>
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<tr>
<td>10:40-11:15</td>
<td>Coffee Break</td>
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<tr>
<td>11:15</td>
<td>Hybrid Collaborative Brain–Computer Interfaces for Augmenting Cognitive Processes</td>
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<td>Ricardo Poli, Essex University, UK</td>
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<td>11:45</td>
<td>Challenges of Translating BCI Research Concepts into Real-World Products</td>
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<td>Claude Clement, Wyss Centre, Switzerland</td>
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<td>12:15</td>
<td>Poster Session</td>
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<td>13:00-14:00</td>
<td>Lunch Break</td>
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<tr>
<td>14:00</td>
<td><strong>Brain-Computer Interfaces for Neurorehabilitation</strong></td>
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<td>Natalie Mrachacz-Kersting, Aalborg University, Denmark</td>
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<tr>
<td>14:30</td>
<td>Precision Manipulation for Neuro-prosthetics Based on EMG-Brain-Computer Interface</td>
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<tr>
<td>15:00</td>
<td>Next-Generation Brain/Neural-Machine Interfaces for Restoration of Brain Function</td>
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<td>15:30-15:45</td>
<td>Coffee Break</td>
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<tr>
<td>15:45</td>
<td>Neuro-stimulation for Spine to Machine Interface Technology</td>
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<td>16:15</td>
<td>Gaze as a Cognition-machine Interface for Human-robot Interaction</td>
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<td>16:45</td>
<td>Poster Award</td>
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<td>17:00</td>
<td>Closing Remarks</td>
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Workshop: Advanced Biophotonics - from Bench to Bedside
Code: WAPM11 | Wednesday, 26th June
Royal Geographical Society

Co-Chairs and Organisers:
Dan Elson, The Hamlyn Centre, Imperial College London, UK
Khushi Vyas, The Hamlyn Centre, Imperial College London, UK
Jang Ah Kim, The Hamlyn Centre, Imperial College London, UK
Dominic Wales, The Hamlyn Centre, Imperial College London, UK
Haojie Zhang, The Hamlyn Centre, Imperial College London, UK

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<tr>
<td>09:00</td>
<td>Opening: Welcome &amp; Introduction</td>
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<tr>
<td></td>
<td>Guang-Zhong Yang, The Hamlyn Centre, Imperial College London, UK</td>
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<tr>
<td>09:10</td>
<td>Fluorescence Lifetime Imaging: from Bench to Robotic Surgery in Patients</td>
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<td>(Keynote) Laura Marcu, University of California Davis, USA</td>
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<td>09:45</td>
<td>Multidimensional Fluorescence Spectroscopy of the Heart and Development</td>
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<td>of Multiphoton Imaging Systems for Biomedical Applications</td>
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<td></td>
<td>Chris Dunsby, Imperial College London, UK</td>
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<td>10:15</td>
<td>Bespoke Multispectral Filter Arrays for Biophotonic Imaging Applications</td>
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<td>Calum Williams, University of Cambridge, UK</td>
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<td>10:45-11:20</td>
<td>Coffee Break</td>
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<tr>
<td>11:20</td>
<td>Ultra-fast Frequency Domain Pulse Oximetry for Real Time Monitoring of</td>
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<td>Tissue Viability and Metabolism</td>
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<td>Darren Roblyer, Boston University, USA</td>
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<td>11:50</td>
<td>Unravelling Approaches for DNA Analysis</td>
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<td>Tracy Melvin, University of Southampton, UK</td>
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<tr>
<td>12:20</td>
<td>Poster Teasers</td>
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<tr>
<td>13:00-14:00</td>
<td>Lunch Break &amp; Poster Session</td>
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</table>
14:00  Robotic Transthoracic Surgery  
(Keynote) Qingquan Luo, Shanghai Chest Hospital, Jiao Tong University, China

14:20  Guided Bronchoscopy System for the Diagnosis and Treatment of Peripheral Lung Nodules  
Jiayuan Sun, Shanghai Chest Hospital, Jiao Tong University, China

14:35  An Update on Bronchoscopic and CT-guided Treatments for Central and Peripheral Lung Cancers  
Justin Garner, Royal Brompton and Harefield NHS Foundation Trust, Imperial College London, UK

15:05  Robotics in Urology: Inside-out  
Ranan Dasgupta, St. Marys hospital, Imperial College London, UK

15:35-16:05  Coffee Break & Poster Session

16:05  Panel Discussion

16:55  Prize Time

17:05  Closing Remarks

17:10  Close
**Workshop: Emerging Learning Techniques for Robotics**  
**Code: WAPM12 | Wednesday, 26th June**  
**Royal Geographical Society**

**Co-Chairs and Organisers:**  
Xiao-Yun Zhou, The Hamlyn Centre, Imperial College London, UK  
Guang-Zhong Yang, The Hamlyn Centre, Imperial College London, UK

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<td>Registration and Coffee</td>
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</table>
| 09:00  | **Opening: Welcome & Introduction**  
Guang-Zhong Yang, The Hamlyn Centre, Imperial College London, UK          |
| 09:10  | **Purposive Learning from Humans** (Keynote)  
Gordon Cheng, Technical University of Munich (TUM), Germany             |
| 09:40  | **Neurotech: Windows to Your Soul**  
Aldo Faisal, Imperial College London, UK                                  |
| 10:10  | **AI-as-a-Medical-Device: What the latest FDA Proposals Mean for Putting AI into the Hands of Clinicians**  
Joe Corrigan, Cambridge Consultant, UK                                   |
| 10:40-11:15 | Coffee Break                                                                |
| 11:15  | **MRI Brain Tumor Segmentation and AI-assisted Annotation Tool**  
Wenqi Li, Nvidia, USA                                                    |
| 11:45  | **Robotic Perception with Vision and Tactile Sensing**  
Shan Luo, University of Liverpool, UK                                    |
| 12:15  | **Machine/Deep Learning for 3D Shape Instantiation**  
Xiao-Yun Zhou, The Hamlyn Centre, Imperial College London, UK             |
<p>| 12:45  | <strong>Poster Session &amp; Networking</strong>                                            |
| 13:00-14:00 | Lunch Break                                                                  |</p>
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<tr>
<td>14:00</td>
<td>Machine Learning for Cardiac Image Analysis</td>
<td>Wenjia Bai, Imperial College London, UK</td>
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<td>14:30</td>
<td>From Imaging to Radiomics: Learning with Features</td>
<td>Karim Lekadir, Universitat Pompeu Fabra, Spain</td>
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<td>15:00</td>
<td>Bayesian Models for Reconstruction and Outlier Detection with Neural Networks</td>
<td>Ender Konukoglu, ETH Zurich, Switzerland</td>
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<tr>
<td>15:30-15:45</td>
<td>Coffee Break</td>
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<tr>
<td>15:45</td>
<td>The State-of-the-Art in Machine Learning for Robot Manipulation</td>
<td>Edward Johns, Imperial College London, UK</td>
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<tr>
<td>16:15</td>
<td>Visibility Metrics and Their Application for Visually Lossless Image Compression</td>
<td>Nanyang Ye, University of Cambridge, UK</td>
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<tr>
<td>16:45</td>
<td>Poster Session &amp; Networking</td>
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<td>17:05</td>
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These systems are revolutionizing the way in which surgery is being done, and offer unique platforms for exploring the potential of intelligent interventions to reduce variability in clinical outcomes and to help deliver better care.

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Website: [https://www.atracsys-measurement.com/](https://www.atracsys-measurement.com/)

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- Product manufacturing of either off-the-shelf or customized tracking solutions
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Atracsys aims at continuously contributing to the improvements in the healthcare all around the world by guiding surgical instruments with sub millimetric precision.
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Website: https://www.cambridgeconsultants.com/home

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We’re passionate about our clients’ success, working together to identify and develop world-changing products and services across a range of industries including robotics, medical technology, consumer products and wireless communications.

Claronav

Website: https://www.claronav.com/

Claronav is dedicated to the development of surgical navigation solutions. It provides both components like MicronTracker or complete surgical navigation systems.

MicronTracker can be used in a variety of guided procedures performed manually or using robotics. MicronTracker gives complete access to video images and depth information, providing “eyesight” to a medical robot.

Force Dimension

Website: http://www.forcedimension.com

Force Dimension develops, manufactures and commercializes high-precision haptic devices and VR solutions for a wide range of applications which include the medical, pharmaceutical, aerospace and entertainment industries. The company’s flagship products are the delta.x, omega.x, sigma.x and lambda.x family of haptic devices. In addition, Force Dimension licenses its technology and customizes its haptic devices OEM product development. Force Dimension also manages the development of the open source software CHAI3D (www.chai3d.org).
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Website: http://www.bbzsrl.com/index.html

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Virtuoso Surgical
Website: https://www.virtuososurgical.net/

Virtuoso Surgical, Inc. is a medical-device startup based in Nashville, Tennessee. VSI is developing a robotic endoscopic surgical tool that is intended to operate through standard 5-8 mm endoscopes. The VSI device’s core technology is concentric-tube nitinol arms, which allow the device to dexterously deliver surgical tools (scalpels, cautery, lasers, baskets, grippers, retractors, suction) through two independent, manipulable arms. The company is commercializing patented technology (U.S. patents) developed at Johns Hopkins University and Vanderbilt University.
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