

Medical Physics Group Postgraduate Dissertation Prize

The IOP Medical Physics Group (MPG) is pleased to announce the second round of the postgraduate dissertation prize. This is awarded annually for the best master's level dissertation, on a topic relevant to medical physics and completed by a student member of the MPG during the previous calendar year. Any dissertation submitted as a part of an MSc programme of study at a university in the UK and Ireland is eligible for consideration. The award, which has a monetary value of £250, will be made to the dissertation that, in the opinion of the MPG Committee, has made the greatest contribution to advancement of medical physics.

The closing date for receipt of applications is 30th January 2015, for dissertations completed in 2013 and 2014.

Applications must contain:

1. A Summary of the Work, written by the student (max 1,000 words).
2. Reflective Thoughts written by the student, describing how you have developed scientifically during the project; (max 300 words), and your work's significance and how it may impact patient care in the future (max 300 words).
3. A letter of support from the project Supervisor / Head of Course, explaining how the candidate meets the evaluation criteria.
4. Your IOP membership number.

A limit of 2 applications per MSc course will be applied – applicants are thus advised to liaise with the Course Director prior to submitting an application. Please send nominations by e-mail to any member of the MPG committee (current MPG officers: dimitra.darambara@icr.ac.uk, gemma.roberts4@nhs.net and d.rassi@swansea.ac.uk) who will be happy to provide any further information required.

Winner of This Year's Dissertation Prize

This year's prize was awarded to Corrine Johnson for her MSc project '*Optimisation and Characterisation of CT Attenuation Correction in Myocardial Perfusion Imaging*'. Corinne completed an undergraduate BSc (Honours) in Physics at the University of Edinburgh, between 2008 and 2012. She then applied to the Clinical Scientist Training Scheme in 2012, and was offered a post at Raigmore Hospital, Inverness.

In the first year of her training she completed an MSc in Medical Physics at the University of Aberdeen, graduating with Distinction and winning the Harry D. Griffith prize for the highest aggregate marks in the written examinations. She undertook her MSc project, '*Optimisation and Characterisation of CT Attenuation Correction in Myocardial Perfusion Imaging*', in the Nuclear Medicine department at Raigmore Hospital. Following her MSc Corinne has undertaken placements within the Radiotherapy, Radiation Protection and Nuclear Medicine departments at Raigmore, as well as a short Brachytherapy placement at The Christie NHS Foundation Trust in Manchester. She was due to complete Part 1 of her training in September, and plans to specialise in Radiotherapy for Part 2.



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Meeting reports

Joint Annual Meeting ISMRM-ESMRMB 2014 Milan, Italy

10th – 16th May 2014

This year's joint annual meeting of the of the *International Society for Magnetic Resonance in Medicine* (ISMRM) and the *European Society for Magnetic Resonance in Medicine and Biology* (ESMRMB) was hosted at the Milano Congressi, in Milan, Italy. With more than 6,000 attendees from over 70 countries, this is the largest annual meeting devoted to promoting communication, research, development and applications in the field of magnetic resonance (MR). Comprising over 800 talks, 3900 traditional and electronic

overwhelming, even walking from one end of the conference centre to the other took the best part of 15 minutes. However the meeting was very well organised, with various ways to plan your itinerary, including a dedicated mobile application, as well as friendly staff to guide you to the different areas.

The meeting began with a weekend of education sessions. Eight sessions ran in parallel, covering body, cancer, cardiovascular, neurological, musculoskeletal, and diffusion /

'*Preclinical Cancer Imaging*', which were very relevant to my current research.

The weekdays were mainly dedicated to the dissemination of new research results through talks and posters. Plenary sessions provided up-to-date reviews of certain areas in MR, with titles such as; '*How MRI Became the Gold Standard*' and '*Magnet Technology: Where We Came From, Where We Are, Where We Are Going To*'. Since my research is focused on the use of contrast agents (CAs) in dynamic

imaging of prostate cancer, I found **Angelique Louie's** lively talk, '*The Promise of Targeted Molecular Imaging Contrast Agents*', very interesting. She spoke of new developments with Iron based CAs, and CAs based on new materials such as carbon nanotubes and europium cryptates, which offer the prospect of better quality imaging using higher field strengths. There were also some very informative talks presented during the '*Clinical Prostate Cancer*' session on the use of MR in prostate cancer imaging. One approach showing great promise is the use of multiparametric MRI, a combination of different MR techniques, such as T2-weighted, diffusion weighted

imaging (DWI), MR spectroscopic imaging (MRSI), and dynamic contrast-enhanced (DCE). **Eline Vos** spoke of their positive results in the assessment of prostate cancer aggressiveness using this multiparametric approach on a standard 3 Tesla system, while her colleague **Marnix Maas** hinted at the future prospect of higher image quality with lower imaging times using higher field strengths (7T). Another session of interest to me in my research was '*Image Reconstruction from Sparse Data*', wherein some novel approaches to the task of image reconstruction were proposed, for example **Justin Haldar**



posters, as well as weekend and early morning educational sessions, this comprehensive conference covered all aspects of MR in medicine and biology. This year also saw the introduction of a new session format, 'power posters', where presenters gave a two-minute 'poster pitch', followed by a one hour poster presentation on large plasma screens. 140 such power posters were presented.

Having only previously attended small national conferences, I initially found the scale of the event quite

perfusion imaging, as well as cross cutting and emerging technologies. Each of the twenty-five minute lectures were delivered by accomplished MR scientists, followed by five minutes of discussion. There were also informal 'Meet the Teachers' breaks throughout the program, allowing an opportunity to speak one-on-one with the lecturers. I particularly enjoyed '*MR Physics for Physicists*', which gave a nice refresher on the basic principles of nuclear MR, as well as some of the more focused sessions, such as '*Imaging Acquisition & Reconstruction*' and

presented a new technique called 'P-LORAKS', which appears to offer advantages over techniques presently used. Other talks provided insights into some of the latest broad developments in MR, such as 'MR fingerprinting', a new method that permits for the simultaneous non-invasive quantification of multiple properties of a material or tissue.

Various social events were organised in the evenings, allowing for some informal networking over a glass of wine. I particularly appreciated the 'Newbie Reception', specifically organised for first time attendees like myself. The reception was divided into 13 specialised topic zones, with a senior representative from that field in each area. It was a great chance to get to meet and chat with some of the world leaders in MR. Milan also offered a great backdrop to catch up with friends and colleagues I had met at previous MR events.

Attending this conference was a very enjoyable and useful experience, giving me a wider perspective on current research being done in MR, as well giving an opportunity to build connections with other researchers working in similar areas to myself.

Silvin Knight

*Irish Cancer Society Research Scholar
Trinity College, University of Dublin.*



Educational resources

Keep an eye out on the MPG group web pages for forthcoming teaching tools such as a Monte Carlo teaching tool for the interaction of radiation and matter by Dr Colin Baker.

The Medical Physics Group is now on LinkedIn!



To join:

- Firstly, make sure you are a member of the Medical Physics Group (MPG) of the IOP by logging on to MyIOP.org and adding the Medical Physics Group as one of your selected groups.
- Next, simply search for the 'Medical Physics Group of the Institute of Physics' through your LinkedIn account and click 'join'.

Meeting reports

Multidisciplinary research in medical physics – an IOP networking meeting Monday 1st December 2014

The second IOP Medical Physics multidisciplinary networking meeting on innovation translated into clinical practice was held in December at the IOP buildings, jointly chaired by Dimitra Darambara (MPG Chair) and Gemma Roberts (MPG Secretary). This was a full day event this year following last year's afternoon meeting. These meetings are going to be annual winter events with the next scheduled for **Monday 30th November 2015** - check the MPG website and IOP emails next autumn.

The main aims of the multidisciplinary meetings are to bring together people from diverse areas of Medical Physics to make contacts in the wider community, hear about some of the latest developments and discuss potential collaboration. This year we had approximately 30 delegates from industry, academia and clinical settings and six invited speakers, who discussed the translation of innovative Medical Physics led developments into clinical practice and explored the processes involved in bringing new technology into clinical use. Feedback on the day was positive, with the speakers and audience appreciating the small group, informal atmosphere and opportunities for interaction and networking.

Many of the speakers have provided the slides from their talks, which we will be posting on the MPG website for members to access.

<http://www.iop.org/activity/groups/subject/med/index.html>

The morning session began with Prof. Dewi Lewis, industry advisor at CERN, who gave a broad overview of the development of some of the latest advances in imaging with ionising radiation and radiotherapy – including SPECT/CT and PET/CT, solid state gamma cameras, cyclotron technology, PET/MR and proton therapy. Prof. Lewis's talk explored the contributions and risks that were required from industry, research organisations and clinical centres for each of these developments and concluded with an audience discussion, in which the general feeling was that none of the technologies covered could have succeeded without a collaborative approach.

The second of the two morning talks was given by Dr. Francois Lassailly, head of In Vivo Imaging at Cancer Research UK (soon to be part of the new Francis Crick Institute). In vivo imaging has

become pivotal in areas such as oncology, developmental biology, immunology, stem cell biology, neurobiology and infectious diseases. Dr Lassailly discussed the importance of non-invasive in vivo imaging in allowing the monitoring of disease progression / drug treatments within small animal subjects, removing the requirement for producing orders of magnitude more at different disease stages. He described the range of imaging modalities required to capture structural, functional, cellular and molecular parameters non-invasively, and in particular focussed on the development of new optical techniques using fluorescent and bio-luminescent molecular labelling.

Prior to lunch and networking there was an open discussion session where several audience members introduced themselves and their work, and further questions and discussion was had with our invited speakers.

The afternoon session started off with a joint talk on the use of Magnetic Resonance Spectroscopy for non-invasive diagnosis of childhood brain tumours from a team at Birmingham. Prof. Andrew Peet is NIHR Research Professor at the University of Birmingham and a Consultant in Paediatric Oncology at Birmingham Children's Hospital and Dr. Martin Wilson is a research fellow at the University of Birmingham, specialising in the application of magnetic resonance spectroscopy to brain diseases. Dr. Wilson gave an overview of the physics behind MRS and outlined the development of his bespoke software and diagnostic "Decision support system" for characterising tumour types based on MRS tumour metabolite profiles. Prof. Peet then gave the clinical background and need for this technology, with fewer children surviving brain tumours than other forms of cancer and MR imaging alone being inadequate for characterisation. He presented the results of retrospective and prospective clinical validation in single and multiple centres, showing high diagnostic accuracy (>90%). It was particularly interesting to note that the software alone gave more accurate tumour characterisation than when combined with an expert visual interpretation. As the software is classed as a medical device it requires regulatory approval - routes towards developing a CE marked product, including forming and ISO compliant company are currently being explored.

Dr. Mike Partridge, head of the radiotherapy research group at the Department of Oncology, University of Oxford, then gave a talk on the exciting possibilities for patient tailored radiotherapy treatments based on advances in functional imaging. He explored how imaging for radiotherapy has developed in recent years to make the best possible use of anatomical imaging in defining treatment volumes more and more precisely, and how this has now reached the limit in terms of delivering homogenous, uniform doses. The next step in personalised treatment is to use functional imaging (for example FLT or FMISO PET) to identify the most radio resistant areas and adapt the treatment plan accordingly using information on the tumour biology and physiology at baseline. It is also likely that we will in future be able to use changes in functional imaging signals during treatment to monitor response and normal tissue toxicity and to use this information to escalate or reduce dose for the remainder of the treatment. Dr. Partridge presented promising results from a range of clinical trials using PET and MR imaging to monitor or affect treatment.

The final talk of the day was given by Dr. John Lees, who thanked everyone for sticking around until the end! Dr. Lees leads the Bioluminescence Unit, based in the Space Research Centre at the University of Leicester, and came to speak about one of the Unit's latest projects transferring space instrumentation technology into medical use. The device is a small field of view, hand held hybrid optical and gamma camera for use at the patient bedside and in operating theatres. The combination of a standard optical camera with a gamma camera means that the output is a "photo" of the site of interest, with the radionuclide image superimposed. There are immediate applications for the innovation in localisation of sentinel lymph nodes in surgery and also for determining sites of contamination in areas where radioactivity is handled. Dr. Lees presented the latest developments of the system and results of clinical testing and discussed the current process of obtaining regulatory approval of the device and ethics approval to use in surgery.

Thanks to all our audience members for attending and participating in this event, and especially to our invited speakers for providing an excellent overview of Medical Physics contributions to some of the latest techniques.

Gemma Roberts
MPG Secretary.

Biography of a Medical Physicist

Interview with Professor Steve Webb

Emeritus Professor of Physics at the Institute of Cancer Research and Royal Marsden Hospital's Joint Department of Physics



Q: Your Medical Physics career began in the Royal Marsden in 1974, following your colleague Robert Speller's move into the subject. Were you aware of the field of Medical Physics before that, and had you ever considered it as a career?

No. At that stage of my career (1st year postdoc) it was very rare for physicists to go into medical physics. Obviously there was the HPA [from 1948] (now IPEM) and people did enter and do both research and clinical jobs but entry seemed a very hit and miss affair. When I went to the ICR RMH there were some doing PhDs in MP and there were those who had passed through MP MSc courses. I was one of the oddballs who was recruited doing theoretical cosmic ray physics one week and radiotherapy and imaging clinical work the next! That is how it was. Training was on the job and I was given a very free hand to develop research ideas so long as I did a few days of clinical work each week.

Q: How do you think your hands-on, in-at-the-deep-end approach compares with the more formal, structured teaching that new-starters receive as part of MSC?

Retirees looking back are dangerous animals. I never had a day's training in medical physics at all and you can judge for yourself from my career whether that mattered. It's easy and tempting to say the profession is now somewhat overtrained but one also has to remember that professional ways of working have changed and the subject is much more complex. A cynic might say there is a danger of now learning key facts and procedures and not allowing enough time to independently think. But I have to say my way of entering wasn't ideal and some training could have been useful. Basically some kind clinical physicists taught me what to do on the job. I worked clinically a couple of days a week and the other 3 days was allowed to just sit and think. Sitting and thinking led to 300+ papers over the years as one idea followed another. I was also very lucky that the almost unique combination of RMH and ICR allowed this. There were few grants and few divisions between work areas. One just moved seamlessly between them. I would say wouldn't I that this served me and I hope the profession well. But there is probably no going back to this way.

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MSc Accreditation Assessors wanted

The Institute of Physics and Engineering in Medicine (IPEM) has launched a new accreditation scheme for masters courses in medical physics and biomedical engineering in the UK. More information can be found at the following website:

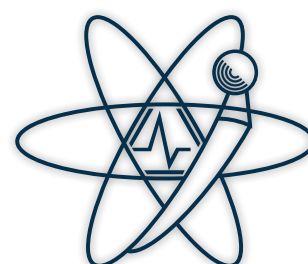
<http://www.ipem.ac.uk/CareersTraining/MastersDegreeAccreditation.aspx>



The accreditation committee is currently looking to recruit a larger pool of expert assessors who can contribute a maximum of one day per year to undertake a site visit to a new university that has applied for accreditation of a programme.

The assessor will be paid travel expenses and invited to a committee training event, most likely in London, in the future. Accreditation assessment activities form high level activities in most professional body CPD schemes.

To register interest in becoming an assessor for the IPEM Masters Level Accreditation Framework, please email Dr Jamie Harle, j.harle@ucl.ac.uk, with a CV. Experience of running or contributing to a Higher Education Institute taught programme at postgraduate level, or indeed prior experience in performing professional body accreditation duties, are highly desirable.



Journal spotlight

Physiological Measurement

Background

Physiological Measurement was first published in its present incarnation in 1993 (previously, it was called "Clinical Physics and Physiological Measurement") and is published monthly by the Institute of Physics Publishing, UK. The journal accepts submissions of full papers (8k word limit), notes (3.5k words) and comments/replies. In addition, topical reviews commissioned by the Editorial board are often sought (12-18k words). A facility to quickly publish outstanding short papers (5k words) is also offered ("fast-track communications").



Scope

A journal for sensors, instrumentation and systems in physiology and medicine. Physiological Measurement covers the quantitative assessment and visualization of physiological function in clinical research and practice, with an emphasis on the development of new methods of measurement and their validation. Practical and theoretical papers are published in topics including:

- measurement in applied physiology
- biomedical sensors
- human biology and clinical medicine
- instrumentation and methods of data analysis
- clinical engineering
- patient monitoring
- life support systems and prosthetic devices
- modeling and simulation as they apply to measurements
- measurement of flow and pressure (for example blood flow, tissue perfusion and hemodynamics)
- body composition (for example XRF, bone mineral density, ultrasound bone measurements)
- bioMEMs and applications of microfabrication technology to biomedical measurements
- physiological measurement at the cellular level

Recent highlights

High-impact recent articles include:

Topical Reviews

A review of signals used in sleep analysis, A Roebuck et al 2014 *Physiol. Meas.* 35 R1
<http://iopscience.iop.org/0967-3334/35/1/R1/article>

Pulmonary function testing in children and infants, B Vogt et al 2014 *Physiol. Meas.* 35 R59
<http://iopscience.iop.org/0967-3334/35/3/R59/article>

Papers

A new measuring and identification approach for time-varying bioimpedance using multisine electrical impedance spectroscopy, B Sanchez, E Louarroudi, E Jorge, J Cinca, R Bragos and R Pintelon
<http://iopscience.iop.org/0967-3334/34/3/339/article>

A feasibility study of magnetic resonance driven electrical impedance tomography using a phantom, Yuqing Wan, Michiro Negishi and R Todd Constable
<http://iopscience.iop.org/0967-3334/34/6/623/article>

A new technique for the assessment of the 3D spatial distribution of the calcium/phosphorus ratio in bone apatite, A Hadjipanteli, N Kourkoumelis, P Fromme, A Olivo, J Huang and R Speller
<http://iopscience.iop.org/0967-3334/34/11/1399/article>

Indexing services including Medline/ PubMed, Science Citation Index and Scopus.

Andrew J Fagan

Centre for Advanced Medical Imaging (CAMI), SJH/TCD
 Dublin.

Notable figures for 2012/13

Impact Factor (Journal Citation Reports® published by Thomson Reuters, 2012)	1.496
Publication times - receipt to first decision (2013)	47 days
Accept to first published online DOI citable	106 days
Acceptance rate (YTD 2014)	25%
Proportion of articles from UK authors (2013)	12%
Proportion of articles from EU authors (2013)	42%
Articles published per year (2013)	133
Articles published per year est. 2014	180
Articles downloaded per year (2012)	Over 120,000
First issue	Feb 1980

Institute of Physics Research Student Conference Fund

The Institute of Physics provides financial support to research students to attend international meetings and major national meetings. Bursaries are not available for meetings organised by the Institute of Physics including those organised by IOP Groups. The Institute of Physics (IOP) handles the application process but it is the relevant IOP group that makes the decision on whether to award the bursary and its value.

Am I eligible?

Research Student Conference Fund (RSCF) bursaries are available to PhD students who are a member of the Institute and of an appropriate Institute group. For example, if an applicant is a member of the Women in Physics Group only then they could only seek support to attend a conference related to women in physics and not to low temperature physics. To be eligible for that meeting, the applicant would also need to be a member of the Low Temperature Group.

What is the bursary worth?

Students may apply for up to £300 during the course of their PhD. Students may apply more than once, for example they may request the full amount or decide to request a smaller amount and then apply for funding again for another conference at a later stage.

Groups have limited funds to award bursaries and so students may not receive the full amount they have requested. If the full amount is not awarded students may apply again to receive further support for a different conference until they reach £300 overall.

Note that grants will normally cover only part of the expenses incurred in attending a conference and are intended to supplement grants from other sources.

How can I apply?

Application details and application form

RSCF applications are considered on a quarterly basis and should reach the Institute by: 1st March, 1st June, 1st September or 1st December; a decision will be made within eight weeks of the closing date. Your application must reach us by the deadline which is at least three months before the conference you wish to attend. We strongly recommend that you submit your application early.

All recipients are asked to produce a report on return from their conference before receiving payment.

Further information

For further information please contact supportandgrants@iop.org

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Q: Your career has spanned 5 decades – what are the more exciting developments you have seen in that time, both in terms of technological advancements and improvements in patient care?

I used to lecture on this. One has to recognise that there are some key developments that change the world forever and make some people household names. So think of the invention of CT, MRI, IMRT, motion-guided therapy and one can see major changes that stemmed from physics and changed the lives of patients. The vast majority of other research instead hones the fine details and I was no exception in having a large part of my career doing work that probably changed little. But I think I did help to change radiation therapy practice. I was lucky to be one of few that did make that difference (I am told).

Q: There are many different career paths that can lead from a role that starts out as a Clinical Scientist. What advice would you give to early-career Medical Physicists regarding career goals and direction?

Try to find a place and role whereby one can do clinical work and research and teaching all of some substance, quality and volume. If not then decide on a single route and ruthlessly pursue it. It may not be possible any more to be a professor of academic physics and a top grade clinical manager.

Q: The field of Medical Physics is constantly transforming as technology improves. How do you predict the job will develop in the future?

Prof Webb has ventured answers on a number of occasions to questions like these, including in a number of papers, and in the 2009 Christmas Lecture at the NPL. A few highlights are listed here:

Improving the diagnosis of disease- 3D multimodality imaging, increased functional imaging, telemedicine.

Improving Radiotherapy planning – multimodality, patient-specific plans based on radiosensitivity and response to assays and functional imaging, multiple plans per patient, accurate predictions of biological outcome.

Improving the delivery of treatment – molecular genetics combined with radiotherapy, treatment 'robots', daily feedback and repositioning based on imaging.

Improving assessing response to treatment – data collection post-treatment becomes the norm, co-ordinated through international trials.

For all this to happen, Medical Physicists need to be:

1. **Educated at school to find science rewarding.**
2. **Led to understand that many breakthroughs in Medical Physics come from applying the physics from mainstream areas, which should also be studied.**
3. **Allowed protected research time.**
4. **Allowed to fail, and follow blind alleys, rather than only conducting grant-driven research.**
5. **Encouraged to avoid repetitive re-invention in Medical Physics.**
6. **Supported by National and International programmes, without being too regimented in training schemes.**
7. **Doing physics! Not just scientific business or scientific politics.**
8. **Supported by Government, society and family.**

Patrice Burke

Diagnostic Imaging Medical Physicist,
Nottingham University Hospitals NHS
Trust, UK.

This newsletter is also available on the web and in larger print sizes.



The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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Call for content

If there is anything you would like to see in future editions of the newsletter then email k.m.hampson@bradford.ac.uk or any other committee members.