Message from Professor Fiona Gilbert

Another year has started in the University and we are seeing significant changes in our activities. While the students have returned for face to face teaching, staff are continuing hybrid working for the foreseeable future – and this is likely to remain with the increasing rate of Covid infections. It is important that all members of the department are vaccinated, get their booster dose when it is offered to them, have the flu vaccine and undertake regular testing especially when they have been in big group activities. Sadly we are being discouraged from socializing together. I really miss the social interaction as I enjoy meeting everyone and hearing what they are doing and regard this as one of the big upsides of working together.

Our VC, Stephen Toope has decided to put family first and has not extended his 5 year term of office. He gave a superb address at the beginning of term which is well worth watching on YouTube. He made many important points highlighting the successes over the past year and firmly confirmed the importance of free speech at the university. We are at an interesting time in our culture where past misdemeanors are judged and actions taken with difficult consequences. Rather than have statues destroyed for historic activities I would prefer that pledges are made that we will not treat people in unacceptable ways and action taken to discourage activities where this is evident currently.

COP26 – the 26th United Nations Climate Change Conference in Glasgow at the beginning of November brought together world leaders to commit to reduce carbon emissions for the coming decades as laid out in the Paris Agreement. The University has a Carbon Zero campaign and this innovative scheme is trying to encourage all of us to be more aware of our carbon footprint and adopt strategies to tread more lightly on our planet. It is worth watching the EarthShot campaign launched by David Attenborough and Prince William to highlight amazing projects around the globe to improve the planet for our children and grandchildren. We all need to be more aware of our actions in relation to the impact on the plant and realize that inaction is no longer an option. Please join Abby Burrage in her goal to make our department a greener workplace.

As the VC said Cambridge is an amazing place to work and the experience is created by the synergy between groups and lively debate and exchange of ideas. It is the interactions of this highly talented workforce that gives us such a unique environment to share our thoughts and ambitions. Please make sure you have the support you need at work and come in and enjoy the wonderful stimulation of working in one of the most prestigious academic environments in the world.
This past month has seen 2 amazing milestones for Cambridge Breast screening studies. With the past year being shadowed by COVID, we are proud to say that here at Cambridge we have now consented over 1000 ladies to BRAID and over 1000 ladies to MyPeBS.

In the **BRAID study**, we have consented **1029** ladies to date. The ladies that are in the Supplementary imaging arms, (ABUS, Contrast Mammogram or Abb-MRI), receive baseline imaging after consent, and repeat imaging at 18months post their initial screening mammogram. We have now completed nearly 800 baseline scans, and we have now re-imaged nearly 300 BRAID ladies who are at their 18month time point. Overall the trial is making fantastic progress.

In the **MyPeBS study**, we have now consented **1142** ladies to date aged between 50 & 70, from the Cambridge Breast Screening area. 50% of these ladies are randomised to standard 3 yearly mammogram screening, and the other 50% are randomised to the Risk Stratified arm of the Trial. This involves the ladies producing a saliva sample for DNA analysis, and along with family & personal medical history & breast density from their recent mammogram, their estimated risk of getting Invasive Breast Cancer over the next 5 years is calculated. Low risk means their next mammogram is in 4 years, average risk means 2 yearly mammograms and high & very high risk means yearly mammograms along with potential additional supplementary imaging.

The MyPeBS study recently caught the eye of ITV News Health Editor, Emily Morgan, who was very excited about this potentially ground-breaking study. To coincide with Pink October and Breast Awareness month, the ITN film crew came at the end of October and interviewed and filmed us here at Addenbrooke’s, as Fiona is the lead for the UK arm of the MyPeBS Trial. Along with interviewing Fiona & myself, two participants, one who had just consented to the MyPeBS trial, and needed a screening mammogram and a saliva sample collecting, along with a lady who is already in the Trial and has been stratified to the High-Risk Arm category, were filmed and their thoughts about being in the trial discussed.

On the back of this television exposure, we had an overwhelming response from nearly 1000 ladies countrywide who wanted to participate in the MyPeBS study. Unfortunately, there are only 3 UK sites where ladies can participate but it is clear from the response that ladies understand the need for tailored screening, improving screening for future generations and that early detection is key in increasing survival rates. International recruitment is progressing very successfully.
In October, ITV News published an article titled ‘10,000 women needed for trial that could revolutionise breast cancer treatment’ promoting the MyPeBS study. The article includes recordings of Professor Fiona Gilbert and Johanna Field-Rayner describing the trial and work being done at the Cambridge Breast Unit—congratulations team!


In addition, gold medals were awarded to Jo and Jamie for exceeding recruitment targets to the BRAID and MyPeBs studies last month. They undertook a monumental amount of work after a publicity drive during Pink October!

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RDU and the International Day of Radiology

By Teik Choon See

On the 8th of November, CUH Imaging Directorate will be celebrating the International Day of Radiology, along with other radiology professionals all over the world.

The role of Radiology in contributing to patient care and leading the development of innovative imaging and minimally invasive techniques is increasingly well recognised. Radiology is core in the prevention, diagnosis and treatment of a wide spectrum of diseases. This is accomplished by a multidisciplinary team including radiologists, radiographers, technologists, nurses, administrators, porters and many other radiology support professionals. Its key role during the Covid-19 pandemic and the subsequent recovery period is substantial. Radiology is also central in education and training in addition to collaborative research including the advances in precision medicine.

This year the International Day of Radiology is dedicated to Interventional Radiology and its role in treating patients. CUH Imaging Directorate provides a comprehensive Interventional Radiology services in all body parts and all imaging modality. Some examples are neurovascular interventions including treatment of cerebral aneurysm and stroke; vascular interventions including endovascular aortic aneurysm repair and peripheral vascular diseases; oncological interventions including tissue diagnosis, endovascular and direct tumour therapies using a range of technological equipment; and transplant interventions including assessment, optimisation and managing complex cases. The Imaging Directorate has gained accreditation in Quality Standard of Imaging awarded by the UK Accreditation Service since 2012 and has consistently achieved Exemplar Status awarded by the British Society of Interventional Radiology since 2014.

The success of CUH Interventional Radiology services runs in parallel with the accomplishment of our Radiology Day Unit (RDU). This year’s International Day of Radiology coincides with the 9th anniversary of the RDU. This nurse-led 8-bedded day unit has evolved over the years and is now well equipped to provide safe and excellent care to a wide range of patients undergoing image guided minimally invasive procedures or treatments. The unit has provided care for over 12,000 patients to date and the avoidance of hospital admissions has led to considerable cost savings, minimise hospital acquired infection and optimise patient flow. The operational and governance processes of the RDU has been adopted elsewhere nationally and its success led to two Transforming Care Awards. Patient feedback have consistently achieved 96-100% good score and there were very low number of unplanned admissions. Currently RDU is continuing to enhance its provision by streamlining pre-procedure assessments and extending capacity.

We hope you will join us in celebrating the International Day of Radiology and in particular wishing all those involved in Interventional Radiology and the RDU a Happy 9th Anniversary!
World first for AI and machine learning to treat COVID-19 patients worldwide

A collaborative study, with Fiona Gilbert (Radiology) as a senior author, used artificial intelligence (AI) to predict COVID-19 patients’ oxygen needs on a global scale. The research was sparked by the pandemic and set out to build an AI tool to predict how much extra oxygen a COVID-19 patient may need in the first days of hospital care. The study included data from Addenbrooke’s Hospital along with 20 other hospitals from across the world and healthcare technology leader, NVIDIA.

Following rapid Covid ethics and governance approvals, facilitated by John Bradley and Mary Kasanicki (both CUH R&D), Josh Kaggie (Radiology), Sarah Hickman (Radiology), Andrew Priest (Radiology) and Stefan Graf (Medicine), the fully anonymised patient information, held in the EPICOV dataset (initiated by Willem Ouwehand), was linked to chest radiographs. An algorithm was sent to each hospital and developed in house, which meant that no original patient data was shared or left its location, a technique known as federated learning. Once the algorithm had ‘learned’ from the data, the analysis was brought together to build an AI tool which could predict the oxygen needs of hospital COVID-19 patients anywhere in the world.

Published in *Nature Medicine*, the study dubbed EXAM (for EMR CXR AI Model), is one of the largest, most diverse clinical federated learning studies to date. Following further validation, researchers envision deployment of the EXAM model in the Emergency Department setting as a way to evaluate risk at both the per-patient and population level, and to provide clinicians with an additional reference point when making the frequently difficult task of triaging patients.

BRC/NIHR Audit Reminder

The BRC support many members of staff in our departments and it is likely that whatever you are doing the BRC will have had some kind of impact. Miles Parkes, the new director of the BRC would like us to put the *strapline* below on every published output from our department. This includes all papers including reviews, letters, commentaries, abstracts, news pieces, in fact material of any kind because as he says “to do so costs us nothing but failure to do so costs us heavily!” The NIHR measure the frequency with which they are mentioned and organisations and departments who fail to do so will not receive further funding. So we now need you to remember two things before you press the “submit” key OPEN ACCESS and BRC!! Please see an example of appropriate acknowledgement below;

‘This research was [fully funded/co-funded]/[supported] by the NIHR Cambridge Biomedical Research Centre (BRC-1215-20014). The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care’

1 Please also list the co-funder.

2 Your research is supported if:

- You’re a PhD student supervised by a BRC Theme /Programme Lead
- You’ve used BRC infrastructure but no BRC funding.
Andrew Grainger and Andoni Toms, with the help of Martin Graves and Joshua Kaggie, are exploring new MRI techniques such as ZTE and MR fingerprinting in musculoskeletal patients, with interesting new findings. These methods may help reduce the need for CT and radiation for patients. Dr Kaggie and Mr Stephen McDonnell have also been imaging sheep stifles (≈ knees) that have stem cells labelled with gold and iron, looking at where these cells are going in the knee with photo-acoustic imaging and MRI. They will hire a portable scanner for early next year for the in vivo portion of their study.

MRI Update

By Professor Martin Graves and Dr Andrew Priest

The MRI facilities in CUH have benefitted from several direct collaborations with GE Healthcare as well as funding from Addenbrooke’s Charitable Trust (ACT) and CUH for a major programme of system upgrades. Unfortunately, due to the global semiconductor shortages progress is slower than we planned by hopefully by mid-2022 we will have a fleet of state-of-the-art MR systems comprising four at 1.5 T and two at 3 T. The decision to perform a comprehensive upgrade was made because several the systems had exceeded the recommended 10-year lifetime and we were very keen to ensure that our clinical and research activities could leverage several of GE’s recent technical developments in MRI under the AIR™ branding. The first has been the development of ultra-flexible AIR™ Coils that use special ‘INCA’ conductors and highly miniaturised pre-amplifiers. These coils are like a thick blanket that can be laid over the subject or even wrapped around anatomy such as the leg or arm. The comfort and lightweight features of these coils has been greatly appreciated by patients as well as the Radiographic team.

The Hyperpolariser group have also worked with the coil developers to create the world’s first $^{13}$C AIR™ Coil for use in hyperpolarised imaging. The second major development is AIR™ Recon DL. This is a new MR reconstruction algorithm that uses deep learning to improve the apparent signal-to-noise ratio (SNR) and spatial resolution of 2D MR images as well as reducing data truncation artifacts. We have performed a 12-week evaluation of the prototype DV 29.1 software that uses AIR™ Recon DL and many of the Radiologists have been stunned by the improvement in image quality. Figure 1 shows the comparison of two single-shot fast spin echo images of the thorax and abdomen using the standard reconstruction method and AIR™ Recon DL. The improved SNR can be traded for either higher spatial resolution images or for reduced acquisition times. The software also introduced modification to the zero echo-time (ZTE) silent MRI pulse sequence in the form of oZTEo, an acquisition and post-processing algorithm that visualises cortical bone in 3D. Figure 2 shows an example of the oZTEo in a patient with a fracture scaphoid. Currently AIR™ Recon DL only works for 2D images but GE plan to release a version that works with 3D and non-Cartesian acquisitions in 2022. Another system upgrade that has taken place recently is the installation of a 32-channel multi-nuclear receiver array that is required to use the higher density coil arrays planned for $^{13}$C and other multi-nuclear studies.

Figure 1. Breath-hold single shot fast spin echo (SSFSE) of the thorax and abdomen showing the standard reconstruction on the top and the AIRTM Recon DL reconstruction on the bottom. Note the improved SNR and definition in the AIRTM Recon DL images.
Figure 2. Scaphoid fracture (arrowed). A) shows a T1-weighted image, b) a coronal proton density fat suppressed image and c) the ZTE, zero echo time pseudo-CT image.

We play a key role in the UKRIN-MAPS project, which has developed a comprehensive suite of functional renal imaging methods, harmonised across GE, Philips and Siemens scanners; this enables multi-centre renal studies, e.g., into chronic kidney disease, aiming to establish urgently needed clinical imaging biomarkers.

Other internal MRI developments include pulse sequences for breath-hold quantitative T2-mapping for prostate luminal water imaging (LWI), continued development of high-resolution blood-suppressed vessel wall imaging as well as the bulk extraction and anonymisation of very large volumes of imaging data to support machine and deep learning algorithm developments and evaluation. We have also established whole-body MRI protocols for both routine clinical imaging (e.g., myeloma, advanced prostate cancer) and several PET/MR research projects.

In terms of awards, Ed Peake, our recently appointed MR Physicist, has won the 2021 joint IPEM and the Worshipful Company of Scientific Instrument Makers (WCSIM) essay prize and IPEM Gold Medal. Andrew Priest has successfully passed the American Board of MR Safety (ABMRS) Magnetic Resonance Safety Expert (MRSE) examination held a few weeks ago and is now entitled to use the post-nominal MRSE (MRSC™). Martin Graves was awarded the 2021 Crues Kressel award from the Society of Magnetic resonance Radiographers and Technologists (SMRT) for his outstanding contribution to MR Radiographic teaching.

Open Access Reminders

As you all know, since HEFCE’s policy change, in order for any publications to be eligible for the REF they must be made Open Access. We must make sure our department is 100% compliant.

The university has a team in place dedicated to making sure this process is as simple as possible and has now linked Open Access with Symplectic Elements so that publication data will be filled automatically from databases.

When a journal accepts your paper for publication, upload it through Symplectic before you sign any copyright or Open Access agreements.

See this page for more information on how to submit accepted publications: http://osc.cam.ac.uk/open-research/symplectic-elements-deposit-pilot/depositing-articles-symplectic-elements.

You can also contact the open access team directly at: info@openaccess.cam.ac.uk
1) Work we are doing to improve PET acquisition and reconstruction in challenging clinical scenarios

2) Work we are doing with novel tracers. New approaches to image and characterise advanced Adrenocortical Carcinoma with PET

Phantoms are routinely used in Nuclear Medicine to assess scanner performance. Traditional phantoms with fillable shapes do not replicate human anatomy. 3D-printing has somewhat overcome this by creating phantoms that reproduce anatomical structures and can be filled with radioactive materials. A limitation to this approach is that fillable cavities reproducing small anatomical structures such as the pituitary or the adrenal glands are not easy or close to impossible to build. To overcome this limitation, Dan Gillett in Nuclear Medicine has been looking at ways to 3D print structures using radioactive resins to obtain single use radioactive phantoms (Gillett, D et al. EJNMMI Physics, 2021, https://doi.org/10.1186/s40658-021-00383-6). A resin containing Fluorine-18 was used to 3D print the helix pictured here. The radioactive object was imaged with PET CT. This work opens the way for printing radioactive phantoms of tiny structures such as pituitary, adrenal, or other tumours from anatomical imaging data. These innovative phantoms will allow to optimise PET acquisition and reconstruction vital to several ongoing projects the Department is involved in in collaboration with CUH Nuclear Medicine, the University Department of Endocrinology and the WBIC.

A study to evaluate PET/MR with $[^{18}\text{F}]$-CETO in patients with advanced adrenocortical carcinoma (ACC) has started recruiting and we have imaged 3 patients. This tracer targets specific biochemical features of tissues of adrenocortical origin. This BRC funded pilot in collaboration with the University Department of Genetics and CUH Endocrinology (Dr. Ruth Casey PI) is addressing sensitivity of this agent to detect and characterise the biology of primary and metastatic ACC. This is the first application of this tracer in this setting. It follows on the successful development and use of $[^{18}\text{F}]$-CETO for imaging Primary Aldosteronism which has been led by Prof. Mark Gurnell (Endocrinology) and Prof. Franklin Aigbirhio (WBIC). ACC is a rare endocrine cancer with poor prognosis and no effective treatment options available to patients other than surgery. Improving the accuracy of staging by developing more sensitive imaging methods is most desirable. There may be future implications for therapy in these patients linked to this project. There is need for more effective systemic treatments in patients with advanced ACC who are not eligible for surgical management. There is evidence in several cancers that radiolabelled drugs that target specific cell populations such as in this case, can be utilized to deliver lethal radiation to kill tumour cells. Although this is premature, there are examples in the literature of agents similar to CETO that have been utilised for this kind of approach. If we are successful in showing specific targeting of ACC lesions with $[^{18}\text{F}]$-CETO we will explore the development of new drugs labelled with suitable radionuclides to use for targeted radionuclide therapy.
Correlating Radiomic Features of Heterogeneity on CT with circulating Tumour DNA in Metastatic Melanoma

By Dr Andrew Gill et al

The analysis of circulating tumour DNA (ctDNA) concentrations in blood plasma and the radiomic analysis of tumour images have both been used to provide information about cancer progression. The purpose of this study was to assess a link between these two different modalities in order to determine whether results from one can be used to predict outcomes from the other.

Our team, from radiology and oncology, evaluated the interrelationship between circulating tumour DNA mutant allele fraction (ctDNAmaf), obtained by targeted amplicon sequencing and shallow whole genome sequencing, and radiomic measurements of CT tumour heterogeneity in patients with stage IV melanoma. ctDNAmaf and radiomic observations were obtained from 15 patients with a total of 70 CT examinations. Principal component analysis was used to define a radiomics signature that predicted ctDNAmaf independently of lesion volume.

These results, published in Cancers, show that radiomics features can predict ctDNA levels in patients with metastatic melanoma even when controlling for confounding influences such as tumour volume. This establishes the potential for new biomarkers of tumour progression that could combine the specificity of ctDNA assays with the high-resolution spatial information obtained by imaging.


Dr Andrew Gill:

Dr Andrew Gill is a Research Associate and Clinical Scientist (Physics), specialising in magnetic resonance imaging and computational image analysis.

Now working in Prof Evis Sala’s Radiogenomics & Quantitative Imaging group, his current research interests include the design of software to aid habitat detection in tumours, supporting a process for MRI-tissue sample alignment using 3-D printed moulds. He has also recently written a software pipeline to facilitate the radiomic analysis of tissue image textures.

Figure: (top) Schematic of experimental design; (center) radiomics signature from 5 best features predicts ctDNA from melanoma tumours in 70 CT exams from 15 patients; (lower) blue dots show simulated data; pink dot is from measured data and is well into the tail of distribution indicating statistical significance.
Radiogenomics and Quantitative Imaging

COVID-19: AIX-COVNET Collaboration

⇒ Fighting a Pandemic with Medical Imaging and Machine Learning: Lessons Learned from COVID-19. Published in: SIM NAews

⇒ Machine Learning for COVID-19 Diagnosis and Prognostication: Lessons for Amplifying the Signal While Reducing the Noise. An editorial, in which we consider how researchers can contribute positively to the COVID-19 machine learning community, Published in: Radiology: Artificial Intelligence:

⇒ Common pitfalls and recommendations for using machine learning to detect and prognosticate for COVID-19 using chest radiographs and CT scans. An extensive review, identifying systemic pitfalls in the machine learning for COVID-19 where the research team make detailed recommendations to ensure that future models are held to a high standard and are of potential clinical utility. Published in: Nature Machine Intelligence!

Liver Cancer

A first study on Hepatocellular carcinoma (HCC) study entitled “Robustness of radiomic features in CT images with different slice thickness, investigated the radiomic feature robustness of liver cancer comparing liver tumour and muscle” has been published in Scientific Reports (2021). In this study, we analysed the robustness of CT radiomic features extracted from images of the same tumours with different reconstructed slice thickness, and we provided guidelines for radiomics studies in heterogeneous cohorts.

Top: Illustration of a 2D CT slice of a case used to compare the values of the radiomic features with reconstructed slice thickness of 2mm (left) and 5mm (right) for HCC tumour (red) and muscle tissue (blue). Bottom: Example of one radiomic feature (first order Energy) values for 5mm vs 2mm before (left) and after (right) correcting its volume dependency. Adapted from Nature Scientific Reports 2021
Cardiovascular Update

By Professor Martin Graves, Dr Jonathan Weir-McCall and Dr Andrew Gill

Welcome Aleksandra!

We are pleased to welcome Aleksandra Bartnik to the department. Aleksandra is a cardiothoracic surgical registrar who is taking time out of training to join us as an MD student studying the role of cardiac MRI in selecting patients for pulmonary endarterectomy for chronic thromboembolic pulmonary hypertension. She hopes to identify markers that will identify those most likely to benefit from this complicated procedure and identify patients at increased risk of persistent/recurrent pulmonary hypertension post-operatively. To do so she will be examining >400 patients over 5 years with pre- and post-operative MRI looking at markers of right ventricular and pulmonary remodelling.

Above, Aleksandra Bartnik

The last 4 months have seen the start-up and close of several studies. We completed recruitment to the international prospective PRECISE randomised control trial. This trial has recruited 2,200 patients to determine if cardiac CT combined with computational fluid dynamics (FFRct) reduces the number of normal invasive angiography studies, compared with a testing approach using stress testing. We have also completed recruitment to the C-MORE trial, which involved whole body MRI to look at the longer-term impact COVID might have on the heart, lung, brain, kidneys and liver.

Above, PRECISE

Andrew Gill has been working on the protocol for the upcoming PRIZE trial - a placebo-controlled trial of zibotentan in microvascular angina (Led by the University of Glasgow). As part of this he has enabled the Gadgetron reconstruction environment on both Papworth MR scanners and installed Dr Peter Kellman’s (NHLBI, Bethesda) research sequences for quantitative myocardial perfusion measurement and other advanced cardiac techniques. In parallel with their incorporation within the trial, these advanced techniques are being translated into clinical care at Papworth. Preparations are still underway for hyperpolarized Xenon imaging of pulmonary patients at Papworth, in collaboration with Prof Jim Wild (University of Sheffield).

A multi-parametric MR imaging study of mesothelioma patient tumours is also currently in the analysis phase and results will be submitted for publication soon.

In MRS we have started the The “SODium valproate to preVEnt stroke” (SOLVE) study with Dr Nick Evans from the stroke unit, looking at carotid stenosis causing stroke or transient ischaemic attack (TIA) to determine whether HDAC9 inhibition with sodium valproate can reduce inflammation within carotid plaque. This project utilises high resolution 2d and 3D MRI together with 4D MRA to investigate plaque inflammation.

NIHR Publication Reminder

All research with NIHR Cambridge BRC/CRF funding and/or support that is due for publication must be reported to the NIHR via the NIHR Cambridge BRC communications team. You can do this via an online form on the NIHR Cambridge BRC website. https://cambridgebrc.nihr.ac.uk/your-research/

The NIHR via your local comms team must also be notified of press releases 14 days in advance. Failure to do so may result in financial penalties.
Dementia is a growing public health problem affecting more than 7% of the population over 65 years of age in the United Kingdom and posing an increasing cost burden to healthcare and social care systems. Anatomical brain imaging with CT or MRI is an important first step in the diagnostic workup but is insensitive in early stages of dementia because structural changes, such as loss of brain volume in certain regions of the brain, develop late in the disease. Imaging of brain metabolism provides more reliable and earlier diagnosis by demonstrating reduction in glucose turnover that is evident prior to clinical symptoms, well before the structural changes. $^{18}$F-FDG-PET is currently the most established metabolic tool for diagnosis and helps differentiate Alzheimer's disease from other forms of dementia by showing reduced glucose metabolism in specific brain regions. However, relatively limited availability of PET equipment, high cost, and the use of radioactive ligand hamper its use in routine clinical practice.

We are currently running a pilot project funded by the Evelyn Trust aiming to examine if deuterium metabolic imaging (DMI) could be used to probe glucose metabolism in dementia. DMI is an emerging imaging method which is based on magnetic resonance spectroscopy but uses a receiver coil modified to detect deuterons instead of protons. DMI can be performed using a standard MRI scanner but requires a modified coil operating at deuterium frequency, and for our project we are using a custom coil built in house by Dr Josh Kaggie. The participants are given deuterated glucose solution orally before the scan and signal from D-glucose is obtained. As an additional advantage, DMI provides spectroscopic information about glucose metabolites such as D-lactate and D-glutamate/glutamine. Our preliminary results show that at the current stage of development the method may not be precise enough to detect regional changes in glucose metabolism that help differentiate specific types of dementia, but spectroscopy traces obtained from the entire brain point towards increased D-lactate and reduced D-glutamate/glutamine signal in dementia patients, suggesting a shift towards non-oxidative glucose metabolism. It remains to be seen if this information could be of diagnostic value, and if further technical refinement of the coil or scanning at higher field strengths could improve spatial signal localisation.

We are currently working hard to improve communication and development within the department, and a big part of that work requires feedback from you. We are open to hearing any feedback or suggestions you have. If you’d like to provide feedback on anything department related, in addition to coming to see us, you can now provide it through a feedback form located on the Internal website via [http://radiology.medschl.cam.ac.uk/internal/feedback/](http://radiology.medschl.cam.ac.uk/internal/feedback/)

We want to hear from all of you in relation to all achievements, updates, news and any information you would like to share with the Department.
For this term’s newsletter, the Department of Radiology PIs have been kind enough to contribute to a new reward and recognition section, in which they will highlight members of their team to praise for going above and beyond expectations at work and thank them publically for their efforts. One particular individual per research group has been spotlighted.

Congratulations to all nominees and thank you to everyone in the department for your incredible contributions to research at Cambridge!

Johanna Field Rayner - Nominated by Professor Fiona Gilbert

We would like to nominate Jo Field Rayner who is the research coordinator on the breast studies for her incredible effort and tireless work on two of the largest studies in Cambridge – the BRAID and MyPeBS studies. Overall Jo has recruited well over 1000 women into MyPeBS and at least 850 into the BRAID trial, has done a fantastic job in training our new staff member, Jamie Pack and other staff across various sites. She was featured in the recent ITV news piece (‘10,000 women needed for trial that could revolutionise breast cancer treatment’) showcasing the studies and subsequently dealt with over 700 email enquiries after it was broadcast – a true trooper supporting research!

Dr Ramona Woitek—Nominated by Professor Ferdia Gallagher

The group nominates Dr Ramona Woitek for her recent publication in Cancer Research. This paper has shown that treatment response can be monitored after only a few days using hyperpolarised carbon-13 MRI in breast cancer, identifying those who go on to have a complete response at surgery. This publication has built on Ramona’s previous work showing that more aggressive breast cancers produce higher levels of lactate. Ramona’s hard work and dedication to the project has made this possible - the project has involved collaborating with a wide range of clinicians and scientists in Radiology and the Breast Unit.

Dimitri Kessler—Nominated by Dr Joshua Kaggie

I nominate Dimitri Kessler for our Musculoskeletal research recognition award: Dimitri is a recent PhD student who has managed to start and complete a study in patients on exercise-related changes within MRI. During his PhD, he was also able to publish on new machine learning techniques that integrated MRI data for automated image processing of musculoskeletal tissues. Dimitri was able to coordinate a collaboration between Brookfield’s and Norwich for the recruitment of patients. Dimitri was funded by GSK, who having recently finished his PhD, is now taking up a position in a nearby image analytics group.

Dr Lorena Escudero Sánchez —Nominated by Professor Evis Sala

We would like to nominate Dr Lorena Escudero Sánchez, who has worked exceptionally hard to set up the NCITA Cambridge image repository node, which is already storing over 30,000 radiological imaging sessions for different cancers, mainly ovarian cancer and COVID19 patient images. She has recently been working on adapting a deep learning-based method for automated segmentation of ovarian cancer, developed at the Department of Applied Mathematics and Theoretical Physics, into the CLARA tools that can be used in the XNAT repository. Her research work on radiomics analysis is mostly focused on liver and kidney cancer.

Dr Nikita Sushentsev—Nominated by Professor Tristan Barrett

We are delighted to nominate Dr Nikita Sushentsev for his dedication and hard work on the MISSION-Prostate project, which has resulted in acceptance of his article in the prestigious Nature Communications journal. Of course, this work is only possible with contributions from the entire team within our department and others, but Nikita as lead author has been exceptional in his co-ordination of such diverse specialists and is deserving of extra recognition.
Hi, I am Chang Sun, a PhD student studying cardiovascular biomechanics and imaging. Time flies quickly; the start of my PhD at four years ago feels like yesterday. With the help from my supervisors Prof Graves, Dr Teng, Prof Gilbert, and many other colleagues, I was able to finish my thesis recently. My research has been focused on the coronary vessel reconstruction using intravascular imaging modalities (i.e. angiogram and intravascular ultrasound). With the coronary model, we assign material properties to different vascular components and perform biomechanical simulation. We are particularly interest in the influence of coronary bending and modelling strategies to the mechanical results. We found bending significantly increase the stresses at luminal regions and the structure-only model is a time efficient modelling strategy with good accuracy.

On the other hand, we have also been working on the MR sequence development for cardiac imaging and the MR attenuation correction for the PET/MR system. We were implementing the 3D stack-of-spirals and stack-of-stars sequence, which has good potential in free-breathing cardiac imaging. To improve the accuracy of MR attenuation correction in the lung, we created pseudo-CT images from the thoracic ZTE images. The pseudo-CT based attenuation correction reduced SUV error in the lung by 3% compared to the standard manufacture’s (Dixon) method.

Besides research, my student life at the Department of Radiology has been very pleasant. The senior students and student representatives are easily reachable and friendly. We had a lot of fun in chatting, sports, parties and celebrations. During the lock down, we formed a cohesive team and were mutually supportive in life and research. I guess the pandemic has distanced us from each other, but also consolidate our bonding in a different way. After the lock down, we finally could reunion and also meet the new students. It feels great to see the new faces in our Department, and moving on to the new routine life.
Sarah Hickman, PhD Update

I have thoroughly enjoyed my PhD evaluating artificial intelligence in breast cancer screening supervised by Professor Fiona J Gilbert. As part of my PhD, working with Richard Black, Andy Priest and Nick Payne, we have created a large mammographic imaging database as well as collaborated with numerous commercial and academic institutions to test their AI tools using this database. The next phase of this project will involve further development of the database, testing new AI tools, as well as investigating the setup of prospective testing and future adoption of AI within the NHS for breast cancer screening. If you would like to read more about our work please see the following publications arising from this project:


Maria Delgado Ortet, PhD Update

It’s no secret that every PhD journey is full of uncertainties, but landing mine right before the pandemic outbreak has added a few more extra twists and turns to it. A biomedical engineer by training, I started in the Department of Radiology Radiogenomics and Quantitative Imaging Group in January 2020, under the supervision of Prof Evis Sala and co-supervision of Prof Richard Prager, head of the Engineering Department.

The purpose of my PhD is to ensure the accurate correlation and integration of radiomic and genomic data –radiogenomics– by working on multiscale registration in high-grade serous ovarian cancer (HGSOC). HGSOC is the female tract fatal malignancy with the worst prognosis and the highest mortality rate. To correlate CT-derived radiomic features with the corresponding tissue genomic analyses, my research focus has been on registering CT scans to real-time ultrasound for in-vivo sampling and to resected lesions for ex-vivo image-guided tissue sampling. In fact, despite the pressure on the healthcare system during my thesis, the sampling of a few cases has been aided with these novel technologies.

While biopsies for the diagnosis of HGSOC are taken under ultrasound guidance, radiomic habitats are derived from CT scans. In order to accurately sample the distinct CT radiomic habitats, I took part in the technical development and piloting of real-time ultrasound-guided habitat-targeted multimodal fusion biopsies in collaboration with Canon Medical Research Europe (CMRE). After the pilot cases, the needs from our end were identified and I approached them as an intern with the CMRE ultrasound software team during summer 2021. Having acquired the perspective from both sides was key during my internship, in which I developed a real-time measure of registration accuracy as well as a registration algorithm with more degrees of freedom, devised to improve the registration for deformable tissues like the omentum –a usual metastatic site for HGSOC patients.

The other main research stream has been developing lesion-specific 3D-printed moulds of ovarian cancer tumours for image-guided tissue sampling. Four pilot cases have already happened in the Cambridge University Addenbrooke’s Hospital and a collaboration with the Department of Obstetrics and Gynaecology at Inova Women’s Hospital (Virginia, USA) has just started. This work was presented during the Cambridge Imaging Festival 2021 and my talk was awarded the best data blitz. This project was nourished by previous work in the department on patient-specific moulds for patients undergoing radical nephrectomy and I assisted in the modelling and printing of these for the WIRE and MISSION clinical trials.

Throughout these rather unusual couple years, I’ve been lucky to meet, e-meet, network, learn and do fascinating research with many supportive colleagues from the Department, the University and external collaborations. I can’t wait to launch my third year, carry on with the work done so far, endeavour new projects, develop new skills through more artificial intelligence work and grasp how pre-pandemic research and conferences were!
Congratulations Professors!

A huge congratulations to Professor Tomasz Matys, Professor Martin Graves, and Professor Tristan Barrett on their incredibly well-deserved professorships!

**Professor Tomasz Matys:**

Tomasz Matys is a University Lecturer at the University of Cambridge and Honorary NHS Consultant Neuroradiologist at CUH NHS Foundation Trust.

Having graduated from the Medical University of Bialystok in 1999 and obtaining PhD in medical sciences/pharmacology in 2001, Professor Matys was involved in basic neuroscience research as a Postdoctoral Fellow at the Rockefeller University in New York, USA (2002-2005) and at the University of Leeds (2005-2007). His basic radiological training (as a NIHR Academic Clinical Fellow) and specialist Neuroradiology fellowship were undertaken in Cambridge. He was appointed to the current University Lecturer position in 2014.

His main research interest is Neuro-oncology with a particular interest in using MRI and PET for characterization of the extent of primary and secondary brain tumours, predicting treatment response and prognostication. His other interests include meningioma and pituitary gland imaging, multiple sclerosis and neuroanatomy.

**Professor Martin Graves:**

Martin Graves is a Professor of Magnetic Resonance Physics at the University of Cambridge, and Honorary Consultant Clinical Scientist and Head of MR Physics and Imaging IT at CUH NHS Foundation Trust.

Professor Graves graduated in Physics with Medical Applications from the University of London in 1984, and obtained his MSc in Medical Electronics and Physics from St. Bartholomew’s Hospital. He obtained his PhD in 2010 from the University of Cambridge and has since received a number of prestigious awards.

His current research interests are in the development of MR imaging, reconstruction, and analysis methods for morphological and functional body imaging, including cardiovascular and oncology applications. See more information about Professor Graves in his spotlight later on in the newsletter!

**Professor Tristan Barrett:**

Tristan Barrett is a University Lecturer at the University of Cambridge and Honorary NHS Consultant Radiologist, specialising in multi-parametric MRI techniques for identifying and characterising prostate tumours and genito-urinary radiology.

Professor Barrett graduated from St. George’s Hospital Medical School, London in 2002. After completing his Royal college of Physicians examinations, he worked as a Visiting Fellow at National Institutes for Health, USA in the Molecular Imaging Program from 2005 to 2007, and trained in radiology at Addenbrooke’s Hospital, Cambridge.

He became a Fellow of the Higher Education Academy, and has co-authored books for medical students and residents. On completion of radiology residency, he undertook a fellowship in body imaging at the University of Toronto, Canada, collaborating with Masoom Haider in prostate imaging projects.
The Biography and Inauguration of Professor Martin Graves

By Professor Martin Graves

My interest in medical imaging started when our A-level computer science group had a visit to the science museum in 1980 and I saw the first CT scanner developed by Godfrey Hounsfield. The mathematics of the Radon transform used to reconstruct the images fascinated me. My interest in the application of physics to medicine grew and when it came to making our choices for University, I applied to the various institutions offering physics with medical applications. One of these, Queen Elizabeth College in Kensington, part of the University of London, ticked all my boxes and I started there in October 1981. My “fate” in MRI or NMR Imaging as it was then sealed in May 1982 when that month’s issue of Scientific American came out. On page 78 there was an article by Ian Pykett on NMR Imaging in Medicine. By the time I reached page 91 my future was clear.

After graduation in 1984 I was fortunate enough to be offered a job working in the Department of Medical Electronics at St. Bartholomew’s Hospital in London as a Probationary Basic Grade Physicist where they had installed one of the first commercial NMR Imagers, an 800 G (0.08 T) vertical field air-cored resistive magnet developed by M & D Technology in Aberdeen. The company was a spin-off from the original NMR imaging research and development work performed in the University. I developed several electronic devices for use with the system such as a fibre-optic cardiac gating system and a system for monitoring magnetic field drift, before starting work on a home-built variable-field NMR spectrometer for investigating how relaxation times varied with magnetic field strength. My contribution was the development of a microprocessor (Z80) based pulse programmer that I used as the project for my part-time MSc in Medical Electronics and Physics that, at the time, was run by Barts Medical School. In 1985 I attended the fourth Society of Magnetic Resonance in Medicine (SMRT) annual meeting, conveniently held at The Barbican, just behind Barts. At the meeting Philips were talking about their 1.5 T superconducting system that was planned to be installed at Guy’s Hospital and I remember thinking that would be a great opportunity.

In 1987 the Division of Radiological Sciences at the United Medical and Dental Schools (UMDS) of Guy’s and St. Thomas’s advertised a research associate working on NMR imaging studies of blood flow, funded by the Wellcome Trust. My experience of NMR imaging at Barts helped in my being appointed in the November and I spent the next two years working on methods for the quantitative measurement of blood flow and developing methods for phase contrast magnetic resonance angiography (MR) on a 1.5 T Philips Gyroscan. This is where I also got my first experience in pulse sequence programming using Philip’s PPWRF environment that ran off a 10 MB removable disk pack on a Digital Equipment Corporation (DEC) VAX-11/730 computer.

In 1989 the funding finished, and I was appointed as an NHS Senior Physicist in Medical Computing, where I had responsibility for managing the computing resources of the Guy’s Hospital Department of Clinical Physics and Bioengineering, or more affectionately known as Cynical Physics and Pseudo-engineering! As the computing resources increased, I started to drift away from MRI (I forget when the nuclear part of NMR Imaging got dropped due to the negative connotations with nuclear radiation) and I was fortunate that my next job was advertised as a Principal Physicist in MRI at St. George’s Hospital in Tooting (even deeper into South London).

I started at St. George’s in October 1992 working on a newly installed GE Signa 1.5 T, after a massive fund-raising effort led by Professor John Griffiths. St. George’s were particularly interested in cardiovascular imaging, and I was involved in evaluation of several prototype pulse sequences including the GE segmented k-space fast cardiac cine imaging sequence, known as Fastcard, and evaluation of coronary MRA using a prototype spiral imaging sequence and 4-channel phased array cardiac coil as shown in Figure 1. I also attended my first GE EPIC pulse programming course at St. George’s. It was during this time that I also became involved in establishing and teaching the physics for the UK’s first MSc in MRI for Radiographers with St. Martin’s College in Lancaster (later to become the University of Lancaster).
Having been in post as Professor of MR Physics for just over four months I am working on establishing my own academic MRI: From Picture to Proton, in addition I have contributed to several book chapters. 

In 2011; honorary membership of the Royal College of Radiologists (RCR) in 2016; senior fellowship of the International Society for Magnetic Resonance Imaging (ISMRM) in 2018; the IPEM academic gold medal in 2018; fellowship of the British Institute for Magnetic Resonance Imaging (BIR) in 2019; and the Crues Kressel award from the Society of Magnetic resonance Radiographers and Technologists (SMRT) in 2021. I have now co-authored over 220 publications as well as several books, including the award-winning MRI: From Picture to Proton, in addition I have contributed to several book chapters.

Over the years I have contributed to many imaging studies including MRI of the body, led by Professor David Lomas, cardiac MRI led by Dr Richard Coulden, and carotid atheroma imaging led by Professor Jonathan Gillard. It is this latter work where I have spent considerable time developing methods for high resolution imaging of the carotid vessel wall and plaque. Figure 2 shows a range of example images acquired over the last 25 years. I have also co-supervised many physics and clinical PhD students. Over the years our research in MRI has yielded a large number and range of publications, even more impressive in my mind that it has been achieved using clinical MRI systems carefully balancing limited research time with the ever-growing demands of the clinical service. It is however, thanks to the stewardship of Professors Adrian Dixon and David Lomas as well as Clare Sims, for many years the MRI Unit Manager, that funds have been secured to enable the acquisition of new MRI systems and upgrades to the existing fleet of systems so that we have always had access to cutting edge commercial MRI technology on which to perform our development work.

In addition, also thanks to the generosity of Adrian and David, and the University of Cambridge allowing part-time PhDs, I started my part-time PhD work in 2004 on the development of interactive MRI, finally receiving the degree in 2010. Not the most conventional way to do things but I got there in the end. I am also very grateful for the other honours and awards that have been bestowed upon me for my various professional, teaching and academic contributions to MR physics including: fellowship of the Higher Education Academy (HEA); fellowship of the Institute of Physics and Engineering in Medicine (IPEM) in 2011; honorary membership of the Royal College of Radiologists (RCR) in 2016; senior fellowship of the International Society for Magnetic Resonance Imaging (ISMRM) in 2018; the IPEM academic gold medal in 2018; fellowship of the British Institute of radiology (BIR) in 2019; and the Crues Kressel award from the Society of Magnetic resonance Radiographers and Technologists (SMRT) in 2021. I have now co-authored over 220 publications as well as several books, including the award-winning MRI: From Picture to Proton, in addition I have contributed to several book chapters.

Having been in post as Professor of MR Physics for just over four months I am working on establishing my own academic group with Radiology, whilst also supporting and collaborating in the activities of the NHS. We also have a very long standing, thirty years in 2020, collaboration with GE Healthcare in Cambridge and I will continue to develop and leverage that relationship in cardiovascular MRI as well as in oncology and musculoskeletal applications. In collaboration with the NHS, I am working to clinically evaluate a range of academic and commercial Artificial Intelligence (AI) algorithms within Imaging.

Finally, I am very grateful to Professor Fiona Gilbert and the Regius, Professor Patrick Maxell, for appointing me to this ad hominem professorship in Magnetic Resonance Physics. Whilst I have the privilege of using the title of Professor, I know that this has only been achieved through not only my own but also the hard work and dedication of my scientific and clinical colleagues as well as the outstanding PhD students that I have had the privilege to help supervise. I am also very grateful to the support of my family who have put up with my absences from home due to the many late nights and weekends working. I am extremely proud of the achievements of both my “work” children (aka PhD students) and my real children Sophie, Katie and Chloe and my wonderful grandson Theodore (aka Ted). Thank you all for supporting my career and I hope that I have made at least a small contribution to supporting yours.
Introducing Ahmed Mohammed—Senior Radio Pharmacy Technician

My name is Ahmed Mohammed. I’m Egyptian so I assume that I’m one of the descendants of the pharaohs.

I had my MSc degree in Biochemistry from Port-Said University, an Egyptian university. Also, I have more than 6 years of experience in the field of Radiopharmaceuticals production and quality control analysis especially with [18F] based radiotracers as I was a Senior radiochemist at the radiopharmaceuticals production facility, Children’s Cancer Hospital of Egypt (CCHE-57357). This hospital is considered as the largest hospital in the middle east specialized in paediatric oncology and it mainly depends on donations from Egyptians and Arabs and serves all patients for free, so it is considered one of the most successful charity projects in Egypt and the Middle East.

On the 18th of March 2021, I started my work as a Senior Radio Pharmacy Technician within Prof Kevin Brindle group, CRUK Cambridge Institute, and Radiology Department, Cambridge University. My main role through the project is focusing on developing the GMP radiosynthesis and quality control methods for $^{18}$F-C2Am, the new radiotracer for cell death imaging. In parallel to that, I am participating with the team of Radiopharmaceutical Production Unit (RPU), Wolfson Brain Imaging Centre (WBIC) in the GMP production of radiopharmaceuticals mainly labelled with F-18 for use in imaging studies in patients and healthy volunteers according to standard operating procedures and in compliance with regulatory licences. As well as participating in the routine quality control checks on radiopharmaceuticals according to the standard procedures.

Introducing Syafiq Ramlee—PhD Student

Hi. My name is Syafiq, and if you’re wondering how to pronounce that, it’s just sha-feek! Yes, a complicated spelling for what sounds quite simple... (please don’t stone me).

I come from Brunei – a small country on the other side of the world – and grew up in the jungle for most of my life. In April 2021, I joined the department and the Radiogenomics and Quantitative Imaging Group as a new PhD student under the supervisions of Professor Evis Sala and Dr Luigi Aloj. Previously, I obtained my MSc in Radiation Biology at Oxford and my BEng degree in Biomedical Engineering at UCL. Now in Cambridge, I’ve rounded out the golden triangle of Loxbridge universities and my long-in-the-making sinister Easter egg hunt is now complete.... (perhaps now you can stone me) (I’m kidding, please don’t).

All jokes aside, I have a particular scientific interest in molecular imaging. My engineering background at UCL led me to develop an image analysis pipeline for quantitative PET. I also had a few stints in radiochemistry: I interned for a few months at a PET radiopharmacy facility back in Brunei and was a member of Oxford’s Radiopharmaceuticals and Molecular Imaging Group (Cornelissen Lab).

Along with tackling impostor syndrome (don’t we all?), the bulk of my PhD years will deal with the application of PET and radiomics (“radiomics on PET” and “PET on radiomics”). This is increasingly relevant given some of the recent commendable strides molecular imaging has made in radiology (with quantitative and targeted functional imaging etc.). Fittingly, Addenbrooke’s Hospital is also home to emerging $^{89}$Zr-immuno-PET trials (targeting CD8 and CA-125 markers) and a wealth of existing untapped PET data ($^{68}$Ga-PSMA etc.), and I’m super keen to discover what we can unravel with these datasets!

Outside the course, my hobbies include photography and graphic design. I’m a visual learner and firmly believe there is “more to a picture than meets the eye” – which is why radiology also appeals to me greatly!

Hope I get to see all of you around :)
Introducing Jamie Pack—Clinical Trial Coordinator

I graduated from University of Lincoln with a Bachelor of Science in Sports and Exercise Science in 2014. I have worked at Royal Papworth for 6 years before moving to the University of Cambridge. I started as a Physiotherapy Assistant Practitioner before joining the Research Team in 2018 as a Clinical Trials Coordinator for two COVID follow up studies (one with a focus on immunology, and the other monitoring the long term effect of COVID).

I have worked on surgical, anaesthetic and most recently COVID clinical trials at Papworth. I am now settling in with the BRAID and MyPeBS team, getting up to speed and progressing well with recruitment. Outside of work I enjoy most sports, exploring some of the UK’s national beauty’s – normally coincided with a trip to any local brewery I scout out.

Introducing Tanvi Rao—PhD Student

Great to meet everyone! My name is Tanvi Rao and I am a first year PhD supervised by Evis Sala and advised by Lorena Escudero, Katja DePaepe, and Matt Hoare. My research will explore radiogenomic methods to improve treatment pathways for Hepatocellular Carcinoma (HCC). We will examine co-registration between in-vivo/ex-vivo images of resected livers.

This research will also focus on developing biologically validated imaging biomarkers of tumor heterogeneity and transcriptional/genomic subtypes for better characterization of the immune microenvironment. Exploring these global multi-variable correlations will enable the development of cross-validated models.

Prior to Cambridge, I studied Biomedical Engineering with a minor in Computer Science at Georgia Tech in Atlanta. My research and internships during this time focused on minimally invasive device design for interventional radiology procedures with a flavour of bioinformatics. I then spent 3 years working across the United States as a consultant focused on data and digital transformation initiatives at various life science clients, including large pharmaceutical companies, hospitals, health insurance companies, and medical device companies.

In my free time, I like to travel, hike, bake, play chess, and sing. I’m always up to grab a coffee or a pint – so please reach out anytime!

The main goal of my thesis work was to provide a deeper understanding of primary breast cancer pathophysiology, using simultaneous PET and multiparametric MRI to characterize functional processes of the tumor microenvironment. In particular, my work aimed to explore relationships between imaging biomarkers of tumor vascularity measured by dynamic contrast-enhanced (DCE) MRI, cellularity using diffusion-weighted imaging (DWI), and hypoxic status using 18F-fluoromisonidazole (18F-FMISO) PET. Likewise, I assessed associations between imaging biomarkers of tumor hypoxia, cellularity and vascularity and, imaging metrics of peritumoral and ipsilateral whole-breast vascularity.

During the last year of my PhD, I explored correlations between functional PET/MRI and immunohistochemical (IHC) biomarkers of tumor hypoxia and vascularity. My PhD work concluded with an investigation on the utility of tumor afferent feeding vessels, an indicator of peritumoral vascularity, to monitor and predict pathological response in breast cancer patients undergoing neoadjuvant chemotherapy (NACT).

Last and most important, my PhD was the best opportunity I have ever had to get to know myself better (my capabilities, strengths, and weaknesses) since it was the first time living abroad alone for a long period of time. Cambridge was a great school to go to, and its proximity to London made it even more interesting. My PhD also left me fantastic memories with wonderful people who have become dear friends, and with whom I wish to stay in contact with for the years ahead. Special thanks to Laura Lechermann, Roido Manavaki and Fiona Gilbert.
My Career Progression: Laura Lecherman
A story to inspire PhD students

Unlike most other department members, I am a radiochemist and I have a passion for metal-chemistry. I studied Chemistry (B.Sc.) and Radiopharmaceutical Chemistry (M.Sc.) where I found my way into cancer research and molecular imaging by using radioactive metals, in particular positron emission tomography (PET) isotopes such as Gallium-68 and Copper-64, to synthesise tracer for the imaging of different targets in vivo. Before starting my PhD in Cambridge I gained most of my post-graduate research experience at the Technical University of Munich (TUM), the Peter MacCallum Cancer Centre in Melbourne and at the University of Melbourne.

My PhD project under the supervision of Prof Ferdia Gallagher investigated the labelling of immune cells using the PET radiometal zirconium-89 for in vivo cell tracking. Zirconium-89 has neither been used for research nor clinically in Cambridge before I started my PhD. Therefore, my project has also laid the foundation for future clinical work with the experience of zirconium-89 gained during this project, assisting in the knowledge regarding handling, waste management, radiation safety and risk assessment.

During this project I have set-up my own study including ethics and established radioactive cell culture in a sterile environment in our lab which has also opened other avenues of research. Most importantly, I have also expanded my own knowledge and expertise working with a multidisciplinary team of academics, clinicians and GSK as an industry partner and funder, which has been a great privilege.

I also tried to take advantage of my time as a PhD student to learn several new techniques used in cell biology and immunology. A typical lab week of mine can consist of working at the bench, in a sterile hood and mostly shielded behind a lead wall. When the radioactivity gets delivered, I spend a day doing radiosynthesis including quality control of the tracer. In addition, I do my cell culture and/or join the immunologists for the extraction of immune cells from fresh blood. Cells are then labelled several times and post-labelling analysis in regards to cellular retention of the radioactivity, viability and other properties follows.

Sometimes I also join the physicists for phantom scans with some of my radiolabelled cells and get involved in 3D printing for some experiments which is great fun and which I enjoy as a change to doing a lot of radiochemistry and cell labelling.

During my PhD, we closely collaborated with immunologists in Cambridge and also with people at the University Medical Centre in Amsterdam (VUmc) who have been a great support and experienced source of know-how for my project set-up. I am currently continuing some of the cell labelling work and in vivo evaluation of some of the approaches established during my PhD at the VUmc in Amsterdam as part of my Postdoc. The transition from PhD to Postdoc for me was very smooth and literally happened from one to the other day as I was fortunate to be able to continue my PhD project as a Postdoc. Given the impact of the pandemic and the constraints that were imposed on lab work I envision to let some of the preliminary PhD work come to fruition in terms of application in vivo and also its clinical translation.

In the future and during my postdoc, I will combine my expertise in developing radiotracer for immune cell labelling and imaging and learn new skills for the phenotyping of immune cells and assay based analysis in preparation for the clinical translation of cell imaging in patients.

I have vastly enjoyed working with clinicians, physicists and immunologists in my project, where I was able to gain a more clinical perspective in general but also in particular within my own research. Looking back at the past 5 years, I had a very steep learning curve and this was only possible by surrounding myself with people outside of the area of my expertise. For me it was certainly a path worth taking and I will always remember my time as a PhD student in Cambridge fondly and the great team I was able to work in and with.
The Cambridge Zero team would like to invite all students at the University of Cambridge, postgraduates, and undergraduates alike, to fill out this 6-minute survey so we can better understand your needs and wants within climate change education and sustainability.

The aim is to improve and tailor what’s on offer and understand your attitudes to the way climate change and sustainability are embedded in your courses, extra-curriculars and daily College and university life. This is an opportunity to let your voice and opinions be heard, and to shape the future of climate change and sustainability at the University of Cambridge.

There are two main parts to the survey:

- **Section 1:** Learning about the climate crisis and action you can take at the University of Cambridge
- **Section 2:** Living a sustainable life at the University of Cambridge

You can also sign up to participate in some future interviews and focus groups on the topics.

Please follow the link to complete the survey; there is a prize draw amongst the respondents for a £50 book token so you can get your hands on some of the books you have been eyeing during lockdown. The first 50 people to respond to the survey will have their name entered twice into the draw! The survey closes on August 16th, shortly after which the winner will be contacted.

We look forward to hearing your opinions and improving the possibilities within climate change and sustainability at the University of Cambridge.

General enquiries: info@zero.cam.ac.uk
Please join me in congratulating Doreen Lau, a previous PhD student from the Department of Radiology, on being one of three finalists for the ESMI award for excellent PhD thesis—a phenomenal achievement! The ESMI award committee were thoroughly impressed by Doreen’s complex and valuable work on “Imaging Biomarkers of Response to Immune Checkpoint Inhibition in Melanoma”... so much so that she has been invited to present her work within the scope of a dedicated “ESMI PhD Award webinar”. Congratulations Doreen!

PhD in Radiology (October 2016 – July 2020)

PhD Supervisor(s): Prof. Ferdia Gallagher (Radiology), Prof. Klaus Okkenhaug (Immunology), Dr. Pippa Corrie (Oncology) and Prof. Edwin Chilvers (Medicine)

Doreen Lau was a Cancer Centre PhD scholar, funded by Cancer Research UK and Cambridge Trust to work on the clinical translation of molecular imaging for cancer immunotherapy. During her PhD, she collaborated with various stakeholders across hospital departments, academic institutions, and AstraZeneca to develop imaging methods and biomarkers of treatment response to immune checkpoint inhibitors. Her work demonstrated potential in using a broad range of molecular imaging techniques to probe for early structural and functional changes in metastatic melanoma following immune checkpoint inhibition. These included multiparametric MRI imaging of tumour microstructure, heterogeneity and vascularity changes following immune cytotoxic killing, SPECT imaging of radiolabelled immune cells for non-invasive detection of immune cell activity and tumour infiltration in patients, and intravital imaging of antigen-specific T cell migration and behaviour in preclinical models to recapitulate the human disease.

Several of Doreen’s work had been published as first and co-authors in good impact journals e.g. Journal for ImmunoTherapy of Cancer, Nature Communications, Frontiers in Immunology, Cancers. She had presented her research as oral papers at various international meetings and was invited as guest speaker at scientific talks e.g. the Immune-Image Consortium Annual Meeting. Doreen’s research in molecular imaging and cancer immunotherapy was a success. She had won several international prizes, travel grants and internal grants during her PhD including the William G. Negendank Young Investigator Award (First Place) by the International Society for Magnetic Resonance in Medicine (ISMRM) Cancer MR Study Group and Women in Molecular Imaging Network Scholar Award by the World Molecular Imaging Society. Most recently, Doreen was selected as the Top 3 finalists for a prestigious PhD Award from the European Society of Molecular Imaging.

Following the completion of her PhD in July 2020, Doreen had embarked on postdoctoral research at the University of Oxford. Continuing with her passion for molecular imaging in cancer immunotherapy, Doreen has been developing multi-modal imaging tools for studying tumour immunity at the preclinical level in Oxford and further developing her expertise in cancer immunology, chemical biology, and preclinical imaging. Doreen has been recently appointed as a Postdoctoral Research Scientist at the newly established Centre of Immuno-oncology in Oxford. She is excited to be working closely with immunologists on developing immuno-oncology, whereby molecular imaging will play a crucial and complementary role with other cutting-edge tools in understanding mechanistic cancer immunology and fine tune treatment strategies in cancer.
The PPIE Team Needs A Postdoc!

Public and Patient Involvement and Engagement (PPIE) is now a vital component of all research grant applications, which is driving our efforts to include patients and members of the public in all aspects of our research. If performed well, PPIE can be very rewarding – having a group of patients telling you your project is awesome is a great confidence booster!

We are planning to establish our own radiology patient/public panel to help us review documentation and offer insights into proposed projects and indeed those already underway. This will help everyone in all stages of their research, but particularly in the initial stages of ideas development to fill that (rather large) box on subsequent grant applications.

In the future there will be regular events to champion the work that we are doing in Radiology. You may be asked to help by demonstrating some work in action, or to give a short presentation. This is a perfect opportunity to practise explaining complex techniques in an understandable way – you never know when you might be interviewed by the media!

We are still looking for a post-doc to join us to ensure that we have diversity across our group. If you’re interested in joining the PPIE team, please contact Karen Eley for more information!

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World Molecular Imaging Meeting 2021... two of the Top 100 Abstracts from our very own Laura and Nikita!

This year’s World Molecular Imaging Congress was anticipated with great excitement to take place in person in Miami, however this was cancelled last minute due to the pandemic. Nevertheless, Laura and Nikita attended the virtual event.

Dr Nikita Sushentsev, a 3rd year PhD student, was selected to give an oral presentation demonstrating the outcomes of his work with his supervisors, Dr Tristan Barrett and Prof Ferdia Gallagher. Nikita’s presentation was focused on the ability of hyperpolarised $^{13}$C-MRI to detect the emergence of a glycolytic cell population within intermediate-risk prostate cancer with high percentage Gleason pattern 4 disease. Clinically, the latter parameter is assessed in biopsy samples to evaluate the suitability of patients for active surveillance, and Nikita’s work has shown its strong correlation with tumour $^{13}$C-lactate production visible on MRI, which presents a non-invasive way to probe it. Furthermore, the increased $^{13}$C-lactate production in more aggressive lesion was explained by high mRNA expression of the enzyme lactate dehydrogenase and linked to the increased expression of lactate exporter MCT4 on tumour epithelial cells. Overall, this study, which scored high among the top 100 abstracts of the meeting, deepens our understanding of both the clinical use and fundamental biology of hyperpolarised $^{13}$C-MRI in prostate cancer.

Dr Laura Lechermann finished her PhD in the department of Radiology in 2021 and is currently continuing her project working with Prof Ferdia Gallagher as a Research Associate. During her PhD, Laura has worked on the development of radioactive tracer for cell labelling. At WMIC Laura presented cell labelling data with the lead compound in direct comparison to the state-of-the-art tracer which has shown promising and interesting results. This work was also scored high among the top 100 abstracts and was also recognized with a Poster Award.

Both Nikita and Laura were also awarded the WMIC Travel Award.
Radiology Restaurant Recommendations
By Sarah Hickman and Gabrielle Baxter

‘Inspired by the well known podcast ‘Off Menu’, Sarah Hickman and Gabrielle Baxter propose this seasons radiology menu for the best starter, main course, side dish, dessert and drink in Cambridge.

Starter - Aromi - Arancini
Main Course - Noodles ++ - Xiao Long Bao (soup) Dumplings
Side Dish - Carlos BBQ - Mixed Kabab (to share)
Dessert - Crosstown - Donuts
Drink - Cambridge Blue - Pint of IPA on tap

Update Your Information

In every newsletter, we will be requesting that all department members – including students - update three specific tasks for us:

1. Please ensure that your Symplectic account is up to date. We pull publication data for the website using this database, so to make sure your publications are up to date on the website.

2. The website pages on research teams and projects are out of date. Any material available for public consumption would be a great help!

3. Please send us any news or information about the projects you’re working on! We want to publicise the department’s achievements as much as possible, and get your names out there. The following are points of contact for research groups:

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Research Area</th>
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<tbody>
<tr>
<td>Ramona Woitek</td>
<td><a href="mailto:rw585@cam.ac.uk">rw585@cam.ac.uk</a></td>
<td>Breast imaging and oncologic imaging</td>
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<tr>
<td>Kelly Holmes</td>
<td><a href="mailto:Kelly.Holmes@cruk.cam.ac.uk">Kelly.Holmes@cruk.cam.ac.uk</a></td>
<td>Advanced Cancer Imaging Programme Manager CRUK</td>
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<tr>
<td>Tristan Barrett</td>
<td><a href="mailto:tb507@medschl.cam.ac.uk">tb507@medschl.cam.ac.uk</a></td>
<td>Multi-parametric MRI techniques for identifying and characterising prostate tumours</td>
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<tr>
<td>Joshua Kaggie</td>
<td><a href="mailto:jk636@cam.ac.uk">jk636@cam.ac.uk</a></td>
<td>Stem cell research for joint repair</td>
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<tr>
<td>Zhongzhao Teng</td>
<td><a href="mailto:zt215@cam.ac.uk">zt215@cam.ac.uk</a></td>
<td>The translational application of combination of in vivo medical imaging and mechanical analysis to assess the vulnerability of atherosclerotic lesions.</td>
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<tr>
<td>Tomasz Matys</td>
<td><a href="mailto:tm418@cam.ac.uk">tm418@cam.ac.uk</a></td>
<td>MRI and PET for characterization of the extent of primary and secondary brain tumours.</td>
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<tr>
<td>Yuan Huang</td>
<td><a href="mailto:yh288@cam.ac.uk">yh288@cam.ac.uk</a></td>
<td>Clinical-oriented risk assessment of CVD</td>
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<td>TBC</td>
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<td>Oncology and haematology trials</td>
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Congratulations to Mr and Mrs Payne!

After 12 years together it’s time to Congratulate Mr and Mrs Payne! Nick and Alice married at the Flint Room, Norwich on Friday 13th August. Their wedding day beautifully coincided with their 12th anniversary as a couple.

As Nick and Alice already had their house set up, instead of asking for a gift list they very thoughtfully encouraged guests who wanted to give something, to donate to the Cancer Research UK and raised a brilliant £1000 in total!

Please note that the donation page is still open to donations at https://fundraise.cancerresearchuk.org/page/mills-payne-alliance if anyone wanted to make some last minute donations.

Nick and Alice, we all wish you the very best for a fantastic married life together!
Wishing everyone a very Merry Christmas. As you prepare to head off for your festive break, please take time to relax and enjoy some family time and festive treats! See you all in 2022.

And Finally...

As many of you are already aware Maxine Carrillo, Leonardo Rundo, Laura Lechermann and Abby Burrage are a group of committed individuals that have recently achieved a University accredited Green Impact Silver Award, for their contribution to the wider-University environmental policy and submission of an extensive workbook.

Being part of our Green Impact team is an opportunity to raise awareness of the current issues that are negatively affecting our climate, eco-systems and quality of life, advocating for change and making tangible contributions to the University’s mission towards a more sustainable future. If you are an individual who is passionate about advocating and driving for change, being part of our team will give you the knowledge and support in doing so. Please contact Abby at (ab2754@medschl.cam.ac.uk) if you want to get involved!