The Hamlyn Symposium on Medical Robotics

Programme

23rd - 26th June 2019
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1 Accredited by the Royal College of Surgeons of England for up to 12 CPD points

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## Hamlyn Symposium on Medical Robotics 2019

### Programme at a Glance

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<tr>
<td>08:30 - 09:00</td>
<td>Coffee</td>
<td>Workshop Erosion</td>
<td>Session 1: Soft &amp; Bioinspired Robot</td>
<td>Coffee</td>
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<td>09:00 - 09:30</td>
<td>Workshop Tissue</td>
<td>Workshop Erosion</td>
<td>Keynote 1: Paolo Dario</td>
<td>Workshop Biologic</td>
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<td>09:30 - 10:00</td>
<td>Workshop Tissue</td>
<td>Workshop Erosion</td>
<td>Coffee (11:30 - 12:00)</td>
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<td>Workshop Tissue</td>
<td>Workshop Erosion</td>
<td>Poster Teaser</td>
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<td>16:00 - 16:30</td>
<td>Presentations at RGS</td>
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<td>17:00 - 17:30</td>
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Monday 24th June 2019

08:30 Registration and Coffee

09:15 Welcome Address: Guang-Zhong Yang

Session 1—Soft and Bioinspired Robot

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. Payne\(^1,2\), D. Van Story\(^1,2\), D. Bautista-Salinas\(^2\), M. Saeed\(^2\), T. Thalhofer\(^1\), P.J. del Nido\(^2\), C.J. Walsh\(^1\), N.V. Vasilyev\(^2\)

\(^1\)Wyss Institute for Biologically Inspired Engineering, Harvard University, USA
\(^2\)Department 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 Mendez\(^1,2\), William Whyte\(^2,3\), Garry P. Duffy\(^3,4\), Ellen T. Roche\(^1,2,5\)

\(^1\)Health Sciences and Technology, Massachusetts Institute of Technology, USA
\(^2\)Institute for Medical Engineering and Science, Massachusetts Institute of Technology, USA
\(^3\)Advanced Materials and Bio Engineering Research Centre, Trinity College Dublin, Ireland
\(^4\)School of Medicine, National University of Ireland Galway, Ireland
\(^5\)Department 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 Li\(^1\), Reza Rahbar\(^2\), Pierre E. DuPont\(^1\)

\(^1\)Cardiovascular Surgery, Boston Children’s Hospital, Harvard Medical School, USA
\(^2\)Department 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. Murai¹, Daniel Martins¹, Pierre G. Silveira², Jian S. Dai³, Shervanthi Homer-Vanniasinkam⁴, Helge A. Wurdemann⁴
¹Mechanical Engineering, Federal University of Santa Catarina, Florianópolis, Brazil
²Surgery Department, Federal University of Santa Catarina, Florianópolis, Brazil
³Department of Informatics, King's College London, UK
⁴Department 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. Sevimli¹, D. Levi¹, A. Bhat¹, O. Puleo¹, R.H. Taylor², D. Saunders¹
¹Galen Robotics, Inc., USA
²Laboratory 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. Gil¹, Julie M. Walker², Nabil Zemiti¹, Allison M. Okamura², Philippe Poignet¹
¹LIRMM, University of Montpellier, CNRS, Montpellier, France
²Department of Mechanical Engineering, Stanford University, Stanford, USA

P5 Autonomous Pick-and-place of Pneumatically Attachable Flexible Rail
C. D’Ettorre¹, A. Stilli¹, G. Dwyer¹, M. Tran² and D. Stoyanov¹
¹Wellcome/ EPSRC Centre for Interventional and Surgical Science (WEISS), UCL, UK
²Research Department of Surgical Biotechnology, University College London, UK

P6 Design of the MUSHA Hand II for Robotic-assisted Laparoscopic Surgery
H. Liu¹, P. Ferrentino¹, M. Selvaggi¹, S. Pirozzi², F. Ficuciello¹
¹University of Naples Federico II, Italy
²University 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 Avery¹, M Runciman², G Mylonas², A Darzi¹

Monday 24th June 2019
P9  Real-time Prediction of Breast Lesions Displacement during Ultrasound Scanning Using a Position-based Dynamics Approach  
D. Dall'Alba¹, E. Tagliabue¹, E. Magnabosco¹, C. Tenga¹, P. Fiorini¹  
¹Dept. of Computer Science, University of Verona, Italy

P10  Needle Segmentation in 3D Ultrasound Volumes Based on Machine Learning for Needle Steering  
G. Lapouge¹², H. Younes¹, P. Poignet², S. Voros¹, J. Troccaz¹  
¹Univ. Grenoble Alpes, CNRS, Grenoble INP, TIMC-IMAG, F-38000 Grenoble, France  
²Univ. Montpellier, CNRS, LIRMM, F-34090 Montpellier, France

P11  Robotically Assisted Electrical Bio-impedance Measurements for Soft Tissue Characterization: a Feasibility Study  
Kim L. Schwaner¹, Diego Dall'Alba², Zhuoqi Cheng³, Leonardo S. Mattos³, Paolo Fiorini² and Thiusius R. Savarimuthu¹  
¹The Maersk Mc-Kinney Møller Institute, University of Southern Denmark, Denmark  
²Department of Computer Science, University of Verona, Italy  
³Department of Advanced Robotics, Istituto Italiano di Tecnologia, Italy

P12  Surgical Action Recognition with Spatiotemporal Convolutional Neural Networks  
Giacomo De Rossi¹, Nicola Piccinelli¹, Francesco Setti¹, Riccardo Muradore¹, Fabio Cuzzolin²  
¹University of Verona, Italy  
²Oxford Brookes University, UK

P13  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

P14  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

P15  Gaze-contingent Robotic Flexible Endoscopy  
A. A. Kogkas¹, B. Glover³, N. Patel³, 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  
³Department of Gastroenterology, Imperial College London, UK

P16  Wave-shape Notched Compliant Joint with High Rigidity  
Seunguk Kim¹, Seongbo Shim¹, Daekeun Ji¹ and Jaesung Hong¹  
¹DGIST, Daegu, Korea
P17 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

P18 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

P19 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

P20 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

P21 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

P22 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

P23 Ultrasound-based Safety Assessment during Moving Organ Tracking Towards In vivo Focused Ultrasound Therapy
A. Mariani, L. Morchi, A. Diodato, A. Cafarelli, S. Tognarelli, A. Menciassi
The BioRobotics Institute, Sant’Anna School of Advanced Studies, Pisa, Italy

P24 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

P25 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
P26 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

P27 Layer Jamming Pneumatic Actuator for Medical Robotics
Michele Ibrahimi, Linda Paternò, Leonardo Ricotti, Arianna Menciassi
The BioRobotics Institute, Scuola Superiore Sant’Anna, Pisa, Italy

P28 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

P29 Towards Semi-automated Mechanical Thrombectomy: Path Planning Considerations for a Double Articulated Microcatheter
Colette Abah¹, Giuseppe Del Giudice¹, Neel Shihora¹, Rohan Chitale², Nabil Simaan¹
¹Department of Mechanical Engineering, Vanderbilt University, Nashville TN, USA
²Department of Neurological Surgery, Vanderbilt University Medical Centre, USA

P30 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

P31 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

P32 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 Momí¹
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
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<th>Time</th>
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<tr>
<td>17:15</td>
<td><strong>Assisting Hand Movement of TBI Patients Through Robotic Orthoses</strong>&lt;br&gt;T. Meier&lt;sup&gt;1&lt;/sup&gt;, P. A. Carvalho&lt;sup&gt;1&lt;/sup&gt;, K. Y. Gandomi&lt;sup&gt;1&lt;/sup&gt;, G. S. Fischer&lt;sup&gt;1&lt;/sup&gt;, and C. J. Nycz&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>&lt;sup&gt;1&lt;/sup&gt;Automation and Interventional Medicine Lab, WPI, Worcester, MA, USA</td>
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<td>17:30</td>
<td><strong>Reciprocal Kinematic Control: Using Human-robot Dual Adaptation to Control Upper Limb Assistive Devices</strong>&lt;br&gt;M. Legrand&lt;sup&gt;1&lt;/sup&gt;, E. de Montalivet&lt;sup&gt;1&lt;/sup&gt;, F. Richer&lt;sup&gt;1&lt;/sup&gt;, N. Jarrassé&lt;sup&gt;1&lt;/sup&gt;, G. Morel&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>&lt;sup&gt;1&lt;/sup&gt;Sorbonne University, CNRS, UMR7222 / INSERM, ISIR- Agathe, Paris, France</td>
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<td>17:45</td>
<td><strong>Virtual Reality Training in Robot-assisted Surgery: A Novel Experimental Setup for Skill Transfer Evaluation</strong>&lt;br&gt;Guido Caccianiga&lt;sup&gt;1,2&lt;/sup&gt;, Andrea Mariani&lt;sup&gt;2&lt;/sup&gt;, Elena De Momi&lt;sup&gt;2&lt;/sup&gt;, Jeremy D. Brown&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>&lt;sup&gt;1&lt;/sup&gt;Johns Hopkins University, Baltimore, Maryland, USA &lt;br&gt;&lt;sup&gt;2&lt;/sup&gt;Politecnico di Milano, Milano, Italy</td>
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<td>18:00</td>
<td><strong>SlicerVR for image-guided Therapy Planning in Immersive Virtual Reality</strong>&lt;br&gt;Csaba Pinter&lt;sup&gt;1&lt;/sup&gt;, Andras Lasso&lt;sup&gt;1&lt;/sup&gt;, Mark Asselin&lt;sup&gt;1&lt;/sup&gt;, Jean-Christophe Fillion-Robin&lt;sup&gt;2&lt;/sup&gt;, Jean-Baptiste Vimort&lt;sup&gt;2&lt;/sup&gt;, Ken Martin&lt;sup&gt;2&lt;/sup&gt;, Gabor Fichtinger&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>&lt;sup&gt;1&lt;/sup&gt;Laboratory for Percutaneous Surgery, Queen’s University, Kingston, Canada &lt;br&gt;&lt;sup&gt;2&lt;/sup&gt;Kitware Incorporated, Carrboro, North Carolina, USA</td>
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<td>18:15</td>
<td><strong>dVRK-XR: Mixed Reality Extension for Da Vinci Research Kit</strong>&lt;br&gt;Long Qian, Anton Deguet and Peter Kazanzides</td>
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<td>Laboratory for Computational Sensing and Robotics, Johns Hopkins University, USA</td>
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<td>18:30</td>
<td><strong>Drinks Reception and Poster Session</strong></td>
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<td>19:15</td>
<td><strong>Programme Committee Dinner (Invitation Only)</strong></td>
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Tuesday 25th June 2019

08:30 Registration and Coffee

Session 4 – Imaging and Emerging Surgical Systems

Chairs: Bradley Nelson and Ichiro Sakuma

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
K. Y. Ho3, P. W. Y. Chiu4, S. J. Phee1
1Robotics Research Centre, Nanyang Technological University, Singapore
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. Wu1,2, D. Podolsky2, N. Hussein1, M. Mikic1,2, T. Looi1, C.R. Forrest2, J.M. Drake1,2
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

10:15 Challenges of Autonomous Surgical Robotics
P. Fiorini, D. Dall’Alba, M. Ginesi, B. Maris, D. Meli, H. Nakawala, A. Roberti, E. Tagliabue
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 Neurologico 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 Kwon²*
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

Surgical Robot Challenge 2019 Finalists

SC1  A Surgical Cockpit for Minimally Invasive Surgery
Mario Aricò, Lucas Joseph, Jimmy Da Silva, Ignacio Avellino, Jesus Mago, Philippe Gauthier, Eleonore Ferriet-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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<tbody>
<tr>
<td>08:30-09:00</td>
<td>Registration and Coffee</td>
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<tr>
<td>09:00</td>
<td>robots, robots, everywhere! in a cardiovascular operating room? <em>(Clinical Keynote)</em> 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 Andreas Melzer, University of Leipzig, Germany</td>
</tr>
<tr>
<td>10:05</td>
<td>Robotic Assistance to Reduce Embolisation and Stroke during Endovascular Interventions Mohamad Hamady, Imperial College London, UK</td>
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<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 Thomas Looi, Sick Kids Hospital, Toronto, Canada</td>
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<tr>
<td>11:40</td>
<td>Origami Engineering for the Brain – The Oxford Endovascular Spinout Journey Mike Karim, Oxford Endovascular, UK</td>
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<tr>
<td>12:05</td>
<td>Magnetically Guided Devices for Endovascular Procedures Quentin Boehler (on behalf of Bradley Nelson), ETH Zurich, Switzerland</td>
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<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>
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<tr>
<td>13:00</td>
<td>Lunch &amp; Poster Session</td>
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</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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<tr>
<td>08:30</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</td>
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<td>(Keynote) 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>
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<tr>
<td>10:20</td>
<td>Stretchable Triboelectric Nanogenerators as Self-powered Robotic Skins:</td>
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<td></td>
<td>Toward Actively Perceiving and Responsive Soft Robots</td>
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<tr>
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<td>Ying-Chih Lai, National Chung Hsing University, Taiwan</td>
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<tr>
<td>10:45</td>
<td>Coffee Break &amp; Poster Session @ The Marquee*</td>
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<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>
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<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>
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<tr>
<td>12:35</td>
<td>Soft Robots for Invisible Intuitive Interactions</td>
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<td>Jamie Paik, Swiss Federal Institute of Technology, Switzerland</td>
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</tbody>
</table>
13:00-14:00 Lunch Break & Poster Session @ The Marquee

14:00 Optoelectronic Sensing of the Deformation of Continuum Structures
Rob Shepherd, Cornell University, USA

14:25 Ferromagnetic Soft Continuum Robots
Yoonho Kim, Massachusetts Institute of Technology, USA

14:50 A Vision for the Future of Soft Electronics and Robotics
Open Panel Discussion

15:25 Closing Remarks

*Posters presented in our:

1. Actively 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 Joshi\(^1\), Mansour Sharabiani\(^1\), Hutan Ashrafi\(^1\), Sadia N Khan\(^2\), Kenny McAndrew\(^2\), Sonal Arora\(^4\), Richard Kwasnicki\(^1\), Graham S Cooke\(^3\), Ara Darji\(^1\)
\(^1\)Department of Surgery and Cancer, Imperial College London, UK
\(^2\)West Middlesex University Hospital, Twickenham, UK
\(^3\)Division of Infectious Diseases, Imperial College London, UK

3. Monolithic Solder-on Nanoporous Si-Cu Contacts for Stretchable Silicone Composite Sensors
Michael Kasimatis\(^1\), Estefania Nunez-Bajo\(^1\), Max Grell\(^1\), Yasin Cotur\(^1\), Giandrin Barandun\(^1\), Ji-Seon Kim\(^2\), Firas Güder\(^1\)
\(^1\)Department of Bioengineering, Imperial College London, UK
\(^2\)Department of Physics, Imperial College London, UK.

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

5. Ultrathin Hybrid Graphene Skins for Biosensing and Actuation
Weinan Xu\(^1\), SantoshK. Paid\(^2\), ZhaoQin\(^3\), QiHuang\(^1\), MarkusJ. Buehler\(^3\), Ishan Barman\(^2\), David H. Gracias\(^1\)
\(^1\)Department of Chemical and Biomolecular Engineering, Johns Hopkins University, Baltimore, Maryland 21218, USA,
\(^2\)Department of Mechanical Engineering, Johns Hopkins University, Baltimore, Maryland 21218, USA,
\(^3\)Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA.

6. Development of artificial blood pump using dielectric elastomers
H Godaba\(^1\), CH Yap\(^3\), J Zhu\(^4\), K Althoefer\(^2\)
\(^1\)Department of Mechanical Engineering, National University of Singapore
\(^2\)Centre for Advanced Robotics @ Queen Mary, Queen Mary University of London, UK
\(^3\)Department 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
9. Towards a Flexible/Stretchable Multiparametric Biosensing Device for Surgical Tools and Wearable Applications
Panagiots Kassanos, FLorent Seichepine, Domini Wales, Giang-Zhong Yang
The Hamlyn Centre, Imperial College London, UK

15:30 Close
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>09:00</td>
<td><strong>Opening: Welcome &amp; Introduction</strong></td>
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<tr>
<td></td>
<td><em>Neil Tolley, Imperial College Healthcare NHS Trust, UK</em></td>
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<tr>
<td>09:10</td>
<td><strong>Minimally Invasive Prostate Therapies - a Decade of Change</strong></td>
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<td><em>(Clinical Keynote) Hashim Ahmed, Imperial College Healthcare NHS Trust, UK</em></td>
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<td>09:40</td>
<td><strong>Effect of Surgical Energy on Diagnostic Potential of the i-Knife Technology</strong></td>
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<td><em>Zoltan Takats, Imperial College London, UK</em></td>
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<td>10:00</td>
<td><strong>Magnetic Navigation for Remote Controlled Catheter Ablation of Cardiac Arrhythmias</strong></td>
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<td><em>Ilaria Cazzoli, Royal Brompton and Harefield NHS Foundation Trust, UK</em></td>
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<td>10:20</td>
<td><strong>A Pound of Flesh, Not a Drop of Blood</strong></td>
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<td><em>Dipankar Nandi, Imperial College Healthcare NHS Trust, UK</em></td>
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<td>10:40-11:15</td>
<td><strong>Coffee Break</strong></td>
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<tr>
<td>11:15</td>
<td><strong>Extensive Spectral Versatility with High Power Fibre Lasers</strong></td>
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<td></td>
<td><em>(Technical Keynote) Joseph Roy Taylor, Imperial College London, UK</em></td>
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<tr>
<td>11:45</td>
<td><strong>Laser-assisted Stapedotomy: High Precision Surgery on the Smallest Human Bone</strong></td>
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<td><em>Digna Kamalski, University Medical Centre Utrecht, Netherlands</em></td>
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</tbody>
</table>
12:05 Development of a Real-Time Thermo-Acoustic Model for Interstitial Ultrasonic Conformal Ablation
Katie Gandomi, Worcester Polytechnic Institute, USA

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

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

13:05-14:00 Lunch Break

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

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

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

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

15:15 Panel Discussion

15:25 Closing Remarks

15:30 Close
**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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<tr>
<td>08:30-08:50</td>
<td>Registration and Coffee</td>
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</table>
| 08:50      | **Opening: Welcome & Introduction**  
*Riccardo Muradore, University of Verona, Italy* |
| 09:00      | **New Robots, Connectivity and AI in Robotic Surgery**  
*Prokar Dasgupta, King’s College London, UK* |
| 09:20      | **Robot-assisted Surgery or Human-assisted Robot?**  
*Alessandro Larcher, Ospedale San Raffaele, Italy* |
| 09:40      | **Real-Time Assessment of Surgical Team Dynamics and Mental Workload with Computer Vision and Psycho-Physiological Data**  
*Marco Zenati, Harvard University, USA* |
| 10:00      | **Impact of the Increasing Level of Autonomy on the Industry**  
*Stephan Nowatschin, Medineering, Germany* |
| 10:20      | **Training and Evaluation of Autonomous Medical Robots**  
*Gernot Kronreif, ACMIT, Austria* |
| 10:40-11:15| **Coffee Break**                                                                            |
| 11:15      | **Robotic Solutions to Remote Trauma Care**  
*Juan Wachs, Purdue University, USA* |
| 11:35      | **Predicting Future Events in Laparoscopic Surgery**  
*Fabio Cuzzolin, Oxford Brookes University, UK* |
| 11:55      | **End-to-End Safe Reinforcement Learning for Autonomous Robotic Surgery**  
*Joel Burdick, Caltech, USA* |
12:15  Towards Autonomy in OR: Complementing Surgeons with Data-driven Situation Awareness  
Duygu Sarikaya, Université de Rennes, France

12:35  Technology Elements for Autonomy in Robotic Surgery  
Paolo Fiorini, University of Verona, Italy

13:00-14:00  Lunch Break

14:00  Perceptually-enabled Robotic Assistance in the Smart OR  
George Mylonas, Imperial College London, UK

14:15  The Role of Human Robot Interaction for Autonomous Small-scale Surgical Robots  
Jessica Burgner-Kahrs, University of Toronto, Canada

Alicia Casals, Polytechnic University of Catalonia, Spain

14:45  Machine Learning for Deep Comprehension of the Surgical Site  
Elena de Momi, Politecnico di Milano, Italy

15:00  A Robust Teleoperation Architecture for Shared Control in Surgical Applications  
Federica Ferraguti, University of Modena & Reggio Emilia, Italy

15:15  Risk and Regulatory Burden: Building a Safety Assurance Case for Medical Robots  
Tim Phillips and Chris Wagner, Cambridge Consultants, UK

15:30  Close
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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</table>
| 09:00 | Opening: Welcome & Introduction  
Pierre Dupont, Boston Children’s Hospital, Harvard Medical School, USA  
Arianna Menciassi, The BioRobotics Institute, Scuola Superiore Sant’Anna, Pisa, Italy |
| 09:10 | Therapeutic Strategies for Cardiac Disease Using Soft Materials, Structures and Devices  
(Keynote) Ellen T. Roche, Massachusetts Institute of Technology, USA |
| 09:45 | Wireless Epidermal Fingertip Devices for Human Sense Restoration and Augmentation  
Gaetano Marrocco, University of Roma Tor Vergata, Italy |
| 10:20 | Ultra-thin Freestanding Polymeric Films Technologies for Soft and Conformable Electronics  
Virgilio Mattoli, Italian Institute of Technology, Italy |
| 10:55-11:15 | Coffee Break |
| 11:15 | Soft Bioelectronic Implants  
John A. Rogers, Northwestern University, USA |
| 11:50 | Bionic Humanoid - An Elaborate Human Model for Medical Innovation  
Fumihito Arai, Nagoya University, Japan |
| 12:25 | Round Table |
| 13:00 | Lunch |
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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<tr>
<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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<tr>
<td>10:40-11:15</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11:15</td>
<td>Smart Lower Limb Prosthetics Abbas Dehghan, University of Leeds, UK</td>
</tr>
<tr>
<td>11:45</td>
<td>A Wearable Device for Ankle Sprain Prevention and Rehabilitation Daniel Fong, Loughborough University, UK</td>
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<tr>
<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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<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>Stéphane Lavallée, Surgivisio, France</td>
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<tr>
<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 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></td>
<td>Dennis Fowler, KARL STORZ Endoscopy-America, USA</td>
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<tr>
<td>15:30-16:00</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>16:00</td>
<td>$0 to $5.75 billion: Making a Medtech Unicorn</td>
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<td>Christopher Velis, Miraki Innovation, USA</td>
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<tr>
<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>
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<td>17:00</td>
<td>Closing Remarks</td>
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<td>17:10</td>
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</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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<th>Time</th>
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<tbody>
<tr>
<td>13:00-14:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>13:40</td>
<td>Opening: Welcome &amp; Introduction</td>
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</tbody>
</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     | Magnetoelectric 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* |
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Speaker &amp; Institution</th>
</tr>
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<tbody>
<tr>
<td>16:25</td>
<td>Magnetic-based Targeted Therapy: from Accumulation to Retrieval</td>
<td>Arianna Menciassi, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy</td>
</tr>
<tr>
<td>16:45</td>
<td>Microrobots: From the Bench, to in vivo, to the Clinic</td>
<td>Bradley Nelson, ETH Zurich, Switzerland</td>
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<tr>
<td>17:05</td>
<td>Closing Remarks</td>
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<td>17:10</td>
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</table>
**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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<th>Time</th>
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<tr>
<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><strong>Current Trends in Brain-Computer Interfaces – From Neurogaming to Disorders of Consciousness</strong> Damian Coyle, Ulster University, UK</td>
</tr>
<tr>
<td>10:10</td>
<td><strong>Brain-Computer Interface for Mental Workload Assessment</strong> 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>
</tr>
<tr>
<td>10:40-11:15</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11:15</td>
<td><strong>Hybrid Collaborative Brain–Computer Interfaces for Augmenting Cognitive Processes</strong> Ricardo Poli, Essex University, UK</td>
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<tr>
<td>11:45</td>
<td><strong>Challenges of Translating BCI Research Concepts into Real-World Products</strong> Claude Clement, Wyss Centre, Switzerland</td>
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<tr>
<td>12:15</td>
<td>Poster Session</td>
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<tr>
<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> Natalie Mrachacz-Kersting, Aalborg University, Denmark</td>
</tr>
</tbody>
</table>
14:30  Precision Manipulation for Neuro-prosthetics Based on EMG-Brain-Computer Interface  
*Dario Farina, Imperial College London, UK*

15:00  Next-Generation Brain/Neural-Machine Interfaces for Restoration of Brain Function  
*Surjo Soekadar, Charité - University Medicine Berlin, Germany*

15:30-15:45  Coffee Break

15:45  Neuro-stimulation for Spine to Machine Interface Technology  
*Joel Burdick, Caltech University, USA*

16:15  Gaze as a Cognition-machine Interface for Human-robot Interaction  
*Ali Shafti, Imperial College London, UK*

16:45  Poster Award

17:00  Closing Remarks

17:10  Close
**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>
<th>Time</th>
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<th>Speaker(s)</th>
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<tr>
<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>
<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 (Keynote)</td>
<td>Laura Marcu, University of California Davis, USA</td>
</tr>
<tr>
<td>09:45</td>
<td>Multidimensional Fluorescence Spectroscopy of the Heart and Development of Multiphoton Imaging Systems for Biomedical Applications</td>
<td>Chris Dunsby, Imperial College London, UK</td>
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<tr>
<td>10:15</td>
<td>Bespoke Multispectral Filter Arrays for Biophotonic Imaging Applications</td>
<td>Calum Williams, University of Cambridge, UK</td>
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<tr>
<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 Tissue Viability and Metabolism</td>
<td>Darren Roblyer, Boston University, USA</td>
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<tr>
<td>11:50</td>
<td>Unravelling Approaches for DNA Analysis</td>
<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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<tr>
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<tr>
<td>14:00</td>
<td>Robotic Transthoracic Surgery</td>
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<td><em>(Keynote) Qingquan Luo, Shanghai Chest Hospital, Jiao Tong University, China</em></td>
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<tr>
<td>14:35</td>
<td>An Update on Bronchoscopic and CT-guided Treatments for Central and Peripheral Lung Cancers</td>
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<td><em>Justin Garner, Royal Brompton and Harefield NHS Foundation Trust, Imperial College London, UK</em></td>
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<tr>
<td>15:05</td>
<td>Robotics in Urology: Inside-out</td>
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<td><em>Ranan Dasgupta, St. Mary's hospital, Imperial College London, UK</em></td>
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<tr>
<td>15:35-16:05</td>
<td>Coffee Break &amp; Poster Session</td>
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<tr>
<td>16:05</td>
<td>Panel Discussion</td>
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<td>16:55</td>
<td>Prize Time</td>
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<td>17:05</td>
<td>Closing Remarks</td>
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</table>
**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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<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08:30-09:00</td>
<td>Registration and Coffee</td>
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</tbody>
</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  | **Al-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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<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>14:00</td>
<td>Machine Learning for Cardiac Image Analysis</td>
<td>Wenjia Bai, Imperial College London, UK</td>
</tr>
<tr>
<td>14:30</td>
<td>From Imaging to Radiomics: Learning with Features</td>
<td>Karim Lekadir, Universitat Pompeu Fabra, Spain</td>
</tr>
<tr>
<td>15:00</td>
<td>Bayesian Models for Reconstruction and Outlier Detection with Neural Networks</td>
<td>Ender Konukoglu, ETH Zurich, Switzerland</td>
</tr>
<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>
</tr>
<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>
<td>Closing Remarks</td>
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Website: https://atracsys-interactive.com/

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The da Vinci® Surgical System enables surgeons to operate with high precision and dexterity through a few small incisions, by using cutting edge telerobotics, vision, and human-computer interface technologies. And the innovation continues with a new generation of integrated systems, smart instruments, single port and endoluminal platforms, as well as advanced analytics, guidance, intelligent systems, and much more to come.

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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https://www.atracsys-measurement.com/

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- **Product manufacturing of either off-the-shelf or customized tracking solutions**
- **Engineering services including consulting and integration support**

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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 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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**BBZ Srl**

Website: 
http://www.bbzsrl.com/index.html

BBZ develops custom solutions for the fast prototyping of surgical robot simulations and user interfaces, based on BBZ proprietary hardware and software.

**Smith & Nephew**

Website: 
http://www.smith-nephew.com/uk/

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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.