

Curriculum Vitae

Paul Summers

Education

- 1990 - 1998 **United Medical and Dental Schools,
Guy's & St. Thomas's Hospitals, King's College, London** *London, UK*
PhD. in Medical Physics
Thesis: Quantitative Flow by Magnetic Resonance Phase Mapping
- 1989 - 1990 **Drexel University** *Philadelphia, USA*
Biomedical Engineering
Left prior to completion of MSc to start PhD
- 1983 - 1989 **University of Alberta** *Edmonton, Canada*
1987 - 1989 - BSc. Equiv. Specialization in Maths
1983 - 1987 - BSc. Specialization in Physics

Career

- Jun 13 – to date **Neuroradiology Department, Policlinico di Milano** *Milano IT*
Assegno di Ricerca (p/t)
I provide sequence optimization, post-processing support and PhD student supervision for a study on Parkinson's disease. We have just initiated a multimodal MRI study of glioma. Prior to start date, I also assisted in an fMRI / DTI study of monolateral glaucoma.
- Mar 08 – to date **Radiology Department, Istituto Europeo di Oncologia** *Milano IT*
Contract Researcher (p/t)
I have implemented body diffusion and perfusion protocols, for use in liver, whole-body, breast and prostate. This has contributed to the institution now marketing whole body MRI, as well as seeing prostate MRI rise to roughly 20% of all MRI referrals in our institution from a base of almost zero 3 years ago. A grant application I authored has been awarded by AIRC (Italian Association for Cancer Research) for the safety assessment and development of mm-Wave technology for medical imaging in collaboration with the University of Pavia, Electronic Engineering group.
- April 07 – Dec 13 **Department of Biomedical Sciences, University of Modena** *Modena, IT*
CoCoCo – CoCoPro – Assegno di Ricerca (p/t)
I am working to establish a robust technique for spinal cord fMRI for use in pain and neurophysiology research. This work has been severely hampered by finding that the assumptions that go along with the use of conventional BOLD fMRI analyses in the brain fail when applied to the spinal cord. I have adapted a 3D EPI sequence that is presently being used to study stimuli applied to cranial nerve V territories. A study of magnetic field changes with respiration is also in course. I have acted as co-tutor for a PhD student who has recently completed, and a paper giving a first demonstration of resting-state VASO is in preparation. Arising from this we are now investigating a 3D TSE technique for fMRI.
- Apr 07 – Mar 10 **Nuffield Department of Surgery, University of Oxford** *Oxford, UK*
Senior MR Physicist
Teleworking, I established the clinical data collection protocols for the

@neurlST Project involving more than 25 academic and commercial partners in informatics, engineering, genetics and ethics, and the 7 clinical partners where the data and samples are to be collected. Our work led to the creation of several software demonstrators for complex data handling, image analysis and data sharing, as well as contributing to the identification of several gene loci associated with risk of aneurysm formation.

- Aug 04 – July 06 **Senior Postdoctoral Scientist,**
I worked on image registration and post-processing of the serial MRA and DSA studies of patients undergoing endovascular treatment of AVMs and intracranial aneurysms. Other activities included the preparation of angiographic and velocity mapping data of patients for computational fluid dynamics models of intracranial aneurysms. I undertook a study of reproducibility of non-invasive intracranial pressure measurement.
- Nov 01 – Aug 04 **Institut für Neuroradiologie, UniversitätsSpital Zürich** *Zürich, CH*
Senior MR Physicist
I developed functional and diffusion imaging strategies in support of the clinical and research applications of our group. I trained and then managed the day-to-day activities of three post-docs, and contributed to the guidance of several doctoral candidates. I was awarded a Swiss National Science Foundation grant for validation of MR and CFD in intracranial aneurysms, and subsequently co-supervised the PHD work for this project. I contributed to the teaching within our department and that of the Zürich Neurosciences Centre. I organized and chaired the 2004 International Workshop on Flow and Motion.
- Sept 98 – Sept 01 **Clinical Neurosciences, King's College Medical School** *London, UK*
Lecturer
I worked closely with neurology colleagues in applying perfusion, diffusion and functional MR imaging to conditions such as CADASIL. For the hospital's general MR department, I implemented direct thrombus imaging and worked to increase the use of MRI liver disease and transplantation. I also contributed to research into small vessel disease, aneurysm treatment and segmentation of angiographic images.
- Sept 99 – Sept 01 **MR Physics, Cromwell Hospital** *London, UK*
MR Physicist (p/t)
I performed an advisory role for clinical MR imaging on a 1.5T, and a 0.35T "open" magnet in a private hospital setting.
- Feb 93 - Aug 98 **MR Physics, Guy's and St. Thomas's** *London, UK*
Research Assistant and PhD Studentship
As RA, I performed support roles for clinical and research activities in the Guy's and St. Thomas's Hospitals' MR Centre. My duties included; teaching, image processing, scanning, and refinement of pulse sequences on Philips and Siemens scanners. MRA and flow measurements were the primary research areas. Projects included: surgery planning, image registration, motion correction, dosimetry, cardiology, interventional MRI and developing a combined MR and PET system.
Prior to full-time employment in the MR Centre, and part-time thereafter, I worked to characterise phase mapping in-vitro, and on its in-vivo application. This led to my PhD Thesis: *Quantitative Flow By Magnetic Resonance Phase Mapping*, University of London, 1998.

Research Funding

Italian Association for Cancer Research (AIRC) Collaborator Jan 2014 – Dec 2016 Eur 230,000
Safety and Medical Imaging Application of mm-Waves.

Swiss National Science Foundation PI May 2003 – Apr 2006 CHF 220,000
Beyond Vascular Anatomy: Hemodynamics in Neurovascular Imaging and Endovascular Therapy
3200B0

Engineering and Physical Sciences Research Council PA Apr 2001 – Mar 2004 UK£ 260,000
Building a patient-specific model of the heart for integrated diagnosis and treatment of tachyarrhythmias
GR/R41002/01

Engineering and Physical Sciences Research Council Col Apr 1999 – Mar 2002 UK£ 172,000
Modeling and data fusion in image-guided endovascular neuro-interventions
GR/M55015

Flow & Motion Study Group - International Society of Magnetic Resonance in Medicine
Multi-centre Trial of Phase Mapping Flow Measurements Aug 1999 – Aug 2000 US\$ 1,000

Publications - Reviewed Works

Liver 4DMRI: a retrospective image-based sorting method.
C. Paganelli, P. Summers, M. Bellomi, G. Baroni, M. Riboldi.
Accepted – Medical Physics.

Squamous cell carcinoma of the oral cavity and oropharynx: what does the Apparent Diffusion Coefficient tell us about its histology?
L. Bonello, L. Preda, G. Conte, C. Giannitto, S. Raimondi, M. Ansarin, F. Maffini, P. Summers, M. Bellomi.
Epub: Acta Radiologica. 2015 May

Magnetic resonance imaging-guided versus surrogate-based motion tracking in liver radiation therapy: a prospective comparative study.
C. Paganelli, M. Seregini, G. Fattori, P. Summers, M. Bellomi, G. Baroni, M. Riboldi.
Int J Radiat Oncol Biol Phys. 2015 Mar;91(4):840-8.

Robot-assisted Radical Prostatectomy: Multiparametric MR Imaging-directed Intraoperative Frozen-Section Analysis to Reduce the Rate of Positive Surgical Margins.
G. Petralia, G. Musi, A.R. Padhani, P. Summers, G. Renne, S. Alessi, S. Raimondi, D.V. Matei, S.L. Renne, B.A. Jereczek-Fossa, O. De Cobelli, M. Bellomi.
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An Approach to the Symbolic Representation of Brain Arteriovenous Malformations for Management and Treatment Planning
P. Orłowski, P. Summers, M. Kamran, Y. Ventikos, J. Noble, J. Byrne.
Neuroradiology. 2014 Mar;56(3):195-209. *Erratum* Neuroradiology.

The current state-of-the-art of spinal cord imaging: Applications.
C. Wheeler-Kingshott, P. Stroman, M. Schwab, M. Bacon, R. Bosma, J. Brooks, D. Cadotte, T. Carlstedt, O. Ciccarelli, J. Cohen-Adad, A. Curt, N. Evangelou, M. Fehlings, M. Filippi, B. Kelly, S. Kollias, A. Mackay, C. Porro, S. Smith, S. Strittmatter, P. Summers, A. Thompson, I. Tracey.
Neuroimage. 2014 Jan;84:1082-93.

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The current state-of-the-art of spinal cord imaging: Methods.

P. Stroman, C. Wheeler-Kingshott, M. Bacon, M. Schwab, R. Bosma, J. Brooks, D. Cadotte, T. Carlstedt, O. Ciccarelli, J. Cohen-Adad, A. Curt, N. Evangelou, M. Fehlings, M. Filippi, B. Kelly, S. Kollias, A. Mackay, C. Porro, S. Smith, S. Strittmatter, P. Summers, I. Tracey.
Neuroimage. 2014 Jan;84:1070-81.

Somatotopy of nociceptive responses in the human spinal cord.

P. Summers, C.A. Porro, F. Giove.
Pain. 2013 Nov;154(11):2572-3.

Risk of Rupture of Small Anterior Communicating Artery Aneurysms Is Similar to Posterior Circulation Aneurysms.

P. Bijlenga, C. Ebeling, M. Jaegersberg, P. Summers, A. Rogers, A. Waterworth, J. Iavindrasana, J. Macho, V. Pereira, P. Bukovics, E. Vivas, M. Sturkenboom, J. Wright, C. Friedrich, A. Frangi, J. Byrne, K. Schaller, D. Rufenacht; @neurIST Investigators. Stroke. 2013 Nov;44(11):3018-26.

Whole-body diffusion-weighted imaging: is it all we need for detecting metastases in melanoma patients?

G. Petralia, A. Padhani, P. Summers, S. Alessi, S. Raimondi, A. Testori, M. Bellomi.
Eur Radiol. 2013 Dec; 23(12):3466-76

Multi-shot turbo spin-echo for 3D vascular space occupancy imaging.

F. Cretti, P. Summers, C.A. Porro
Magn Reson Imaging. 2013 Jul;31(6):875-81.

DCE-MRI and DWI Integration for Breast Lesions Assessment and Heterogeneity Quantification.

C.A. Méndez, F. Pizzorni Ferrarese, P. Summers, G. Petralia, G. Menegaz
Int J Biomed Imaging. 2012;2012:676808.

Quantification of Variability in Breath-hold Perfusion CT of Hepatocellular Carcinoma: A Step toward Clinical Use.

G. Petralia, P. Summers, S. Viotti, R. Montefrancesco, S. Raimondi, M. Bellomi
Radiology. 2012 Nov;265(2):448-56.

Anterior prostatic tumours are difficult to diagnose without MRI.

G. Petralia, S. Alessi, A. Alconchel, P. Summers, G. Musi, V. Matei, O. De Cobelli, G. Renne, M. Bellomi
Ecancermedicalsecience. 2012;6:252.

Breast MR with special focus on DW-MRI and DCE-MRI.

G. Petralia, L. Bonello, F. Priolo, P. Summers, M. Bellomi
Cancer Imaging. 2011 Oct 3;11 Spec No A:S74.

Semiautomated segmentation of the human spine based on echoplanar images.

G. Giulietti, P. Summers, D. Ferraro, C.A. Porro, B. Maraviglia, F. Giove
Magn Reson Imaging. 2011 Dec;29(10):1429-36.

Computational modelling for the embolization of brain arteriovenous malformations.

P. Orłowski, P. Summers, J.A. Noble, J. Byrne, Y. Ventikos
Med Eng Phys. 2012 Sep;34(7):873-81.

Breast MR with special focus on DW-MRI and DCE-MRI.

G. Petralia, L. Bonello, F. Priolo, P. Summers, M. Bellomi
Cancer Imaging. 2011 Jun 28;11:76-90. Review

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Diffusion-weighted MR imaging in assessing cervical tumour response to nonsurgical therapy.

S. Rizzo, P. Summers, S. Raimondi, M. Belmonte, M. Maniglio, F. Landoni, N. Colombo, M. Bellomi

Radiol Med. 2011 Aug;116(5):766-80.

Towards treatment planning for the embolization of arteriovenous malformations of the brain: intranidal hemodynamics modeling.

P. Orlowski, F. Al-Senani, P. Summers, J. Byrne, J.A. Noble, Y. Ventikos

IEEE Trans Biomed Eng. 2011 Jul;58(7):1994-2001.

Intraobserver and interobserver variability in the calculation of apparent diffusion coefficient (ADC) from diffusion-weighted magnetic resonance imaging (DW-MRI) of breast tumours.

G. Petralia, L. Bonello, P. Summers, L. Preda, A. Malasevski, S. Raimondi, R. Di Filippi, M. Locatelli, G. Curigliano, G. Renne, M. Bellomi

Radiol Med. 2011 Apr;116(3):466-76.

Functional exploration of the human spinal cord during voluntary movement and somatosensory stimulation

P. Summers, G. Iannetti, F. Lui, D. Duzzi, C. Porro

Magn Reson Imaging. 2010 Oct;28(8):1216-24.

@neurlST: infrastructure for advanced disease management through integration of heterogeneous data, computing, and complex processing services.

S. Benkner, A. Arbona, G. Berti, A. Chiarini, R. Dunlop, G. Engelbrecht, A. Frangi, C. Friedrich, S. Hanser, P. Hasselmeyer, R. Hose, J. Iavindrasana, M. Köhler, L. Iacono, G. Lonsdale, R. Meyer, B. Moore, H. Rajasekaran, P. Summers, A. Wöhrer, S. Wood

IEEE Trans Inf Technol Biomed. 2010 Nov;14(6):1365-77.

A quantitative comparison of fMRI responses to noxious and innocuous stimuli in the human spinal cord

P. Summers, D. Ferraro, D. Duzzi, F. Lui, G-D. Iannetti, C. Porro

Neuroimage. 2010 May 1;50(4):1408-15.

Strategies for health data exchange for secondary, cross-institutional clinical research

B. Elgera, J. Iavindrasana, L. Lo Iacono, H. Müller, N. Roduit, P. Summers, J. Wright.

Computer Methods and Programs in Biomedicine. 2010 Sept;99(3):230-51.

Rest versus Exercise Hemodynamics for Middle Cerebral Artery Aneurysms: A Computational Study.

T. Bowker, P. Watton, P. Summers, J. Byrne, Y. Ventikos

AJNR Am J Neuroradiol. 2010 Feb;31(2):317-23.

Genome-wide association study of intracranial aneurysm identifies three new risk loci.

K. Yasuno, K. Bilguvar, P. Bijlenga, S. Low, B. Krischek, G. Auburger, M. Simon, D. Kres, Z. Arlier, N. Nayak, Y. Ruigrok, M. Niemelä, A. Tajima, M. von und zu Fraunberg, T. Dóczi, F. Wirjatijasa, A. Hata, J. Blasco, A. Oszvald, H. Kasuya, G. Zilani, B. Schoch, P. Singh, C. Stürer, R. Risselada, J. Beck, T. Sola, F. Ricciardi, A. Aromaa, T. Illig, S. Schreiber, C. van Duijn, L. van den Berg, C. Perret, C. Proust, C. Roder, A. Ozturk, E. Gaál, D. Berg, C. Geisen, C. Friedrich, P. Summers, A. Frangi, M. State, H. Wichmann, M. Breteler, C. Wijmenga, S. Mane, L. Peltonen, V. Elio, M. Sturkenboom, P. Lawford, J. Byrne, J. Macho, E. Sandalcioğlu, B. Meyer, A. Raabe, H. Steinmetz, D. Rüfenacht, J. Jääskeläinen, J. Hernesniemi, G. Rinkel, H. Zembutsu, I. Inoue, A. Palotie, F. Cambien, Y. Nakamura, R. Lifton, M. Günel

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D: Hollnagel, P. Summers, D. Poulidakos, S. Kollias
NMR Biomed. 2009 Oct;22(8):795-808.

Intra- and interobserver agreement and impact of arterial input selection in perfusion CT measurements performed in squamous cell carcinoma of the upper aerodigestive tract.

G. Petralia, L. Preda, S. Raimondi, G. D'Andrea, P. Summers, G. Giugliano, F. Chiesa, M. Bellomi
AJNR Am J Neuroradiol. 2009 Jun;30(6):1107-15.

Tuning of the visual word processing system: distinct developmental ERP and fMRI effects.

S. Brem, P. Halder, K. Bucher, P. Summers, E. Martin, D. Brandeis
Hum Brain Mapp. 2009 Jun;30(6):1833-44

Ultrafast bold fMRI using single-shot spin-echo echo planar imaging.

S. Boujraf, P. Summers, F. Belahsen, K. Prüssmann, S. Kollias
J Med Phys. 2009 Jan;34(1):37-42.

Computational modelling for cerebral aneurysms: risk evaluation and interventional planning.

Y. Ventikos, E.C. Holland, T. Bowker, P. Watton, N. Kakalis, M. Megahed, F. Zhu, P. Summers, J. Byrne
Br J Radiol. 2009 Jan;82(Spec No 1):S62-71. Review

T2' imaging predicts infarct growth beyond the acute diffusion-weighted imaging lesion in acute stroke

S. Siemonson, T. Fitting, G. Thomalla, P. Horn, J. Finsterbusch, P. Summers, C. Saager, T. Kucinski, J. Feihler
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Sensorimotor tongue representation in individuals with unilateral upper limb amelia.

M Funk M, K Lutz, S Hotz-Boendermaker, M Roos, P Summers, P Brugger, M Hepp-Reymond, S Kollias
Neuroimage. 2008 Oct 15;43(1):121-7.

@neurlST - Chronic Disease Management through Integration of Heterogeneous Data and Computer-interpretable Guideline Services.

R Dunlop, A Arbona, H Rajasekaran, I Lo Iacono, J Fingberg, P Summers, S Benkner, G Engelbrecht, A Chiarini, C Friedrich, B Moore, P Bijlenga, J Iavindrasana, R Hose, A Frangi.
Stud Health Technol Inform. 2008;138:173-7.

The @neurlST Project.

J. Iavindrasana, L. Lo Iacono, H. Müller, I. Periz, P. Summers, J. Wright, C. Friedrich, H. Dach, T. Gattermayer, G. Engelbrecht, S. Benkner, M. Hofmann-Apitius, R. Dunlop, A. Arbona, H. Rajasekaran, J. Fingberg, A. Chiarini, B. Moore, P. Bijlenga, R. Hose, A. Frangi
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Magnetic resonance measurement of blood and CSF flow rates with phase contrast - normal values, repeatability and CO2 reactivity.

S. Piechnik, P. Summers, P. Jezard, J.V. Byrne
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Preservation of motor programs in paraplegics as demonstrated by attempted and imagined foot movements.

S. Hotz-Boendermaker, M. Funk, P. Summers, P. Brugger, MC. Hepp-Reymond, A. Curt, S. Kollias
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Laser Doppler velocimetry (LDV) and 3D phase-contrast magnetic resonance angiography (PC-MRA) velocity measurements: validation in an anatomically accurate cerebral artery aneurysm model with steady flow.

D. Hollnagel, P. Summers, S. Kollias, D. Poulikakos
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V. Kurtcuoglu, M. Soellinger, P Summers, D Poulikakos, P Boesiger
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Computational investigation of subject-specific cerebrospinal fluid flow in the third ventricle and aqueduct of Sylvius

V. Kurtcuoglu, M. Soellinger, P Summers, K. Boomsma, D Poulikakos, P Boesiger, Y. Ventikos
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Electrophysiological and hemodynamic evidence for late maturation of hand force control under visual feedback

P. Halder, S. Brem, K. Bucher, S. Boujraf, P. Summers, T. Dietrich, S. Kollias, E. Martin, D. Brandeis
Human Brain Mapping. 2007;28(1):69-84.

A preliminary study of the effects of trigger timing on DTI of the human spinal cord

P. Summers, P. Staempfli, T. Jaermann, S. Kwiecinski, S. Kollias
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In-vivo estimation of the flow-driven adiabatic inversion efficiency using velocity measurements from phase contrast MR angiography

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Neuroimage. 2006 Jul;31(4):1625-36.

Evidence for developmental changes in the visual word processing network beyond adolescence

S. Brem, K. Bucher, P. Halder, P. Summers, T. Dietrich, E. Martin, D. Brandeis
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Reconstruction of Cerebrospinal Fluid Flow in the Third Ventricle Based on MRI Data

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Cortical organization of sensory corrections in visuomotor skill acquisition

S. Mitra, A. Bhalerao, P. Summers, S.C. Williams
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An fMRI study of the role of suprapontine brain structures in the voluntary voiding control induced by pelvic floor contraction

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M. Meyer-Wittkopf, A. Cook, A. McLennan, P. Summers, G. Sharland, D. Maxwell

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A Variable Pitch Oxygen Saturation Indicator Designed for Use in the MR Environment

M. Smith, P. Summers, T. Padayachee

Physiological Measurement, 1994 Nov;15(4):401-6.

Spiral CT angiography and 3D display of abdominal aortic aneurysms

A.R. Padhani, M. Farrugia, S. Rankin, J. Reidy, J. Zhao, P.E. Summers, D. Hawkes, P. Taylor

Clinical Radiology, 1994 Oct; 49(10):738

Publications - Invited Articles

MR Angiography of the Cerebral Circulation

P. Summers, M. Graves, T. Padayachee

Rad Magazine, July 1992

Invited Presentations

Misure di Perfusion

La perfusione TC in oncologia: attualità e prospettive: 1st International Workshop on Perfusion CT, Siena Italy, Dec. 2009.

MR Physics and Imaging of Flow - Accuracy in Clinical Studies

ISMRM Cardiovascular Flow, Function and Tissue Mechanics Workshop

Sintra, Portugal, September 2009

Functional exploration of the human spinal cord during voluntary movement and somatosensory stimulation

International School on Magnetic Resonance and Brain Function – VII Workshop

Erice Italy, May 2009.

Memberships and Professional Affiliations

Clinical Scientist – UK Health Professionals Council (CSci)

Member - Institute of Physics and Engineering in Medicine

Member - International Society of Magnetic Resonance in Medicine

Member - European Society of Magnetic Resonance in Medicine and Biology

Member – British Institute of Radiology

Related Activities

Organizing Committee: Spinal Cord MRI Workshop, Toronto, Canada, 2015

Chair: ISMRM Flow and Motion Quantitation Study Group. 2012-14

Moderator: Perfusion MRI Session, NIST Workshop on Standards for Quantitative MRI, Boulder CO, USA, 2014.

Coordinator First Spinal Cord MRI Workshop, Milan, Italy, 2014

Member: International Spinal Research Trust - Wings for Life Foundation Focus Group on Imaging in Spinal Cord Research. London, England, 2011

Coordinator: International Workshop on Flow and Motion, Zurich, Switzerland. July, 2004

Chair: ISMRM Flow and Motion Quantitation Study Group. 2003-4

L'autorizzo il trattamento dei dati e alla pubblicazione sul sito web della Fondazione ai sensi della normativa vigente ed in particolare dell'art 15 del d.lgs n. 33 del marzo 2013.

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