

## NAME AND CONTACT DETAILS

Pádraig J. Cantillon-Murphy  
+33 (0)6 02 05 24 09 [padraig@alum.mit.edu](mailto:padraig@alum.mit.edu)

School of Engineering, University College Cork, Cork, Ireland  
 <http://biodesign.ucc.ie>  [@cantillonmurphy](https://twitter.com/cantillonmurphy)  [UCC BioDesign](https://www.youtube.com/channel/UCUCCBioDesign)

## CAREER PROFILE

Biomedical Design Research Group at UCC (Principal Investigator) Cork, Ireland  
*Summer 2010 –*

*Lead an interdisciplinary research group focused on image guided interventions in surgery and endoscopy, as well as novel medical device design and development.*

Institute for Image Guided Surgery (Visiting Faculty) Strasbourg, France

INSA Strasbourg (Visiting Faculty) Strasbourg, France

*August 2016 – August 2017*

Hamlyn Centre for Robotic Surgery (Honorary Lecturer) Imperial College London

*February 2013 – February 2016*

Harvard Medical School (Research Fellow) Boston, MA

Laboratory for Electromagnetic and Electronic Systems (MIT) (Postdoctoral Fellow) Cambridge, MA

Gastroenterology Division at Brigham and Women's Hospital (Postdoctoral Fellow) Boston, MA

*Summer 2008-Summer 2010 (concurrent appointments at MIT/Harvard/Brigham and Women's Hospital)*

*Pioneering work using magnetic coupling for transluminal endoscopic access in gastrointestinal surgery*

Massachusetts Institute of Technology Cambridge, MA

Ph.D. in Electrical Engineering, June 2008.

Doctoral Dissertation: *On the Dynamics of Magnetic Fluids in MRI* (GPA: 4.9 / 5.0)

Master of Science in Electrical Engineering, June 2005.

Masters Thesis: *Three-dimensional Passive Elements for Power Electronics*

University College Cork

Cork, Ireland

Bachelor of Electrical and Electronic Engineering, October 2003. *First class honours*

## HISTORY OF MENTORING AND SUPERVISION

### *Current*

2016 - 2017 Fabian Trauzettel / MEngSc student (mech), School of Engineering, UCC

2015 - 2018 Herman Alex Jaeger / PhD student (elec), School of Engineering, UCC

2013 – 2016 Conor O'Shea / PhD student (mech), School of Engineering, UCC

### *Graduated*

2014 - 2015 Herman Alex Jaeger / Masters graduate, School of Engineering, UCC

2014 - 2015 Riccardo Volpi / Masters graduate, School of Engineering, UCC and Università degli Studi di Genova

2012 – 2015 Pietro Nardelli / PhD student (elec), School of Engineering, UCC

2013 – 2015 Kashif Ali Khan / MD student (co-supervised), School of Medicine, UCC

2014 - 2015 Christopher Nelson / Masters student, BioInnovate, School of Engineering, UCC

2014 - 2015 Peter Dawson / Masters student, BioInnovate, School of Engineering, UCC

2014 - 2015 Colm McGarvey / Masters student, BioInnovate, School of Engineering, UCC

2014 - 2015 Gareth Ryan / Masters student, BioInnovate, School of Engineering, UCC

2011 – 2014 Kilian O'Donoghue / PhD graduate (elec), School of Engineering, UCC

2013 – 2014 Josef Tugwell / Masters graduate, School of Engineering, UCC

2013 – 2014 Alberto Corvo / Masters graduate, School of Engineering, UCC and Università degli Studi di Genova

2012 – 2013 Conor O'Shea / Masters graduate, School of Engineering, UCC

2011 – 2013 Dr. Robert P. McEvoy / postdoc researcher (part-time), School of Engineering, UCC

2011 – 2012 Pietro Nardelli / Masters graduate, School of Engineering, UCC and Università degli Studi di Genova

2010 – 2011 Declan Loughnane / Masters graduate, School of Engineering, UCC

2010 – 2011 Martin McMenamin / Masters graduate, School of Engineering, UCC

2010 – 2011 David Cronin / Masters graduate, School of Engineering, UCC

## CURRENT RESEARCH PROJECTS

**Catheter Navigation & Tracking:** *Funded by the IRC PhD Scholarship (2011-2014) and the Marie Curie Reintegration Award entitled 'Smart Mag Solutions' (2010-2014), UCC Faculty start-up fund (2014-2018).* Development of a novel 3D robotic catheter positioning system for applications in endoscopy. A customised planar coil array transmits to a miniaturised coil to be embedded in a 1.2mm robotic catheter. Comparable performance to commercial systems (<1 mm position accuracy)

Students: Kilian O'Donoghue (PhD 2014), Josef Tugwell (MEngSc 2014), Alex Jaeger (PhD candidate).

Collaborators: CUH Respiratory Medicine, CUH Radiology, DFKZ Heidelberg, IHU Strasbourg.

**Image guided airway visualization and virtual bronchoscopy.** *Funded by HRB (2012-2016)*

Aims to develop world's first open-source virtual bronchoscopy suite using the Slicer3D environment for lung segmentation. Working with collaborators at Harvard Medical School and MD Anderson Cancer Center, as well as local clinicians. Project to provide the vision platform which will enable virtual navigation using the robotic catheter navigation.

Students: Pietro Nardelli (PhD 2015, MEngSc 2012), Riccardo Volpi (MEng 2015) Alberto Corvo (MEngSc 2014), Kashif Ali Khan (MD 2015), Jaspar Pahl (MEng Erasmus 2016).

Collaborators: UCC Department of Radiology, CUH Respiratory Medicine, CUH Radiology, The Surgical Planning Laboratory at Harvard Medical School, MD Anderson Cancer Centre at University of Texas.

**Medical Device Research:** *Funded by Enterprise Ireland commercialisation award (2011-2014) and IRC PhD Scholarship (2013-2016)*

Significant expertise in the mechanical design and commercialisation of innovative technologies for surgery and endoscopy. Endoluminal retraction devices prototyped in-house and evaluated in the pre-clinical (animal) setting.

Students: Conor O'Shea (PhD candidate, MEngSc 2013)

Collaborators: CUH Surgery, MUH Surgery, CUH Anaesthesia, UCC ASSERT Centre.

**Magnetic Manipulators:** *Funded by Marie Curie Reintegration Award entitled 'Smart Mag Solutions' (2010-2014).*

Novel self-deployed magnetic assembly for robotic transluminal access in gastrointestinal surgery (SAMSEN). Design and testing of magnetic retrieval system for stents in the biliary tree. Magnetic port design for endoluminal surgery.

Students: Valeria Gervasi (MEngSc candidate), Dr. Robert P. McEvoy (post-doc)

Collaborators: UCC School of Pharmacy, MIT Research Laboratory for Electronics

## INNOVATION/COMMERCIALISATION ACTIVITY

P. Cantillon-Murphy, "A Method and Apparatus for Combining Magnetic Nanoparticle Hyperthermia with MRI for Cancer Therapy" U.S. Patent Application No. 61/179,256. May 2009.

P. Cantillon-Murphy, J.H. Lang, M. Ryou, C.C. Thompson, "Description of Magnetic Self Assembly and Self Expansion for Magnetic Compression Anastomosis and One-step Endoscopic Access," U.S. Patent Application No. 61/308,680. Feb 2010.

P. Cantillon-Murphy, D. Cronin, "A magnetic coupling to improve placement of gastroenteral feeding tubes and colostomy tubes", European Patent Application EP11193758.7 Dec 2011.

C. O'Shea, P. Cantillon-Murphy et al., "An inflatable laparoscopic retractor for atraumatic retraction in abdominal surgery", European Patent Application EP12198842.4. Dec 2012.

C. O'Shea, P. Cantillon-Murphy et al., "An indication device and method for locating a natural cavity in a body," European Patent Application EP14150806.9, Jan 2014.

Co-founder of Rare Earth Magnetics (2009), now GI Windows, to commercialise magnetic access port technology for surgery. No current involvement.

Co-founded Skellig Surgical (2016) to commercialise surgical devices for minimally invasive surgery.

Total publications	Senior author publications				
54	43				
Journal Articles	Reviews	Book Chapters	Books	*Conference associated publications	Other
25	1	0	0	28	0

### Peer Reviewed Journals

- \* "Open-source Virtual Bronchoscopy in Pre-clinical Validation Using 3D Slicer," P. Nardelli, A.J. Jaeger, C. O'Shea, K.A. Khan, M.P. Kennedy, P. Cantillon-Murphy. International Journal of Computer Assisted Radiology and Surgery International Journal of Computer Assisted Radiology and Surgery, doi: 10.1007/s11548-016-1447-7.
- "Navigational Bronchoscopy for Early Lung Cancer: A Road to Therapy," K.A. Khan, P. Nardelli, H.A. Jaeger, C. O' Shea, P. Cantillon-Murphy, M.P. Kennedy MP. Advances In Therapy, 33 (4):580-596, 2016.
- \*"Evaluation of Endoscopically Deployed Radiopaque Tumor Models in Bronchoscopy," C. O'Shea, K.A. Khan, P. Nardelli, H.A. Jaeger , M.P. Kennedy, P. Cantillon-Murphy, Journal of Bronchology & Interventional Pulmonology, 23 (2):112-122, 2016.
- \* "Optimizing parameters of an open-source airway segmentation algorithm using different CT images," P. Nardelli, K.A. Khan, A. Corvò, N. Moore, M.J. Murphy, M. Twomey, O.J. O'Connor, M.P. Kennedy, R. San José Estépar, M.M. Maher, P. Cantillon-Murphy, Biomedical Engineering Online, 14(1), 62, 2015.
- \* "Magnets for therapy in the GI tract: a systematic review," P. Cantillon-Murphy, T. Cundy, N.K. Patel, G-Z Yang, A. Darzi, J.P. Teare, 82(2), 237–245, 2015.
- \* "Addressing biomedical problems through interdisciplinary learning: a feasibility study," P. Cantillon-Murphy, J. McSweeney, C. O'Tuathaigh, L. Burgoyne, S. O'Flynn and G. Shorten, International Journal of Engineering Education, 31 (1), 282-291 , 2015.
- \* "Low cost super-Nyquist asynchronous demodulation for use in EM tracking systems", K. O'Donoghue and P. Cantillon-Murphy, IEEE Transactions on Instrumentation and Measurement, 64 (2), 458-466, 2015.
- \* "Planar magnetic shielding for use with EM tracking systems" , K. O'Donoghue and P. Cantillon-Murphy, IEEE Transactions on Magnetics, 51(2), 1-12, 2015.
- \* "Electropermanent Magnetic Anchoring for Surgery and Endoscopy" J. Tugwell, P. Brennan, C. O'Shea, K. O'Donoghue, T. Power, M. O'Shea, J. Griffiths, R.A. Cahill, P. Cantillon-Murphy, IEEE Transactions on Biomedical Engineering, 62 (3), 842-848, 2015.
- \* "Catheter position tracking system using planar magnetics and closed loop current control," K. O'Donoghue, D. Eustace, J. Griffiths, M. O'Shea, T. Power and P. Cantillon-Murphy, IEEE Transactions on Magnetics, 50(7), 1-9, July 2014.
- \* "Design, Development and Evaluation of an Inflatable Retractor for Atraumatic Retraction in Laparoscopic Colectomy". C O'Shea, D. Kelliher, E. Andrews, M. Ó Riordáin, M O' Shea, T. Power, P. Cantillon-Murphy. Annals of Biomedical Engineering, 42(9):1942-1951, Sept 2014.
- \* "Magnetic compression in gastrointestinal and bilioenteric anastomosis: how much force?" T. Lambe, M.G. O'Riordain, R.A. Cahill, and P. Cantillon-Murphy, Surgical Innovation, 21(1), 65-73, Feb 2014.
- "Convergence and translation: attitudes to inter-professional learning and teaching of creative problem-solving among medical and engineering students and staff," H. Spoelstra, S. Stoyanov, L. Burgoyne, D. Bennett, C. Sweeney, H. Drachsler, K. Vanderperren, S. Van Huffel, J McSweeney, G. Shorten, S. O'Flynn S, P. Cantillon-Murphy, C. O Tuathaigh. BMC Medical Education. 14, 14, January 2014.
- \* "Deflection modeling of permanent magnet spherical chains in the presence of external magnetic fields," K. O'Donoghue and P. Cantillon-Murphy, Journal of Magnetism and Magnetic Materials, 343, 251-256, Oct 2013.
- \* "Self-deployed Magnetic Polygons: Design, Construction and Application". R. McEvoy, M. McMenamin, G. Ha, J. Lang, and P. Cantillon-Murphy, IEEE Transactions on Magnetics, 39, 496 - 505, Jan 2013.
- "Use of a group concept mapping approach to define learning outcomes for an interdisciplinary module in medicine," S. Stoyanov,H. Spoelstra, D. Bennett, C. Sweeney, S. Van Huffel, G. Shorten, S O'Flynn, P. Cantillon-Murphy, C. O'Tuathaigh, Louise Burgoyne, Perspective in Medical Education, *in press*, February 2014.
- "Magnetic pancreaticobiliary stents and retrieval system: obviating the need for repeat endoscopy (with

- video)," M. Ryou, P. Cantillon-Murphy et al., *Gastrointestinal Endoscopy*, 75, 888-892, April 2012.
18. "Smart Self-Assembling MagnetS for ENdoscopy (SAMSEN) for transoral endoscopic creation of immediate gastrojejunostomy (with video)," M. Ryou, P. Cantillon-Murphy et al., *Gastrointestinal Endoscopy*, 73, 353-359, February 2011.
  19. "A Magnetic Retrieval System for Stents in the Pancreatobiliary Tree," P. Cantillon-Murphy, M. Ryou, C.C. Thompson and J. Lang, *IEEE Transactions on Biomedical Engineering*, 57, 2018-2025, 2010.
  20. "A Magnetic Retrieval System for Pancreaticobiliary Stents: Obviating the Need for Second Endoscopy," M. Ryou, P. Cantillon-Murphy, J. Lang, and C.C. Thompson, *Gastrointestinal Endoscopy*, 71, AB134, 2010.
  21. "Transoral Endoscopic Creation of Immediate Cholecysto-Gastrostomy Using Smart Self-Assembling Magnets via Endoscopic Needle (SAMSEN) ," M. Ryou, P. Cantillon-Murphy, J. Lang, and C.C. Thompson, *Gastrointestinal Endoscopy*, 71, AB242, 2010.
  22. "Heating in the MRI environment due to superparamagnetic fluid suspensions in a rotating magnetic field," P. Cantillon-Murphy, L.L. Wald, M. Zahn and E. Adalsteinsson, *Journal of Magnetism and Magnetics*, 322, 727-733, March 2010.
  23. "Proposing Magnetic Nanoparticle Hyperthermia in Low-Field MRI," P. Cantillon-Murphy, L.L. Wald and E. Adalsteinsson, *Concepts in Magnetic Resonance, Part A*, 36A, 36-47, 2010.
  24. "Measuring SPIO and Gd contrast agent magnetization using 3T MRI," P. Cantillon-Murphy, L.L. Wald, E. Adalsteinsson and M. Zahn, *NMR in Biomedicine*, 22, 891-897, July 2009.
  25. "Evaluating Force in NOTES Surgery: A Comparison of Proximal and Distal Push, Pull and Torque Forces in a Specific Shape-locking Endoscopic Platform versus a Flexible Endoscope, " M. Ryou, R. Ewers, K. Obstein, P. Cantillon-Murphy, M. Ryan and C.C. Thompson, *Gastroenterology*, 136, A-649, May 2009.
  26. "Simulating Magnetic Nanoparticle Behavior in Low-field MRI under Transverse Rotating Fields and Imposed Fluid Flow," P. Cantillon-Murphy, L.L. Wald, M. Zahn and E. Adalsteinsson, *Journal of Magnetism and Magnetics*, 322, 2607-2617, 2010.

### **Conferences and Presentations (selected)**

1. \* "Novel algorithm for solitary pulmonary nodule malignancy prediction," P Nardelli, SP Power, J Pahl, K O'Regan, MP Kennedy, P Cantillon-Murphy. Radiological Society of North American Annual Scientific Meeting, Chicago, Illinois, 27 Nov – 2 Dec 2016.
2. \*\* "Appraisal of an Atraumatic Retractor for Laparoscopic Surgery," C O'Shea, E Andrews, M Ó Ríordáin, P Cantillon-Murphy. Annual Meeting of the Society of American Gastrointestinal and Endoscopic Surgeons, Boston, Massachusetts, 16-19 Mar 2016.
3. \*\* "SQL Databases for Lung Nodule Annotations in the LIDC Collection," J Pahl, K Murphy, P Nardelli, P Cantillon-Murphy. 19th International Conference on Medical Image Computing and Computer Assisted Intervention Athens, Greece, 17-21 Oct 2016.
4. \*\* "Image-guided catheter navigation with electromagnetic tracking," A Jaeger, P Nardelli, C O'Shea, J Tugwell, KA Khan, T Power, M O'Shea, M Kennedy, P Cantillon-Murphy. 28th Conference of the International Society for Medical Innovation and Technology Delft, Netherlands, 5-8 Oct 2016.
5. \*\* "A light-dependent training tool for flexible cystoscopy," M Donovan, L Standley, HA Jaeger, C O'Shea, M O'Shea, P Sweeney, P Cantillon-Murphy. 28th Conference of the International Society for Medical Innovation and Technology Delft, Netherlands, 5-8 Oct 2016.
6. \*\* "Electropermanent Magnet Control Using Dynamic Switching," M O'Sullivan, L Fennelly, P Cantillon-Murphy (2016) 28th Conference of the International Society for Medical Innovation and Technology Delft, Netherlands, 5-8 Oct 2016.
7. \*\* "Endoscopy mouthpiece design with easy clamp-and-release," JP McAuliffe, M Kennedy, KA Khan, P Cantillon-Murphy (2016), 28th Conference of the International Society for Medical Innovation and Technology Delft, Netherlands, 5-8 Oct 2016.
8. \*\* "The Effects of Occupying the Working Channel on Endoscope Manipulation," C O'Shea, KA Khan, J Tugwell, M Kennedy, P Cantillon-Murphy. Annual Meeting of the Society of American Gastrointestinal and Endoscopic Surgeons Boston, Massachusetts, 16-19 Mar 2016.
9. \*\* "The Impact of Instruments on Endoscopic Manipulation ," 27th International Conference of the Society for Medical Innovation and Technology. C O'Shea, J. Tugwell, K.A. Khan, M. Kennedy, P. Cantillon-Murphy. 27th International Conference of the Society for Medical Innovation and Technology Brno, Czech Republic, 9-12 Sep 2015.
10. \*\* "Design and development of an atraumatic retractor for laparoscopy," C. O'Shea, E. Andrews, M. Ó Ríordáin, P. Cantillon-Murphy. Design of Medical Devices Europe Vienna, Austria, 8-9 Sep 2015.
11. \*\* "Evaluation of a novel tracking system in a breathing lung model", K. O'Donoghue, A. Corvó, P.

Nardelli, C. O'Shea, K. A. Khan, M. Kennedy and P. Cantillon-Murphy, 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Chicago, Illinois, USA, August 26-30, 2014.

- 12.\*K. O'Donoghue, A. Corvó, P. Nardelli, C. O'Shea, K. A. Khan, M. Kennedy and P. Cantillon-Murphy, "Evaluation of a novel EM tracking system in a breathing lung model", The Hamlyn Symposium on Medical Robotics, London, United Kingdom, July 12-15, 2014.
- 13.\*C. O'Shea, P. Lee, and P. Cantillon-Murphy, "Design and development of a visual syringe for epidural entry," 11th IASTED International Conference on Biomedical Engineering (BioMed 2014), Zurich, Switzerland, June 23 – 25, 2014.
14. \*P. Nardelli, R. San Jose Estepar, P. Cantillon-Murphy, "Semi-automated Airway Segmentation for Lung CT Datasets," 27th International Congress and Exhibition in Computer Assisted Radiology and Surgery (CARS), Heidelberg, Germany. June 26-29, 2013.
- 15.\*D. Hogan, M. Healy, J. Griffiths, T. Power, M. O'Shea, K. O'Donoghue, M. Kennedy, and P. Cantillon-Murphy. "Two-dimensional Magnetic Catheter Navigation with Applications in Endoscopy". 24th International Conference of the Society for Medical Innovation and Technology (SMIT), Barcelona, Spain. September 20-22, 2012.
- 16.\*C. O Lionaird, S.P. Walsh, L. Barry, M. Buckley, J. Griffiths, T. Power, M. O'Shea, K. O'Donoghue, F. Carpi, and P. Cantillon-Murphy. "An Optimised Electromagnetic System for Endoscopic Capsule Propulsion: Report on a Benchtop Feasibility Study." SMIT 2012, Barcelona, Spain. Sept 20-22, 2012.
- 17.\*K. O'Donoghue, D. Hogan, M. Healy and P. Cantillon-Murphy, "Magnetic Catheter Guidance in a Human Lung Model: an initial feasibility study." Joint Workshop on New Technologies for Computer/Robot Assisted Surgery, Madrid, Spain, July 2012.
- 18.\*P. Cantillon-Murphy, T. Lambe and D. Cronin, "A Magnetic Coupling to Improve Placement of Gastrointestinal Feeding Tubes," BIODEVICES 2012, Vilamoura, Portugal, February 1-4, 2012.

### **Seminars (selected)**

1. TU Delft 3M "Developing medical devices in the academic setting." (2015).
2. DFKZ Heidelberg. "Image-guided interventions in the pre-clinical airways" (2015).
3. Otto von Guericke Universität, Magdeburg "Electromagnetic tracking with low-cost design" (2015).
4. "Education and the Needs of Irish Medtech: Joint Industry-Academia Workshop," (Jan 2015). Part of the National Forum for the Enhancement of Teaching and Learning in Higher Education seminar series 2014/15. Moderator: P. Cantillon-Murphy
5. TEDxUCC (Nov 2011) "When doctors and engineers talk " 1700+ views on Youtube.
6. The Hamlyn Centre for Robotic Surgery, Imperial College London. Invited seminar. (2013)
7. University of Oxford. Invited seminar to the Clarendon Laboratory condensed matter physics group (Professor H Jones) (2011)
8. Cork University Hospital Grand Rounds: "Magnets and Surgery, what future?" (2010)

### **INTERNATIONAL STANDING**

#### *External activities*

- 2013- Honorary lecturer at the Institute for Global Health Innovation, Imperial College London
- 2015 European Commission Horizon 2020 PHC-11-2015 stage 1 and 2 reviewer
- 2014 European Commission Horizon 2020 PHC-2015 stage 1 and 2 reviewer
- 2014 Czech-Norwegian Research Programme (CZ09) reviewer
- 2014- EPSRC College member
- 2014 Enterprise Ireland life sciences commercialisation fund reviewer
- 2013 European Commission FP7 Health 2013 Innovation stage 1 and 2 reviewer
- 2013 National University of Ireland scholarship panel member
- 2012 Irish University Association travel scholarship selection committee member
- 2011 Hoya Corporation, Tokyo. Independent consultant on magnetic devices for surgery

#### *Journal review*

- 2014 – Reviewer, Sensors
- 2010 – Reviewer, Journal of Magnetism and Magnetic Materials
- 2010 – Reviewer, IEEE Transactions on Biomedical Engineering
- 2011 – Reviewer, IEEE Transactions on Magnetics
- 2012 – Reviewer, IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control