CCRCB
Centre for
Cancer Research
& Cell Biology

ANNUAL REPORT 2014

We are exceptional

Queen's University
Belfast

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DIRECTOR'S INTRODUCTION

DAVID WAUGH, Director

The Centre for Cancer Research and Cell Biology (CCRCB) is the beating heart of a comprehensive cancer research programme in Belfast, focused on accelerating the delivery of scientific discovery to clinical application. CCRCB is the research hub of the Belfast Cancer Research UK Centre and the Belfast Experimental Cancer Medicine Centre (ECMC), operating in partnership with the Belfast Health and Social Care Trust. Our integrated clinical and scientific programmes address clinically unmet needs. Our principal objective is to promote evidence-based, innovative clinical trials in order to underpin improved patient outcomes in high incidence solid tumours of Gastro-Intestinal, Prostatic, Breast and Ovarian origin, and in specific Blood Cancers. Our unifying research theme is to develop translational outputs, in the form of biomarkers and/or novel therapeutic strategies that enable our Centre to be at the forefront of personalized cancer medicine in these prevalent diseases.

This report will capture the major activities and successes of CCRCB researchers over the 2014 calendar year. We hope that reading this brochure will inform you about the dynamic research environment within CCRCB and inspire you and your organization to support and/or partner with our teams to achieve our mission on behalf of cancer patients here in Northern Ireland and across the world.

Overview of Centre Strategy

The Centre's research strategy has been shaped to accelerate the translation of pre-clinical discovery to clinical application. Investigators operating in inter-disciplinary teams through our disease-focus groups are driving important pre-clinical discovery and knowledge relevant to improving patient treatment and care. Our partnerships with Biotech and Industrial partners, drawn from within and outwith Northern Ireland, are bridging the innovation gap by informing the development of products that will have future clinical utility. Through the expertise of the Northern Ireland Cancer Trials Centre, our Centre can then undertake the early clinical development of these products. As such, through this pipeline of collaborative research activity underpinned by core partnerships, CCRCB is now able to point to a substantive and exciting innovative early phase clinical trials programme operating within the Northern Ireland Cancer Centre and Belfast Health and Social Care Trust. Our continued focus remains on growing the scale of the trials portfolio, concentrating on increasing the number of biomarker-enabled patient enrichment and biologically-informed clinical trials that we can offer to patients in Belfast.

The Centre is well served by dedicated and talented senior academics that constitute an ambitious management team. Professor Kevin Prise and Professor Manuel Salto-Tellez have provided invaluable support in their capacity as Deputy Directors of the Centre, while simultaneously providing national and international leadership in Radiation Biology and Molecular Pathology, respectively. Our ECMC innovative clinical trials programme continues to go from strength-to-strength under the leadership of Professors Kennedy and Wilson, with a record number of patients electing to enrol in clinical research. In Professor Paul Harkin and Professor Tim Harrison, the Centre benefits from both academic and commercial expertise in biomarker discovery and cancer therapeutic development, enabling the wider scientific community within the Centre to also consider the pathway required to develop science towards clinical impact. Finally, three industrious Associate Directors in Professor Ken Mills, Professor Mark Lawler and Dr Dan Longley have worked continuously to update, refresh and innovate our undergraduate, postgraduate and post-doctoral training programmes. In addition, the Centre is fortunate to also call upon the leadership of Dr Karen McCloskey, a former Associate Director within CCRCB, who now serves as Director of the Gender Equality Office for the School of Medicine, Dentistry and Biomedical Sciences.

The Centre is now home to greater than 40 Principal Investigators, has a total annual grant income in excess of £14M, and is home to over 300 researchers. Our expansion has been underpinned by successful team working to develop competitive externally-funded research programmes, and by leveraging key academic-industrial-healthcare partnerships to populate our research pipeline. At the time of writing the Centre is preparing to welcome its third spin-in company, CV6 Therapeutics, a SME relocating from Southern California. This exciting development is a clear indicator of our ambition to interface directly with commercial parties and will hopefully encourage other companies to build a direct presence within our estate. Growing the entire academic and industrial life science sector in Northern Ireland also provides new employment opportunities for our postgraduate and undergraduate researchers. Our new Masters programmes are now providing comprehensive education in Translational Medicine, and in addition to our established PhD training programme, we are expecting to offer a new International Doctoral Training Programme beginning in late 2015.

Centre Programmes

CCRCB has served as a catalyst for change by focusing the resource leveraged from external funders to develop and grow essential activities that directly impact on patient care. Cancer Research UK (CRUK) remains a major funder of research activity within the Centre. The renewal of the Belfast CRUK Centre and ECMC programmes continues to underpin the core infrastructure for our Centre in developing state-of-the-art capabilities in molecular diagnostics, clinical trials and molecular pathology. The new five year research strategy of CRUK was announced during a visit to the Centre by their Chief Executive Harpul Kumar and Chief Clinician Professor Peter Johnson in May. Their future emphasis on supporting inter-disciplinary and translational research is firmly in line with our Centre's strategic vision and strengths, an opportunity that we hope will lead to greater funding going forward. Importantly, the research advances being realised in our programmes in Belfast is underpinning a closer partnership with other Centres in the CRUK network. For example, the ECMC network is ensuring that ALM-201, a novel anti-cancer drug developed by Almac Discovery in partnership with CCRCB and Queen's University is undergoing early clinical evaluation in Manchester and Newcastle-upon-Tyne, in addition to Belfast. This not only ensures that research discoveries made in Belfast are impacting on patient care nationally but also enables us to import other discoveries so that patients in Belfast can benefit from new improvements in treatment and care.

Financial funding from local charities and individual bequests continue to provide generous and welcome funding to the Centre. Leukaemia & Lymphoma NI, formerly the Northern Ireland Leukaemia Research Fund, celebrated their 50th Anniversary in 2014, and as an integral part of their future strategy, announced a £1.5M investment in Blood Cancer research within CCRCB. Over the past two years, the Centre has also benefitted from additional commitments of over £5M to grow our clinical research activities. For example, the Friends of the Cancer Centre is funding a number of vital clinical research staff that care for cancer patients enrolled on clinical trials within the Northern Ireland Cancer Centre. A further private bequest is currently funding a number of Clinical Research Fellowships in Medical Oncology and Molecular Pathology, with the dual purpose of supporting an immediate expansion of clinical trials research while also promoting a strong culture and commitment to research in our future Consultants.

Mr Allister Murphy (patient) with Professor David Waugh and Professor Joe O'Sullivan

Professor David Waugh (CCRCB Director) with Harpal Kumar (CRUK Chief Executive), Professor Peter Johnson (CRUK Chief Clinician), Jo Reynolds (CRUK Director of Centres, Operations and Reporting) and Professor Patrick Johnston (QUB President and Vice-Chancellor) at the launch of Cancer Research UK 5-year research strategy

The NI-MPL and Drug Discovery programmes, whose creation were a major highlight of 2013 continue to build momentum. The Molecular Pathology programme has secured a very high national and international profile and has been short-listed for late stage competition for £multi-million CRUK Accelerator and MRC Pathology Nodes grants in early 2015. The Drug Discovery Programme in partnership with Almac Discovery continues to advance several projects towards clinical development, with the expectation of two new agents entering early phase clinical trials by the end of 2015.

The Movember FASTMAN Centre of Excellence officially launched in July 2014. This £5M programme in partnership with Manchester is driving a multi-disciplinary programme to understand optimal approaches to improve radiotherapy and radionuclide response in prostate cancer patients. Attracting this programme to Belfast against heavy national competition further exemplifies the strength of team working and the value of the disease-focus groups in CCRCB. On the back of the successful award of FASTMAN, we have also had the ability to appoint new investigators and team leaders to our prostate cancer programme. Dr Karl Butterworth was appointed to a Lectureship in Translational Radiation Biology and his team will work in developing advanced disease models to model radiotherapy response in the prostate gland and its environs. Moreover, Dr Ian Mills, will join CCRCB in early 2015 to take on the leadership of the Prostate Cancer programme.

Centre Life

CCRCB has played host to a busy calendar of visits from academics and key stakeholders over 2014. Our annual Mitchell Lecture was delivered by Professor Mike Stratton, the Director of the Wellcome Trust Sanger Institute in Cambridge, and exemplified how a detailed understanding of the genome of specific cancers is revolutionalising the ability to deliver tailored therapies. Professor Lisa Coussens, a pioneer of immune cell targeting in the tumour microenvironment and Director of the Knight Cancer Center in Oregon, is the next honouree in this prestigious series. Professor Bob Brown from Imperial College London gave the 2014 Cancer Research UK Lecture, rounding up another successful year long seminar programme.

The Centre has also played host to a number of important patient information events across our major disease focuses. Paramount amongst these was a very successful patient information evening held in Riddell Hall in June 2014. Presentations from Professors Joe O'Sullivan, Anna Gavin, Tracy Robson and Richard Kennedy gave a truly impressive expose of the pioneering precision cancer medicine and population-based cancer research currently ongoing in Belfast.

Our academic and research staff have contributed significantly to many major cancer conferences and symposia. In addition to the major contribution of our young researchers to the Irish Association for Cancer Research and the Haematology Association of Ireland meeting, our postgraduates and research fellows have presented at a range of important conferences across the UK, Europe and the US. Members of our academic staff have also been prominent in both organizing and speaking at a range of key European and UK wide conferences, highlighting the increasing impact and dissemination of our findings across the cancer research community.

The life of the Centre has been enriched by a number of new academic appointments to consolidate our translational research programmes. In addition to the aforementioned appointments of Drs Butterworth and Mills, the Centre also made key Lectureship appointments to Dr Emma Evergren and Dr Melissa LaBonte, who were recruited from Cambridge University and the University of Southern California, respectively. Moreover, the Centre has made further significant clinical academic appointments. Dr Gerry Hanna has been appointed as a Consultant Senior Lecturer in Radiation Oncology and Dr Richard Turkington has been appointed as a Consultant Senior Lecturer in Medical Oncology. I would also like to give a special mention to Richard Wilson who was promoted to Professor of Cancer Medicine during the academic year in recognition of his international and national leadership of clinical trials in the UK. Richard was also recently appointed as Chair of the NCRI Clinical Steering Group for Colorectal Cancer, a significant personal honour and further recognition of the impact that research ongoing in Belfast is having across the UK. Our congratulations also go to Drs Mohamed El-Tanani and Frank Emmert-Streib who left CCRCB during the academic year to take up Professorial appointments in external academic institutions. We wish them every success in their new locations and offer our thanks to them for their significant contribution to CCRCB during their tenure with us.

Professor Joe O'Sullivan, Professor Richard Kennedy, Professor Tracy Robson, Dr Anna Gavin, Professor James McElnay and Professor David Waugh at the Patient Information Evening held in Riddel Hall

Research Awards

The Centre takes great pride in recognising the outstanding achievements of our staff in 2014. A synopsis of the major and notable awards of our staff includes:

• Professor Patrick Morrison received a CBE in the 2014 New Years Honours for services to Healthcare in Northern Ireland. Professor Morrison, a Consultant in Clinical Genetics and Honorary Professor of Human Genetics at the CCRCB in Queen's University, is an expert on hereditary cancers and neurological disorders. His published papers include work on the recognition and delineation of new phenotypes in human genetic disorders, which details the internationally recognised work that has taken place in the genetics service over the last 25 years. His international collaborative work has allowed cutting edge translational research to take place in the genetics service, helping a very large number of patients to have world class treatments early on the NHS giving a great cost-saving to the Trust, as well as significantly improving patient care. Professor Morrison has published over 300 papers on hereditary cancer disorders and has particular interests in hereditary breast, ovarian and renal cancers.

• Professor Richard Wilson was appointed in February 2014 as the new chair for the National Cancer Research Institute Colorectal Clinical Studies Group, replacing Professor Will Steward from Leicester. Richard has been a member of the Colorectal CSG since 2007, and the chair of one of its four subgroups (for adjuvant and advanced disease) since 2009. This appointment will provide increased access for QUB and other locally based colorectal cancer investigators to bring their research ideas forward to the national arena. The NCRI CSGs represent a central component of the framework for cancer research across the UK, providing the primary route through which new ideas for cancer clinical trials (and much translational research) are developed. There are currently 21 NCRI CSGs, including 15 cancer site-specific groups and six cross-cutting groups.

• Professor Kevin Prise was appointed to the CERN Medical Applications International Strategy Committee.

• Professor Manuel Salto-Tellez was elected a Fellow of the Royal College of Physicians of Ireland (RCPI).

• Dr Karl Butterworth was elected to the committee of the UK Association for Radiation Research.

• Dr Kyle Matchett was awarded the position of Fellow of the Higher Education Academy (FHEA) by The Higher Education Academy. Kyle has also been selected to sit on the Junior Irish Association for Cancer Research (IACR) Council, representing Queen's University Belfast.

• Dr Richard Turkington received an ASCO Merit Award at the American Society of Clinical Oncology conference in Chicago on 30 May – 3 June 2014. This is the first time that the award has been given to a trainee from Belfast. Richard's abstract was entitled 'Association of a DNA Damage Response Deficiency (DDRD) assay and prognosis in early stage Oesophageal Adenocarcinoma.'

• Dr Michael Moran was awarded with the medal for best scientific presentation at the 2014 annual meeting of the Irish Otolaryngology - Head and Neck Surgery Society, which took place on 10 - 11 October 2014.

• Ms Mihaela Ghita was awarded a highly competitive fellowship to attend the NASA Space Radiation Research School being held at the Brookhaven National Laboratory, USA.

Professor Manuel Salto-Tellez, Fellow of the Royal College of Physicians in Ireland

FOCUS GROUPS

Advanced Radiotherapy

ALAN HOUNSELL
Chairperson

Focus Group Membership:	
Dr Karl Butterworth	Dr Conor McGarry
Ms Mihaela Ghita	Dr Stephen McMahon
Dr Gerry Hanna	Ms Angela O'Neill
Dr Simon Horn	Dr Sarah Osman
Dr Suneil Jain	Professor Joe O'Sullivan
Dr Raymond King	Professor Kevin Prise
Dr Ciara Lyons	Dr Phil Turner
Dr Karen McCloskey	

The Advanced Radiotherapy Group is developing new translational research programs with the application of advanced radiotherapies as an underlying theme. Common areas which the group are working on include the applications of image-guided therapies, ion beam therapies and radionuclide approaches. The work includes basic research, preclinical and trial activity in these areas feeding into Centre themes around biomarker development and combinations of advanced radiotherapies with new molecularly targeted agents. The group is a multidisciplinary team having strengths in radiation physics, radiotherapy physics, cell biology, mathematical modelling, radiation biology, neuro-oncology, bladder physiology, and radiation oncology. The membership includes basic scientists, clinical scientists and clinicians. Additional members are invited along to meetings ad hoc depending on the focus of the current work of the group. Some aspects of the work are disease specific, with a particular focus around prostate cancer, but other interests are in breast, lung and brain tumours with some members also contributing to other focus groups such as breast, ovarian and genito-urinary/ prostate. The objectives of the Advanced Radiotherapy group are to maximise our input into Radiation Oncology Research and Development by:

- Developing new collaborative research programmes in Advanced Radiotherapies;
- Maximising the translational opportunities of our research;
- Inputting into new radiation-based clinical studies at the Northern Ireland Cancer Centre (NICC);
- Maximising training opportunities in radiation sciences;
- Initiating collaborative projects with other focus groups and external partners;
- Profiling radiation-based work at Queen's, nationally and internationally.

Our research covers three component areas:

- Radiation Biology;
- Radiotherapy Physics;
- Clinical Radiotherapy Research (including radiographer led research).

Breast

STUART McINTOSH
Chairperson

GERRY HANNA
Deputy Chairperson

Focus Group Membership:		
Dr Jackie Clarke	Dr Tong Lioe	Dr Eileen Parkes
Dr Alison Clayton	Dr Seamus McAleer	Professor Kevin Prise
Professor Paul Harkin	Dr Nuala McCabe	Professor Tracy Robson
Dr Jane Hurwitz	Dr Shane McKee	Professor Manuel Salto-Tellez
Dr Colin James	Dr Paul Mullan	Dr Kienan Savage
Professor Richard Kennedy	Dr Niamh O'Brien	Dr Laura Taggart
		Dr Stephen Walker

The Breast Cancer Focus Group is comprised of Oncologists, Surgeons, Pathologists, Geneticists and laboratory-based Scientists.

Its role is to facilitate the transition of novel biomarkers or therapies from the laboratory into prospective clinical trials run in the Belfast Experimental Cancer Medical Centre (ECMC) for the benefit of patients affected by breast cancer.

Clinical research:
Ultimately this focus group aims to translate laboratory research findings such as the identification of novel biomarkers or the development of novel therapies and incorporate them into prospective clinical trials. Significant progress has been made within the last year to establish the research infrastructure necessary to deliver such translational research.

Beyond the development of clinical studies from discoveries made within CCRCB, the Clinical Team in the Cancer Centre aim to provide a range of National and International Clinical Studies for patients with breast cancer. The Breast Cancer Focus group aims to provide strategic advice on the composition of the breast cancer clinical trials portfolio within the Northern Ireland Cancer Trials Network.

A summary of some of the studies is available at:
http://www.qub.ac.uk/research-centres/nictc/ClinicalTrials/Bycancertype/BreastCancer/

If you are a patient and are interested in taking part in a clinical trial, please speak with the Doctor who is responsible for your care.

Basic and translational research:
Breast cancer research within CCRCB is centred around the following themes:

- DNA damage signalling;
- DNA Repair;
- Hormone therapy resistance;
- Triple Negative and BRCA phenotypes;
- Angiogenesis;
- Biomarkers of response;
- Chemoprevention in women at high risk of breast cancer;
- Breast tissue response to ionising radiation.

Blood Cancers

KEN MILLS
Chairperson

Focus Group Membership:	Associate Membership:
Dr Lesley Anderson	Dr Claire Arnold
Dr Mark Catherwood	Dr Gary Benson
Dr Mohamed El-Tanani	Dr Robert Cuthbert
Dr Frank Emmert-Streib	Dr Mary Drake
Dr Gerald Gavory	Dr Damian Finnegan
Professor Tim Harrison	Dr Mervyn Humphreys
Dr Sandra Irvine	Mrs Amy Logan
Professor Terry Lappin	Dr Christine Macartney
Professor Mary Frances McMullin	Dr Scott McCloskey
Dr Melanie Percy	Dr Peter McGrattan
Dr Kienan Savage	Dr Michael Quinn
Dr Alex Thompson	Dr Oonagh Sheehy
Dr Lakshmi Venkatraman	
Dr Paul Winter	
Dr Shu-Dong Zhang	

The Blood Cancer Focus Group, formerly known as the Haematological Malignancy Focus Group, is directing its research programme at two main areas.

One area of focus in on the Myeloid Malignancies, a spectrum of diseases which covers Myelodysplastic Syndromes (MDS), Myeloproliferative Neoplasms (MPN), Acute Myeloid Leukaemia (AML), and Chronic Myeloid Leukaemia (CML). A significant percentage of patients with MDS, MPN or CML will eventually transform into an AML type disease. These diseases do occur at any age, but are predominantly a disease of the elderly and are associated with an unsatisfactory outcome for the majority of these patients. It is recognised that there is an unmet need for novel therapies that are less intensive therapies, and better tolerated, by this group of patients.

The second area of focus is around myeloma, also known as multiple myeloma, is a blood cancer arising from plasma cells and is considered to be incurable but treatable. Myeloma has a remitting-relapsing disease course, with remissions induced with steroids, chemotherapy, proteasome inhibitors or immunomodulatory drugs but these do not have long term benefit.

The Blood Cancers Focus Group is using different research strands can be used to identify and understand how therapies could be used in combination with other novel or cytotoxic therapies to improve the outcome of the patients within the myeloid malignancies and myeloma focus areas. These strands include using in vivo models of disease initiation and maintenance; the characterisation of the molecular responses to epigenetic, proteasome and other novel agents; using integrated analysis transcriptomics, genomic mutations, methylation and/or histone modifications profiles. The intertwined analysis of these strands will identify: markers of disease progression; re-purposed therapeutic agents; and identifying the molecular basis for a rationally designed therapeutic combinations based around an induced synthetic lethality concept.

The focus group encompasses a wide range of translational and clinical scientists, bio-informaticians, medicinal chemists, pathologists and academic clinicians from the CCRCB and the Belfast Health and Social Care Trust. The laboratory approaches are complemented by participation in national and international trials for MDS, AML, MPN and CML supported by the Leukaemia and Lymphoma Research Therapy Acceleration Programme (TAP) portfolio within the Experimental Cancer Medicine Centre.

Genito-Urinary/Prostate

DAVID WAUGH
Chairperson

Focus Group Membership:	
Dr Karl Butterworth	Dr Simon McDade
Dr Mark Catherwood	Dr Paul Mullan
Professor Peter Hamilton	Dr Declan O'Rourke
Professor Tim Harrison	Professor Joe O'Sullivan
Dr Suneil Jain	Dr Konstantin Panov
Professor Richard Kennedy	Professor Kevin Prise
Dr Adrien Kissenpfennig	Professor Manuel Salto-Tellez
Dr Dan Longley	Dr Steven Walker
Dr Darragh McArt	Dr Rich Williams
Dr Karen McCloskey	

Prostate cancer is a highly incident male cancer in Western society. This disease shows a very significant range of clinical presentation in men, stemming from indolent, slow-growing and asymptomatic cancers to lethal cancers which account for over 11,000 deaths in the UK each year. Within CCRCB, we are driving innovation in clinical practice through a focused inter-disciplinary programme, bringing forth key scientific discovery alongside the pursuit of clinical trials that facilitate rapid application of this knowledge. The award of the Movember UK Centre of Excellence to CCRCB in partnership with colleagues in Manchester is testimony to the strength and depth of our expertise in this disease. This £5M award over five years provides a very significant foundation on which we can further build the scale of our prostate cancer research programme.

Improving the early detection of the disease and enabling clinicians to make an improved diagnosis is critical for this disease. Consequently, many countries have used large population-based screening programmes to detect the disease. However, the inability to use this screen to reliably differentiate those "indolent" prostatic tumours from those that are "high-risk" and potentially lethal has resulted in many men opting to undergo unnecessary treatment. Our researchers are working to develop a molecular diagnostic test that can be used to provide a definitive diagnosis of high-risk disease in patients, enabling them and their clinician to make an informed choice of their future treatment.

Radiotherapy is a frequently used and very effective treatment for locally-aggressive, high-volume prostate cancers. Nearly 70% of patients are cured by radiotherapy. Our comprehensive scientific and clinical research team, under the framework of the Movember Centre of Excellence is working to acquire new knowledge that enhances the use of this treatment modality in patients. Our objectives are to use our expertise in pathology, genomics, bioinformatics and biomarker discovery to identify novel prognostic and predictive biomarkers that establish patients that are at higher risk of relapse after radiotherapy. Such discovery will enable us to develop diagnostic tests that can be used in conjunction with radiotherapy planning to identify patients who may require more intensive therapy. A further research team is seeking to define the biological basis of relapse in patients, with the intent of being able to characterize biologically-informed clinical interventions that can be used to increase the effect of radiotherapy in these patients. Additionally, we are seeking to identify improved ways to schedule the delivery of radiotherapy in order to enhance patient outcomes.

The integration of clinical and scientific research is very evident in the prostate cancer focus group. Professor Joe O'Sullivan and Dr Suneil Jain, working in partnership with Professor Kevin Prise and Dr Karl Butterworth are undertaking world-leading research in radionuclide therapy for advanced prostate cancers. Their translational research will provide new insights into the biological

mechanisms of Radium-223, the current class-leading drug. Our pre-clinical research outcomes will seek to extend and inform optimal use of this bone-targeted radiation, and complements the role of Professor O'Sullivan in leading the next generation of clinical trials of this agent, including the investigator-initiated trial ADDRAD.

Other major developments of note include the success of Dr McCloskey in obtaining significant MRC funding examining the basis of radiation-induced bladder toxicity. This important work, in collaboration with Professor Prise and Dr Jain, provides important knowledge that can be used to appraise, detect and seek to limit the toxicity stemming from pelvic radiotherapy, while at the same time delivering the optimal dose of radiotherapy to the patient.

Castrate-resistant prostate cancer remains currently incurable. Our researchers are working to define improved therapeutic strategies to treat this disease by providing an enhanced understanding of the genomics and biological pathways that are driving the progression of this stage of disease. Investigators are currently running several parallel studies, all primarily concerned with understanding different therapeutic options. Significant work has already been devoted to understanding the driving biology of PTEN-deficient prostate cancers, with emphasis on characterizing the clinical utility of therapeutics directed against DNA-damage stress (Kennedy, Prise), inflammatory markers (Waugh, Kissenpfennig and Salto-Tellez) or proteases (Williams, Mullan) as key exemplars.

Our progress in prostate cancer will be accelerated further by the forthcoming appointment of Dr Ian Mills to CCRCB. Ian has an ever-growing international reputation as a key opinion leader in prostate cancer, and I very much welcome his future leadership of the Prostate Cancer Focus Group from early 2015.

In summary, our goals are:

- To promote molecularly-stratified approaches that identify high risk patients;

- To characterize novel therapeutic strategies and accompanying biomarkers for molecular stratified, high-risk groups;

- To identify increasingly effective treatments of advanced castrate-resistant prostate cancer, especially in the context of bone metastasis;

- To characterize novel therapeutic strategies and biomarkers of radio-resistant prostate cancers.

Gastro-Intestinal

DAN LONGLEY
Chairperson

Focus Group Membership:		
Dr Aidan Armstrong	Dr Donna Graham	Dr Jane McClements
Professor Frederick Campbell	Mr Ronan Grey	Dr Simon McDade
Dr Marie Cantwell	Professor Peter Hamilton	Dr Damian McManus
Dr Declan Carey	Dr Claire Harrison	Dr Stephen McQuaid
Dr Mark Catherwood	Dr Caitriona Holohan	Dr Liam Murray
Dr Helen Coleman	Dr Jacqueline James	Dr Bode Oladipo
Dr Vicky Coyle	Professor Brian Johnston	Dr Colin Purcell
Dr Nyree Crawford	Professor Patrick Johnston	Professor Manuel Salto-Tellez
Dr Sonali Dasgupta	Dr Claire Jones	Dr Richard Turkington
Dr Michael Devlin	Dr Paul Kelly	Dr Sandra Van Schaeybroeck
Dr Philip Dunne	Professor Mark Lawler	Dr Rich Williams
Dr Martin Eatock	Mr Jack Lee	Professor Richard Wilson
Mrs Cathy Fenning	Dr Maurice Loughrey	Dr Shu-Dong Zhang
Dr Caroline Ford	Dr Darragh McArt	

The Gastro-Intestinal Focus Group has established a comprehensive collaboration between basic and translational scientists, clinician scientists, clinical academics, epidemiologists, oncologists, surgeons, pathologists, bio-informaticians and medicinal chemists from CCRCB, CII, School of Pharmacy and CPH in QUB and the Belfast Health and Social Care Trust (BHSCT). It addresses a number of important clinical problems, both in the early and advanced disease settings.

The main activity in this focus area is on colorectal cancer. This has built on the foundation of a basic/translational research group in CCRCB and an early and late phase clinical trials group in the clinical Cancer Centre, which have come together closely over the last few years. Scientifically, its major goals and achievements to date are the identification of novel targets, in particular for specific molecular subtypes of colorectal cancer (eg: mutant p53, Kras and Braf), and the identification of biomarkers of response to chemotherapy and targeted agents. Moreover, it is the ultimate goal of the focus group to translate this research into the clinical trials arena. For example, GI Focus Group members (Van Schaeybroeck, Lawler, Johnston, Salto-Tellez, Wilson) are leading Mercuric, one of the first early phase, European-wide, multi-Centre clinical trials based on science generated by the group and which is supported by European Union funds.

In addition to Mercuric, national and international clinical trials in GI cancer are led by investigators from the GI Focus Group including the innovative FOCUS4 adaptive clinical trial in metastatic CRC, the Add-Aspirin adjuvant CRC trial, the pre-operative Vitamin D CRC trial, the BALLAD adjuvant trial in small bowel adenocarcinoma and the Easi-Switch trial. Members of the group are also involved as clinical or scientific partners in other national and international phase I-III trials and are members of the NCRI Colorectal Clinical Studies Groups and Supportive and Palliative Care CSG as well as the EORTC GI group and International Rare Cancer Initiative Small Bowel Adenocarcinoma Working Group.

In the recent MRC Stratified Medicine call, CCRCB researchers (Lawler, Johnston, Salto-Tellez, Kennedy, Wilson) were successful in securing a Stratified Medicine Programme Grant entitled Stratification in COloRectal cancer: from biology to Treatment prediction (S-CORT). S-CORT is a ~£5M progrmame funded by the MRC and CRUK. It involves researchers at Queen's, Oxford, Leeds, Birmingham, Cambridge, London and Aberdeen, industry Partners including Almac Diagnostics and patient advocacy/PPI groups including the Northern Ireland Cancer Research Consumers Forum. S-CORT will develop new approaches for molecular stratification of patients with colon and rectal cancer, utilising a cohort of 2,000 clinically annotated samples from patients in clinical trials throughout the UK. CCRCB researchers are leading 3 of the 6 Workstreams in this Programme, emphasizing our central role in securing this prestigious funding.

Parallel to the long-standing and established research in the CRC arena, the group has started to expand its work in focused projects in other areas of gastrointestinal oncology, including oesophageal and gastric cancer, pancreatic cancer and small bowel cancer, building on clinical trials activity and previous research in these disease domains. The advancement of biobanking through the International Cancer Genome Consortiuum OCCAMS trial allows the collection of tissue and plasma samples to drive future translational research in oesophago-gastric cancer. Combined with the enhancement of radiotherapy practice through participation in the Neo-SCOPE and SCOPE-2 trials in oesophago-gastric cancer and the SCALOP-2 and PIONEER trials in pancreatic cancer, we seek to further develop multi-modality and personalized oncology in these disease sites.

Brain Tumours

KEVIN PRISE
Chairperson

Focus Group Membership:	
Dr Shahnaz Al Rashid	Dr Darragh McArt
Dr Roberta Burden	Ms Sandra McKillop
Dr Tom Flannery	Professor Manuel Salto-Tellez
Dr Gerry Hanna	Dr Perry Maxwell
Dr Jackie Harney	Professor Chris Scott
Dr Estelle Healy	Professor David Waugh

A Brain Tumour Focus Group has recently formed at CCRCB, in partnership with Brainwaves NI, to develop new translational research programs and critical mass in this area. Brain tumour research is a highly under resourced area of research (receiving less than 1% of funding from UK charities and health agencies) even though it is the leading cause of cancer deaths in children and adults under the age of 40, and outcomes for patients show little improvement over the past 20 years.

There are currently very few opportunities for brain tumour patients in Northern Ireland to be enrolled in national trials and a pressing need to build capacity and develop programs, which will improve patient outcomes.

The Brain Tumour Focus Group is a multidisciplinary team having strengths in Neurosurgery, Cancer Biology, Radiation Physics, Biology and Oncology, and Molecular Pathology. The membership includes basic scientists, clinical scientists and clinicians. The aim is to bring new researchers with experience in other areas or tumour sites together with existing clinicians and clinical scientists working with brain tumour patients to deliver new innovative translational research programs.

The focus group aims to develop 3 key strands of activity. Firstly to build translation programs based on existing research areas, which the group members are working on. This includes the development of targeting strategies against the protease Cathepsin S, which plays a role in invasive processes of brain tumours and may underpin resistance to radiotherapy, by optimising the use of radiation based therapies alongside Cat S inhibitors. Secondly, new molecular pathology analysis of a range of markers, in clinical samples from patients with primary and recurrent brain tumours, to allow the discovery of specific markers, which may be predictive for treatment outcomes and allow stratified approaches in patients. Finally we will develop clinical trial opportunities for brain tumour patients initially linking into national on-going trials but with the longer-term goal of translating the research of the focus group into new trial opportunities. The work will include basic research, preclinical and trial activity in these areas feeding into key themes in CCRCB including biomarker, drug development and combinations of advanced radiotherapies with new molecularly targeted agents.

Additional members will be recruited into the focus group and invited along to ad hoc meetings depending on the focus of the current research of the group.

The overall objectives of the Brain Tumour Group are to maximise our input into new approaches for treating brain tumours by:

- Developing new collaborative research programmes in Brain Tumour Research;
- Maximising the translational opportunities of our research;
- Inputting into new clinical studies for Brain Tumour patients at the Northern Ireland Cancer Centre (NICC);
- Maximising training opportunities in Brain Tumour research;
- Initiating collaborative projects with other focus groups and external partners;
- Profiling brain tumour related research at Queen's, nationally and internationally;
- Engagement with local patient groups and funding stakeholders.

Genomics

KEN MILLS
Chairperson

Focus Group Membership:		
Dr Tim Davison	Professor Mark Lawler	Dr Niamh O'Brien
Dr Ricardo De Matos Simoes	Dr Fabio Liberante	Professor Manuel Salto-Tellez
Dr Mohamed El-Tanani	Dr Darragh McArt	Dr Alex Thompson
Dr Frank Emmert-Streib	Dr Simon McDade	Dr Stephen Walker
Dr Gerald Gavory	Professor Mary Frances McMullin	Dr Kate Williamson
Dr Sandra Irvine	Dr Julia Miskelly	Dr Shu-Dong Zhang
Dr Jackie James	Professor Patrick Morrison	

The new cross-discipline Genomics focus group was formed during 2014 with the aims of:

- coordinating genomic activities across the CCRCB;

- identifying novel areas of collaboration for research and grant applications.

The members of the group are drawn from most of the other disease based focus groups and include laboratory scientists, bioinformaticians, clinical academics and researchers. The group has had presentations on epigenetics, bioinformatics analysis, genomic strategy and clinical genetic issues.

Overall, the group is aimed at improving patient outcomes through genomic or epigenetic based research activities.

Ovarian

RICHARD KENNEDY
Chairperson

Focus Group Membership:	
Dr James Beirne	Dr Joanne Millar
Dr Paul Buchanan	Professor Patrick Morrison
Dr Sharon Eddie	Dr Paul Mullan
Dr Aya El-Helali	Dr Niamh O'Brien
Dr Fiona Furlong	Dr Eileen Parkes
Professor Paul Harkin	Dr John Price
Dr Ian Harley	Professor Tracy Robson
Professor Tim Harrison	Dr Kienan Savage
Dr Nuala McCabe	Professor Manuel Salto-Tellez
Dr Karen McCloskey	Dr Claire Thompson
Professor Glenn McCluggage	Ms Laura Webster
Professor Sarah McKenna	

The Ovarian Focus Group is comprised of Oncologists, Gynaecological Oncology Surgeons, Pathologists, Geneticists and laboratory-based Scientists. Its role is to facilitate the transition of novel biomarkers or therapies from the laboratory into prospective clinical trials run in the Belfast Experimental Cancer Medical Centre (ECMC).

The major projects are:

• Targeting of FKBPL in ovarian cancer. The ALM201 peptide based drug was originally discovered and developed in Professor Tracy Robson's laboratory. In collaboration with Almac, the peptide will enter a Belfast ECMC supported clinical trial in advanced ovarian cancer in February 2015. The focus group has been active in developing biomarker strategies to allow stratification of patients for this study.

• Identification of Biomarkers for Ovarian Cancer Progression. The group has successfully profiled a series of clinical samples that represent the progression from normal tissue to malignant disease. This study has identified important molecular changes that may be detectable in blood as an early biomarker for ovarian cancer. These findings are being validated in a prospective tumour and blood collection study from high-risk patients which started in October 2013.

• Generation and Validation of Ovarian Cell line models. The group has developed a transcriptional-based methodology for the validation of tumour of origin and histological classification of ovarian cancer cell lines. Using this approach we have discovered that some ovarian cell lines commonly used for research are of non-gynaecological origin. We are in the process of developing new cell lines that more accurately reflect ovarian cancer biology.

Other areas of focus include:

• Development of biomarkers for SRC inhibitors

• Molecular subtyping of ovarian cancer.

ENABLING TECHNOLOGIES

Drug Discovery

TIM HARRISON
Lead Investigator

It has become increasingly clear that rather than being a single disease, cancer is a heterogeneous collection of diseases. In order to diagnose and treat cancer effectively, strategies for patient selection must be combined with the development of molecularly targeted therapeutics so that patients can receive the drug or combination of drugs which is most appropriate for the treatment of their disease, at the appropriate time. This approach necessitates the involvement of multi-disciplinary teams of basic researchers and clinicians, working within an infrastructure which allows for effective knowledge transfer.

The Drug Discovery group at the Centre for Cancer Research and Cell Biology (CCRCB) integrates both academic and industrial scientists to facilitate the translation of basic research discoveries into products which can ultimately derive value for patients. Working in close partnership with researchers from across the University and local hospitals, as well as with external researchers, the mission of the Drug Discovery group is to identify molecular targets which are relevant to disease and to develop strategies to modulate their function. Working closely with colleagues within the Centre (which includes the new Northern Ireland Molecular Pathology Laboratory and Northern Ireland Biobank), a strong emphasis will be placed on the early development of biomarkers, both to aid patient selection, and to establish that the drug is interacting with its intended target in patients.

Key to the progression of any drug discovery programme is the identification of a chemical compound (either small molecule or peptide/protein based) which can interact with the target. This drug "hit" is then optimised to provide a compound (often termed a Preclinical Candidate) which has the potency, specificity and pharmaceutical properties to interact with the target in humans at a therapeutic concentration which does not cause unacceptable side effects. This candidate molecule is further evaluated in pre-clinical development studies before progressing into clinical trials.

The capabilities of the Drug Discovery group include:

• Medicinal chemistry expertise in hit identification, hit to lead and lead optimisation;

• Biology expertise in target validation and assay development using multiple formats;

• Fragment screening (using a range of orthogonal biophysical techniques);

• Computer aided drug design and chemoinformatics;

• Bioinformatic expertise in data mining;

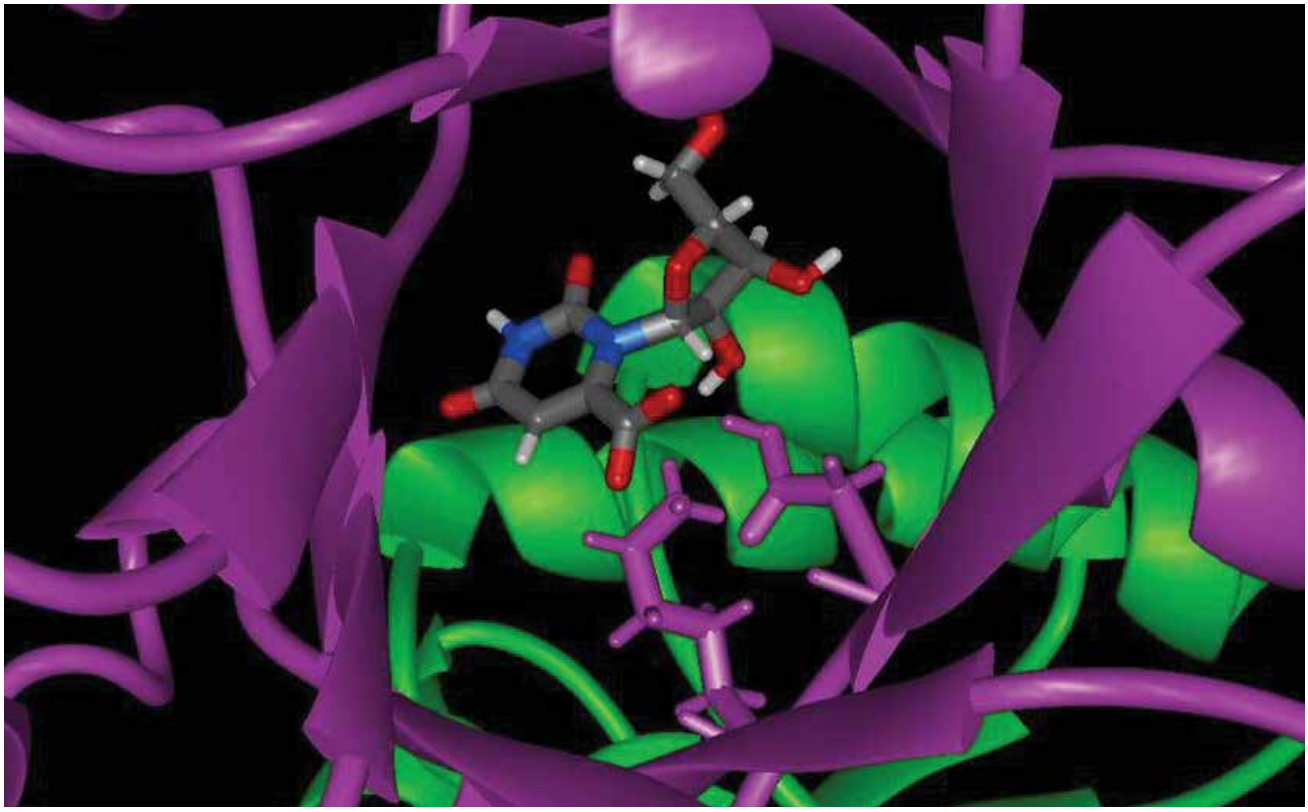
• Measurement and interpretation of Absorption, Distribution, Metabolism and Excretion (ADME) and physicochemical properties of molecules;

• State of the art compound storage and data management facilities;

• Pre-clinical and clinical project management;

• International network of collaborators and outsourced service providers.

Research is currently focussed on the discovery of inhibitors of ubiquitin specific proteases and other ligases involved in the ubiquitin-proteasome system, as well as other targets shown to be involved in disease progression and therapeutic resistance. There is also a strong interest in developing new strategies for the disruption of protein-protein interactions, using both small molecules and peptides, and in the development of novel protein-based delivery vehicles for the specific targeting of therapeutic agents to tumours. Based on these drug discovery capabilities, it is anticipated that molecules will emerge that may be developable into the next generation of clinical medicines. The projects originate both from the CCRCB and other Schools within QUB. The multidisciplinary environment within the Centre for Cancer Research and Cell Biology, itself situated within easy reach of other QUB research faculties and Clinical Centres, offers an exciting opportunity for chemists, biologists, bioinformaticians, physicists, radiographers and clinicians to combine their expertise to facilitate the drug discovery process. The ultimate goal is to develop new therapeutics which can make a real difference to patients lives.

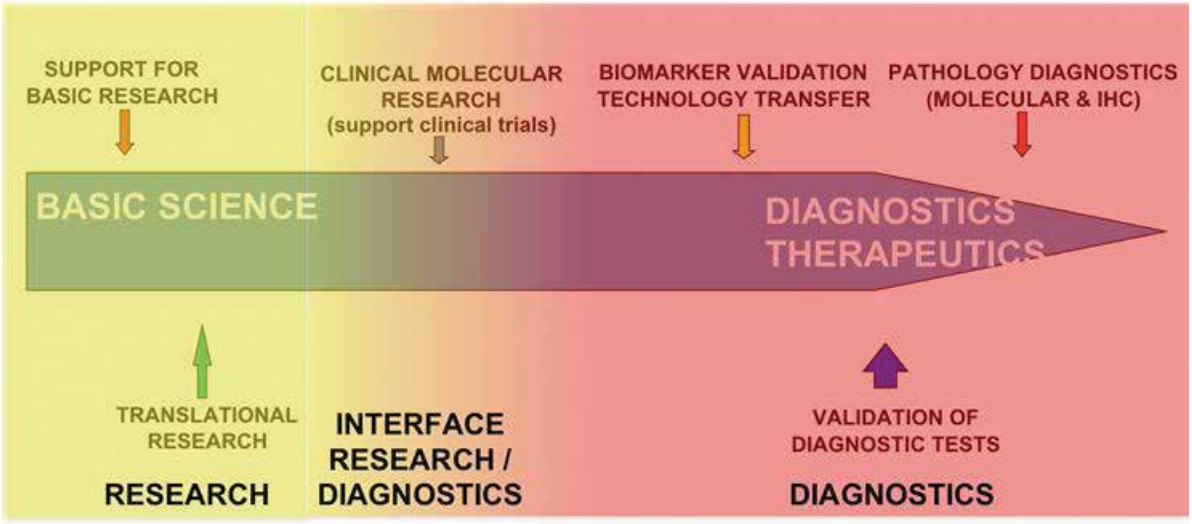


Molecular Pathology and Biobanking

MANUEL SALTO-TELLEZ
JACKIE JAMES
Lead Investigators

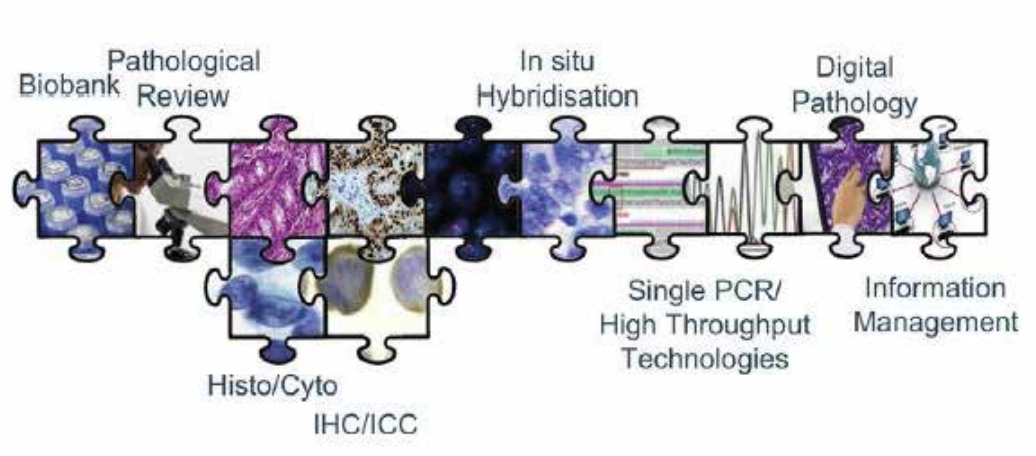
The Molecular Pathology Programme at CCRCB includes the Northern Ireland – Molecular Pathology Laboratory (NI-MPL), the Northern Ireland Biobank (NIB), the Digital Pathology programme and an incipient Comparative Pathology Group. NI-MPL is a self-contained, purpose-designed, nationally accredited hybrid operation capable of performing molecular pathology translational research and molecular diagnostics of solid tumours. The molecular pathology diagnostic unit is a partnership between CCRCB and the Belfast Health and Social Care Trust (BHSCT).

The technologies available in the basement hub are tissue and nucleic acid based, and include: tissue processing and embedding, conventional HE, manual and automated immunohistochemistry, various automated in-situ hybridization techniques, tissue microarrays, gel and capillary electrophoresis, Q-PCR, Next Generation Sequencing, laser capture microdissection and tissue bioimaging. This has been complemented with capacity to undertake high-throughput gene expression, methylation and gene copy number analyses, currently under validation. The laboratory environment ensures the proper SoPs, procedure manuals and QA/QC schemes to exercise its hybrid role. This laboratory is able to provide research support to basic scientists willing to understand the clinical relevance of their research findings, academic oncologists willing to have biomarker analysis or validation in the context of clinical trials, and all those in need of high-quality, affordable molecular diagnostic testing in oncology. Within the first 24 months, the programme has attracted research funding and diagnostic structural funds in excess of £1million, has validated some of the core molecular diagnostic tests and has taken part in some of the best published work of CCRCB.



Pipeline to deliver basic science discoveries into diagnostic and therapeutic end-points

Molecular Pathology research in Belfast involves academics at QUB and clinicians within the BHSCT Tissue Pathology laboratories and is underpinned by the new Northern Ireland Biobank. The NIB is funded by the Health and Social Care (HSC) Research and Development (R&D) Division of the Public Health Agency of the Northern Ireland and a local charity, the Friends of the Cancer Centre; it is also supported through the CRUK Centre grant. The NIB enhances translational cancer research through the quality assured collection of tissues and blood samples linked to reliable clinical and pathological data sets. The Belfast Experimental Cancer Medicine Centre (ECMC) previously had project-based but no systematic tumour tissue collection capabilities; however, the NIB has now put in place a robust infrastructure to facilitate tissue collections associated with phase I-III trials. The NIB complements clinical trial activities by establishing a unique targeted collection of tissues and bodily fluids, including normal and tumour tissues, for translational studies. The NIB is supported by a secure, information management system modified to include the integration of whole slide imaging and tissue microarray management. There is a close working relationship between the NIB and the NI Cancer Registry to ensure all samples processed for the bank are linked with robust de-identified clinical and pathological information collected from state of the art data repositories.



The integrated puzzle of pathology activities and technologies

Translational Bioinformatics and Imaging

PETER HAMILTON
Lead Investigator

The Cancer Bioinformatics group consists of scientists with expertise across a broad spectrum of subjects including Computational Biology, Computer Vision, Machine Learning, Data Integromics, and Systems and Network Biology. In the era of high-throughput big data generation in genomics and molecular oncology, quantitative computational methods are key for understanding disease processes, identifying druggable targets and developing targeted therapies in cancer. In complex diseases like cancer, deciphering the vast genomic landscape that underpins the disease presents one of the major challenges in translational and experimental cancer research. Understanding and developing novel computational approaches to interpreting genomic, transcriptomic and proteomic data forms the cornerstone of modern cancer research. Strongly allied to this is the concurrent analysis of tissue phenotypic data. Digital pathology, image analysis and informatics provide important technologies to support high throughput computerised analysis of tissue samples and to measure and validate candidate diagnostic, prognostic and predictive biomarkers in cancer.

The aim of the group is to lead on the development of novel computational and statistical methods in the analysis of genomic and image data, and to support interdisciplinary collaborative research by working closely together with biologists, pathologists and oncologists within the Centre for Cancer Research and Cell Biology (CCRCB), providing the interface between genomic data, tissue pathology and translational medicine.

Key research areas include:

- Computational biology and biostatistics;
- Pathway analysis, causal inference of regulatory networks, and integration of genetics and genomics data;
- Tissue imaging, image analysis and tissue biomarker discovery;
- High-throughput analysis of genomic and image data;
- Quantitative methods in disease-genes-drugs connection discovery;
- Data "Integromics".

Dynamic research within the group spans from basic exploration and method development to applications in specific diseases. Using the high-throughput platforms within the Northern Ireland Molecular Pathology Laboratory (NI-MPL), we generate a wealth of data across a range of cancer specific projects. Using the latest analytics software and in-house algorithms, key hypotheses are generated and tested with the aim of generating novel biomarkers and multivariate signatures for cancer diagnostics and prognostics. Through collaboration with the Northern Ireland Biobank (NIB), NI-MPL and Digital Pathology, the Molecular Pathology Informatics team have also developed a novel "integromics" platform called PICAN (Pathology Integromics in Cancer) for the management of clinical, phenotypic and genotypic data from cancer tissues.

The group has also built up strong expertise and capacity in gene expression connectivity mapping, pushing forward on three fronts in this research field: algorithmic design, novel applications in cancer therapeutics, and high performance software development. The research work of the group has generated a great deal of interest and interactions with QUB colleagues and international collaborators. The recent awards of grants from CR-UK and Leukaemia & Lymphoma NI, both of which use connectivity mapping approach as their essential components, are testimonies of this group's research impact on academic beneficiaries.

The group has a strong interest in Tissue Imaging and Pathology Informatics and works closely with the NI-MPL and the NIB to achieve these goals. It has one of the most extensive digital pathology laboratories in the UK, with scanning technologies, image and tissue microarray (TMA) management software, along with image analysis capabilities for quantitative biomarker discovery, validation and translation. PathXL Ltd was spun out from these activities and is now a leading digital pathology software company with customers worldwide. It has been working closely with the group on automated tumour identification and has established TissueMark as a leading software platform with dedicated algorithms for tumour markup and analysis.

Finally, the group takes a leading role in the education and mentoring of students and scientists to provide them with a deeper knowledge and understanding of modern methods in bioinformatics, computational biology and tissue imaging, as needed to cope with the data revolution in biology and medicine. This includes a comprehensive MSc course in Bioinformatics and Computational Genomics.

Northern Ireland Cancer Trials Centre and Network

RICHARD WILSON
Lead Investigator

Our mission at the Northern Ireland Cancer Trials Centre (NICTC) and the Northern Ireland Cancer Trials Network (NICTN) is to deliver the highest quality and standard of care to cancer patients across Northern Ireland through leading edge clinical and translational research.

Goals:

• to ensure high quality patient care by participation in clinical research;

• to co-ordinate and promote cancer clinical trial activity throughout Northern Ireland;

• to drive the development of early phase cancer clinical research;

• to integrate with Queen's University Belfast and University of Ulster basic science and translational research programmes;

• to develop and train clinical research staff.

The Northern Ireland Cancer Trials Centre (NICTC) was formally established in 1999 following the signing of the National Cancer Institute-Ireland-Northern Ireland Cancer Agreement supported by local NHS R&D funding. The Northern Ireland Cancer Trials Network (NICTN) was set up in 2008 with joint funding by Cancer Research UK and the Northern Ireland Health and Social Care Research & Development Division. The HSC R&DD provide core funding for NICTC, and along with Cancer Research UK support our Experimental Cancer Medicine Centre and the NICTN. We receive additional funding from Leukaemia Lymphoma Research for our Therapy Acceleration programme Centre and receive significant and increasing support from the Friends of the Cancer Centre.

The role of NICTC is:

• to co-ordinate and promote cancer clinical trials, and run the full range of first-in-human phase I to phase IV trials, along with genetic epidemiology, questionnaire, quality of life, translational and other high quality studies. Clinical trials can be designed locally (investigator-initiated) or adopted as part of a multi-centre study. Investigator-initiated trials often involve collaboration with other academic groups within local universities or hospitals;

• to act as the co-ordinating centre for the NICTN responsible for the co-ordination of cancer clinical trial and translational research activity throughout Northern Ireland, particularly phase III trials and epidemiology studies;

• to manage an academic early phase clinical trials unit running a portfolio of Cancer Research UK, commercial and local investigator-initiated experimental cancer medicine studies including phase I, II and translational trials. In April 2007, the NICTC was awarded Experimental Cancer Medicine Centre (ECMC) status, one of 18 such centres appointed within the UK.

In 2013-14, our target recruitment of at least 10% incident cancers was exceeded (target number 850) with 1665 participants, or 19.6% of incident cancers (excluding non-melanoma skin cancer) being recruited into 66 cancer clinical trials and other adopted clinical research studies.

EDUCATION AND TRAINING

Clinical Academic Training Programme

The Clinical Academic Training Programme (CATP) at Queen's University Belfast was established in conjunction with the Northern Ireland Medical and Dental Agency (NIMDTA) and the Belfast Health and Social Care Trust in 2008 to provide a unique opportunity for highly motivated individuals who want to excel in both clinical and academic training.

The three programmes available are: Academic Foundation (AF2) – a four month placement which enables the trainee to gain insights into clinical academic medicine at an early stage through regular interaction with academic clinical supervisors and scientific staff. The Academic Clinical Fellow (ACF) is targeted at doctors in the early years of specialty training. This is a two-year funded programme, attracts a National Training Number (academic), and allows the ACF to develop academic skills simultaneously with specialty clinical skills. This academic training environment is aimed at helping the ACF prepare a competitive application for a training fellowship to undertake a higher degree. The Academic Clinical Lecturer (ACL) post offers exciting opportunities for aspiring trainees who are considering a career in clinical academic medicine. These posts are designed for doctors who have already obtained a higher degree. Trainees will finish their clinical training while continuing academic development at post-doctoral level.

The CATP Committee oversees the academic progression of the trainee in ACL, ACF and AF2 programmes. The CATP Committee is comprised of members from the School of Medicine, Dentistry and Biomedical Sciences at Queen's University Belfast, NIMDTA and the Belfast Health and Social Care Trust. The Committee approves and appoints supervisors and allocates trainees to the appropriate Research or Education Centre within the School of Medicine, Dentistry and Biomedical Sciences. Progress is reviewed at the end of each AF2 placement and at six monthly intervals for the ACF and ACL trainees.

While undertaking the CATP, Richard Turkington (ACL) received an ASCO Merit Award at the American Society of Clinical Oncology conference in Chicago on 30 May – 3 June 2014. This is the first time that the award has been given to a trainee from Belfast. Since completing the Clinical Academic Training Programme, Richard has been appointed to the post of Clinical Senior Lecturer in Medical Oncology in CCRCB.

In CCRCB we have successfully had trainees on all levels of the Clinical Academic Training Programme and the current trainees within the Centre are listed in the table below.

For further information on the Clinical Academic Training Programme contact the Programme Administrator, Ms Valerie Reid (v.reid@qub.ac.uk), School of Medicine, Dentistry and Biomedical Sciences.

Dr Patrick Campbell

Programme	Name	Period
ACL	Turkington, Richard (Supervisors: P Johnston/ S Van Schaeybroeck)	1 August 2011 – 31 July 2014
ACF	Campbell, Patrick (Supervisors: K McCloskey/J Price)	1 August 2012 – 31 July 2014
AF2	Greenfield, Graham (Supervisor: M McMullin)	6 August 2014 – 5 December 2014
AF2	Yu Sun, Julia (Supervisor: J O'Sullivan)	4 December 2013 – 1 April 2014

Post Doctoral Programme

DAN LONGLEY
Associate Director for
Post-Doctoral Studies

In addition to the training of PhD students, CCRCB is a major centre within the School of Medicine, Dentistry and Biomedical Sciences for further research training and career development. It attracts researchers from the UK, Ireland and across the world due to the breadth and quality of the research, and the emphasis on international and cross-disciplinary collaborations. Researchers at all stages of their career development benefit from the very active programme of seminars and internal research meetings and the availability of courses to learn key scientific and complementary skills. Our aim is to continue to attract enthusiastic scientists and clinicians to work with our established staff and to draw on their experience and also to independently generate new ideas in a stimulating research environment.

Central to the post-doctoral programme within the Centre is a weekly seminar programme at which Post-Doctoral Research Fellows present their work to their peers and colleagues and gain skills in introducing speakers and leading questioning.

As part of encouraging active career development for our post-doctorate, we also run a mentoring scheme within the Centre which aims to take forward a small group of post-docs and assist them with preparing applications for fellowships to be held at CCRCB or elsewhere. This is supported by Staff Training and Development Fellowship workshops. Currently 6 post-docs are in the CCRCB Fellowship mentoring programme, and several fellowship applications have been submitted to funders including CRUK, the MRC, EU and the Breast Cancer Campaign. In the last few years, several prestigious fellowships have been awarded to post-docs on the mentoring programme, and several post-doctoral researchers have been successful in obtaining faculty positions.

The Centre's post-doctorate continue to be major players in the School-wide Post-Doctoral Society. Initially setup by members of CCRCB, the committee is currently chaired by Dr Ricardo De Matos Simoes. The Society acts as a forum to provide a voice for the postdoctoral community within the School and to promote opportunities for career advancement, personal development and social interaction. The society holds an annual symposium featuring both scientific presentations from the postdoctoral body and career-focussed talks from invited speakers. The next symposium will be held in Riddel Hall on 20 March 2015. In 2014, the wide Post-Doctoral Society launched a monthly series of technical seminars in conjunction with the QUB BEER society. These are held on the first Thursday of every month in the basement seminar room in CCRCB and have been well attended by postdocs and students from across the faculty.

Throughout the period covered by this report, a number of our postdoctoral fellows obtained awards for their academic achievements, some of which are highlighted below:

• Dr Karl Butterworth was elected to the committee of the UK Association for Radiation Research.

• Dr Zenobia D'Costa, post-doctoral research fellow in Dr Paul Mullan's research group, was awarded the Roche Prize for 2014. Dr D'Costa was presented with a medal and cheque for £400 at the Centre for Cancer Research and Cell Biology on 10 November 2014. Her winning presentation was entitled 'TBX2 represses CST6 resulting in uncontrolled legumain activity to sustain breast cancer proliferation: a novel cancer-selective target pathway with therapeutic opportunities.'

• Ms Mihaela Ghita was awarded a highly competitive fellowship to attend the NASA Space Radiation Research School being held at the Brookhaven National Laboratory, USA.

• Dr Kyle Matchett was selected to sit on the Junior Irish Association for Cancer Research (IACR) Council, representing Queen's University Belfast. Kyle was also awarded the position of Fellow of the Higher Education Academy (FHEA) by The Higher Education Academy.

Julie McAlinden presents the 2014 Roche Prize to Dr Zenobia D'Costa

Seminar Programme

An important aspect of our work and success is the Centre's seminar programme which provides an opportunity to talk about our research and share ideas with colleagues. We have a post doctoral seminar programme where each week the post doctoral research fellows present and discuss their work with colleagues in other research groups within the Centre. In addition we have an external seminar programme (advertised on our website www.qub.ac.uk/ccrcb) in which we host guest speakers to encourage collaborations and interactions with other research institutions.

Our distinguished Mitchell Lecture, which was initiated in 2007 and is held annually to honour the previous Chancellor of Queen's University Belfast, Senator George Mitchell, for his enormous contributions to the University and the wider community, took place on 20 February 2014. The lecture was given by Professor Sir Mike Stratton, Director of the Wellcome Trust Sanger Institute. Professor Stratton's talk was entitled "the Genomes of Cancer Cells".

This year's prestigious CRUK Lecture, held annually as part of the Belfast Cancer Research UK Centre initiative was delivered on 8 May 2014 by Professor Bob Brown, Imperial College London. Professor Brown's talk was entitled "Epigenetic drivers of the cancer patient journey through the epigenome landscape".

The following external seminars were held during the period of this annual report:

Professor Chas Bountra, University of Oxford
"How can the SGC partner with QUB to accelerate the discovery of new medicines";

Dr Adrian Bracken, Trinity College Dublin
"Polycomb Proteins in Cell Cycle Control";

Dr Tatjana Stankovic, University of Birmingham
"Clonal evolution and new therapeutic approaches in Chronic Lymphocytic Leukaemia with DNA Damage Response defect";

Dr Vasiliki Tzelepi, University Hospital Galway
"Molecular profiling of castrate-resistant prostate cancer: an integrated approach using xenograft models and patient's samples";

Dr Richard Baylis, University of Leicester
"How protein structures inform cancer biology and drug discovery";

Mr Sean Duffy, National Cancer Director, NHS England
"Cancer Outcomes - addressing the survival challenge";

Dr Alejo E. Rodriguez-Fraticelli, Martin-Belmonte Lab, Madrid
"Regulation of polarized endocytic trafficking during epithelial morphogenesis";

Dr Ester Hammond, University of Oxford
"Replication stress and chromatin context link ATM activation to a role in DNA replication";

Dr David Komander, University of Cambridge
"Mechanisms and Regulation of Deubiquitinase and Specificity";

Professor Nallasivam Palanisamy, Michigan Center for Translational Pathology, University of Michigan.
"Molecular Classification of Prostate Cancer and the Role of Molecular Pathology in Stratified Medicine";

Professor David Thurston, King's College London
"Small Molecule Transcription Factor Inhibitors: The Next Wave of Cancer Therapeutics?";

Professor Shaun Thomas, King's College London
"Proteomic analyses of human T lymphocytes";

Professor Simon Boulton, London Research Institute
"The function and execution of RTEL1 activities at vertebrate telomeres";

Professor Michael McManus, Peter MacCallum Cancer Centre, Melbourne
"Circulating tumour cells in NSCLC";

Professor Olivier Tillement, University of Lyon
"Theranostic MRI-Radiosensitizer gadolinium based particles";

Professor Faustino Mollindeo, University de Salamanca
"Lipid rafts and endoplasmic reticulum as major targets in the anticancer action of alkylphospholipid analogs";

Dr David Gonzalez de Castro, Royal Marsden NHS Foundation Trust
"Stratified medicine in cancer genetics";

Dr Antoinette Perry, Trinity College Dublin
"Translational epigenetics for the early detection of high-risk prostate cancer";

Professor David Grimwade, King's College London
"Molecular pathogenesis of APL and therapy-related leukaemias";

Dr Melissa Labonte, Azusa Pacific University, California
"New strategies for an age old problem – targeting drug resistance in colorectal cancer";

Dr Fernando Calvo, The Institute of Cancer Research
"Investigating the mechanisms of cancer cell dissemination and the pro-tumorigenic role of cancer-associated fibroblasts";

Dr Mark Saunders, Christie Hospital, Manchester
"Novel treatments for rectal cancer – the DREAM therapy study";

Professor Wolfgang Doerr, University of Vienna
"Normal Tissue Radiobiology: Progress and Perspectives";

Dr Sharon McKenna, University College Cork
"Role of Autophagy in Response to Cancer Therapy";

Professor Constanze Bonifer, University of Birmingham
"Abberant chromatin programming in Acute Myeloid Leukaemia";

Dr Andrew Loblaw, Sunnybrook Health Sciences Centre, Canada
"Image guided prostate diagnosis and treatment";

Professor David Bates, University of Nottingham
"Next generation cancer treatments – understanding the tumour microenvironment";

Professor Anthony Chambers, University of Glasgow
IRRS Meeting Lecture;

Professor William Foulkes, McGill University, Montreal
"Inherited susceptibility to non-epithelial ovarian cancers - a reSMARCably dicey story";

Professor Matthew Freeman, Oxford University
"Control of signalling by the rhomboid-like superfamily";

Professor Charles Swanton, University College London
"Intratumour Heterogeneity and Cancer Evolution: Opportunities for Screening and Drug Development";

Dr Xiao-Jun Ma, Chief Scientific Officer, Advanced Cell Diagnostics
"Ultrasensitive RNA in situ hybridization for cancer biomarkers using RNS scope technology";

Dr Nigel Blackburn, CRUK Director of Drug Development
"Presentation of new CRUK Drug Development Strategy";

Randox Molecular Diagnostics
"On Target with Biochip Array Technology – Taking Targeted Therapy to the Next Level";

Professor Andrea Musacchio, Max-Planck Institute of Molecular Physiology, Dortmund
"Molecular basis of feedback control in cell division";

Professor Andrea Bertotti, Candiolo Cancer Institute, Italy
"Preclinical strategies for precision medicine in metastatic colorectal cancer: Challenges and opportunities";

Andrew Knox and Nikolai Lissin, Immunocore
"High-affinity soluble TCRs for targeting cancer cells";

Professor Olaf Heidenreich, Newcastle University
"RUNX1/ETO: Pinion in the Leukaemic Gear Box";

Dr Mohammad Asim, University of Cambridge
"Emergence of resistance Mechanisms that drive Lethal Prostate Cancer";

Dr Sarah Gulliford, The Institute of Cancer Research
"Trials and tribulations: The challenges of normal tissue toxicity analysis".

Postgraduate Programme

MARK LAWLER
Associate Director for Postgraduate Studies

Our Postgraduate Training Programme in CCRCB provides an enriched environment for incoming clinical fellows/scientific graduate students to perform high quality research and to achieve their career goals. It combines scientific rigour with skills development opportunities to empower our students to perform excellent research for publication in international peer review journals and to acquire new skills sets to advance their burgeoning careers. 2013-2014 was an excellent year for the CCRCB Postgraduate Programme with a >2fold increase in the number of postgraduate students since 2011-2012. A total of 25 new PhD students started their research in the Centre. Currently, we have over 60 postgraduate students in CCRCB (61% female/39% male) with over 20% EU/international students, reflecting our commitment to QUB's internationalisation agenda. Funding of our evolving doctoral training programme is achieved through the Department of Education and Learning, and from competitive grant funding through Research Councils, Charities, the European Commission and other funding sources. In addition, we provide opportunities for self-funding students to undertake research in the Centre. Self-funding candidates are invited to discuss their research project preferences and supervisory team at the time of application, to ensure that their research interests and career development are best addressed.

The Research Project is the fulcrum of the Postgraduate Programme with the student undertaking internationally competitive research under the direction of one of the 40 Principal Investigators within the Centre. All students are assigned a Primary and a Secondary Supervisor for the duration of their PhD. Communicating science to both peer and lay audiences forms part of our training programme. Students are encouraged to present their research at national/international conferences, which not only expands their research experience but also provides an opportunity for networking for future career opportunities. Where appropriate, students also undertake short visits to collaborators' laboratories in the UK, Europe, the USA or other international centres, in order to advance their research and knowledge.

We are dedicated to providing an overarching skills and career development programme as part of our postgraduate offering. In pursuit of this goal, incoming PhD students can from 2014 undertake two modules, Cancer Biology and Translational Cancer Medicine, which provide the expert skills and knowledge that can contribute both to their PhD and their developing career. Further career development skills modules are planned as we move towards a premier Doctoral Training Programme in Precision Cancer Medicine.

Mentoring of students is achieved through a combination of an Annual CCRCB Symposium for each PhD cohort and an Annual Progress Review (APR), which also ensures that students are "on track" for the timely completion of their PhD. Winners of the Oral Presentation awards in 2013-2014 at the Annual CCRCB Symposia were:

1st Year PhD: Alex McIntyre (Supervisors: Dr Simon McDade & Dr Dan Longley)
2nd Year PhD: Conor Bradley (Supervisors: Dr Sandra Van Schaeybroeck & Prof Patrick Johnston)
3rd Year PhD: Gareth Irwin (Supervisors: Prof Paul Harkin, Dr Kienan Savage & Dr Paul Mullan)

This year there was a new initiative at School of Medicine, Dentistry and Biomedical Sciences (SMDB) Level, the SMDB Postgraduate Education and Research Forum, which took place at Riddel Hall. As part of this Forum, there was a "3-2-1" style series of oral presentations and a Poster Presentation Session. Eileen Parkes (Supervisor: Prof Richard Kennedy & Dr Paul Mullan) won overall 1st Prize in the 3-2-1 Presentation Sessions while Bailey Evans (Supervisor: Dr Karen McCloskey & Prof Richard Kennedy) secured 2nd Prize in the Poster Session.

In addition to the leadership role that CCRCB has taken in the development of the Postgraduate Research and Education Forum, CCRCB has also demonstrated significant leadership in the newly developed Masters of Research (MRes) in Translational Cancer Medicine (http://www.qub.ac.uk/schools/mdbs/pgd/PT/MRes/). Ten students are undertaking the Cancer stream of the MRes in Translational Medicine Programme in the current academic year.

A number of our postgraduate students have received awards during the period of this report:

• Charlotte Burt won the "best poster prize" for myeloid malignancies at the British Society of Haematology meeting in Birmingham in April 2014;

• Bailey Evans (supervisor K McCloskey) was awarded second prize for her poster presentation at the SMDBS Postgraduate Research Day at Riddel Hall, September 2014;

• Thomas Marshall was awarded a US Radiation Research Society Scholars-in-Training award and an Emily Montgomery Fellowship to attend the 60th Annual Meeting of the Society held in Las Vegas in September 2014;

• Michael Moran was awarded with the medal for best scientific presentation at the 2014 annual meeting of the Irish Otolaryngology - Head and Neck Surgery Society, which took place on 10 - 11 October 2014.

Finally, I would like to take the opportunity to thank my predecessor Dr Karen McCloskey, whose tireless work over the last number of years have helped establish the CCRCB Postgraduate Programme as an excellent research and training programme for our incoming students.

Naomi Dickson, PhD student

Philip Burn, PhD student

A summary of the postgraduate degrees awarded during this period is shown below:

Name	Degree Awarded	Date	Thesis Title
Bill, Malgorzata	PhD	July 2014	Investigation of cellular responses to modulated radiation fields in transitional cell carcinoma and normal bladder urothelium: a role for radiation-induced bystander signalling (Supervisors: K McCloskey/K Prise)
Cole, Aidan	PhD	July 2014	Investigation of the radiobiological and dosimetric implications of respiratory motion in advanced radiotherapy (Supervisors: J O'Sullivan/K Prise/A Hounsell)
Diamond, Owen	MD	July 2014	Determination of Femoral Head Centre During Total Hip Arthoplasty (Supervisors: D Beverland/G Dickson/J Orr)
Fee, Emily	PhD	December 2014	Identification and functional analysis of MAP4K3 as a novel regulator of autophagy (Supervisors: J Murray/D McCance)
Hay, Jodie	PhD	July 2014	The molecular mechanisms of histone deacetylase inhibitors in acute myeloid leukaemia (Supervisors: K Mills/A Thompson)
Kieran, Declan	PhD	July 2014	Whole Slide Analysis, Intelligent Search and Integromics in Digital Pathology (Supervisors: P Hamilton/W Yan)
Oram, Lisa	PhD	July 2014	The Role of p53 Gain-of-Function Mutations in the Pathogenesis of Basal-like Breast Cancer (Supervisors: P Mullan/D Waugh)
Orr, Katy	PhD	July 2014	The Identification and Characterisation of TBXA2R as an Oncogenic Driver in Triple Negative Breast Cancer (Supervisors: P Mullan/D Waugh)
Riley, Joel	PhD	July 2014	The clinical relevance of c-FLIP in non-small cell lung cancer (Supervisors: D Longley/S Van Schaeybroeck)
Rozycka, Ewelina	PhD	July 2014	Functional analysis and pharmacological targeting of the autophagy – regulating protein kinase, ULK1 in cancer (Supervisors: D McCance/J Murray)
Taggart, Laura	PhD	July 2014	The characterisation of the radiosensitising effect of gold nanoparticles (Supervisors: G Schettino/F Currell)

Undergraduate Programme

KEN MILLS
Associate Director for Undergraduate Studies

The role of Associate Director for Undergraduate Studies is to coordinate and link the CCRCB teaching contribution to the various activities in the School Education Centres. CCRCB researchers coordinate and lecture on a range of biomedical, medical and dental modules across all levels of undergraduate course. In addition, around 42 Biomedical Science Level 3 students and Intercalated students undertake research projects across the various focus groups within the CCRCB. One intercalated student, Grace McKenna, who had completed her research project in 2013 in the CCRCB was the 2014 International Life Sciences winner of the highly competitive and prestigious 'The Undergraduate Awards'.

Laura Graham, 4th Year dental student, won the International Association for Dental Research (IADR) Irish Division Undergraduate Award at the Division's recent scientific meeting. Laura presented her research on p63 and *BRCA-1* gene expression in oropharyngeal carcinomas, completed during her Intercalated MRes studies, under the supervision of Dr Jacqueline James and Dr Simon McDade. Laura will now represent the Irish Division in the renowned and highly competitive IADR Hatton Awards competition at the annual scientific meeting in Boston in March 2015, a competition won last year by QUB dental student Rebekah Eves. As part of her prize, Laura has also been invited to the headquarters of the dental materials company Ivoclar Vivadent, sponsors of the Award, and will travel to Lichtenstein for a 2-day visit.

CCRCB's 2014 Summer Research Students

The Biomedical Education Centre in collaboration with the research centres introduced "Research Discovery Days" for 1st and 2nd year students. These visits occur four times within the first two years of their degree and involve groups of students being introduced to the research themes and the focus groups' research activities. The visits are combined with the allocation of a defined research mentor who can discuss specific topics in more depth and address options for future careers.

The CCRCB Summer Research Programme has been established since 2009 and provides an excellent opportunity for promising young students to undertake a short laboratory based research project for eight weeks over the summer period. The students benefit from learning laboratory techniques, data analysis and interpretation and are required to write a research report and present their work at a CCRCB summer student symposium.

In 2014, over 110 applications were received for the 25 studentships. The cohort of students were either studying biomedical science, dentistry or medicine at QUB or for science or medical degrees from Northern Ireland, the UK, the Republic of Ireland, USA and even Ukraine. The studentships were funded by the School of Medicine, Dentistry and Biomedical Sciences, CCRCB, Pathology Society, Biochemistry Society, Leukaemia Lymphoma Research, Leukaemia & Lymphoma NI, Friends of the Cancer Centre and other organisations.

The research that dental student, Rebekah Eves, completed during her 2013 summer studentship was presented at a series of national and international meetings in Ireland and South Africa resulting in her being awarded the prestigious Hatton Prize by the International Association for Dental Research.

Details of the Undergraduate Education Programmes offered within the School of Medicine, Dentistry and Biomedical Sciences can be found at www.qub.ac.uk/schools/mdbs/students.

PUBLIC ENGAGEMENT ACTIVITIES

Public Engagement Activities

The role of CCRCB's engagement activities is to share our pioneering research – and its impact on prevention, diagnosis and care in the future – with people across Northern Ireland. In this section we highlight the successes of our engagement programme during 2014.

Public engagement is central to the Belfast CRUK Centre strategy – it brings to life the ground-breaking research taking place at CCRCB and builds support for this work within the local community. Our researchers are the key to all our engagement work, regularly talking to people about their projects, hosting interactive lab tours, and volunteering their time outside work hours to help with public events and fundraising activities.

CCRCB is part of the Belfast Cancer Research UK Centre – one of 15 Cancer Research UK (CRUK) designated Centres of Excellence across the UK. This virtual Centre encompasses a network of scientists, doctors and nurses based at the Northern Ireland Cancer Trials Centre and the five Cancer Units located in hospitals across the region, as well as the CCRCB and the Centre for Public Health. The Centre brings doctors, scientists and nurses closer together so that developments in cancer research can be taken swiftly from the bench to the bedside.

Other charities provide funding to CCRCB and also contribute to our public engagement activities and outreach programmes. For example, CCRCB regularly welcomes supporters and volunteers of local charities such as Leukaemia & Lymphoma NI, Prostate Cancer UK, Friends of the Cancer Centre, Cancer Focus NI, Brainwaves NI and others.

Raising the profile of research engagement within the centre

The CCRCB Engagement Committee was established in May 2014. This new initiative brings together staff from a range of disciplines and levels to spearhead engagement activity both in the centre and at outside events. The committee has improved communication of centre activities to all staff, and been instrumental in the development of engagement activities targeting new audiences. The Committee also sponsored science communication training for staff which was designed and delivered by CRUK; future training needs have been identified and the committee will organize further training for researchers in 2015.

New communication tools

February 2014 saw the first edition of the CRUK Belfast Centre newsletter, which will be issued biannually. It showcases survivor stories, outlines details of new grants awarded, and provides information about upcoming events. It is made available to attendees at all events, both in the CCRCB and externally, and posted or emailed to supporters upon request.

Bringing local research to life

People who have supported CRUK and others interested in local cancer research are regularly invited to the CCRCB to hear about our work from the researchers themselves. Our researchers lead groups on interactive tours of the laboratories – bringing local research to life and explaining the impact their work could have on cancer detection and treatment in the future. In 2014 170 people took part in these lab tours, and an additional 299 people participated in other events in the Centre.

Our researchers also take time to attend community events where they talk to people about our work. Our researchers volunteered at over 60 events this year, including the CRUK Race for Life in Belfast, a range of events targeting young people, and a number of community events throughout NI. Altogether there were 167 instances of researcher engagement in 2014.

Scientists from the CCRCB and CRUK funded Research Nurses from across the region joined Channel 4 and Cancer Research UK for Stand Up To Cancer in October 2014. The #sciencecakes competition saw a number of people in the centre showcase their baking and decorating skills. The CCRCB winner received awards in both the national 'best communication of science' competition and the Twitter competition. A quiz was also held, and all funds raised helped to take the total for Stand Up To Cancer to over £15 million which will fund translational cancer research.

Roisin Foster (Chief Executive, Cancer Focus NI) with Professor Mark Lawler

Inspiring the next generation of cancer researchers

Once again we joined forces with the CRUK Clinical Research Nurses from across Northern Ireland to run simultaneous events at Cancer Units across NI in celebration of International Clinical Trials Day. This year our events were held in conjunction with the NI launch of the 'It's OK to Ask' campaign, encouraging patients to ask about clinical trials. Events were held in the Cancer Centre in Belfast, Antrim, Ulster and Altnagelvin hospitals. Members of the NI Cancer Research Consumer Forum also participated in these events, and their perspective helped to raise awareness of the importance of clinical trials in the advancement of prevention, diagnosis, treatment of cancer.

Reaching out to new audiences

This year part of the focus of our research engagement programme was to reach out to new audiences who may not be aware of the Centre's work. Our researchers participated in a range of new large-scale activities including:

• Culture Night Belfast where our 'science buskers' engaged over 500 people;

• A film screening of 'The Enemy Within' at the QFT which was followed by an expert panel discussion;

• Ulster Rugby Family Fun Day where our scientists engaged with over 250 children and their parents about DNA.

Cancer awareness and prevention

Prevention and early diagnosis messages are important in the efforts to beat cancer sooner. During 2014, the CRUK Senior Research Nurse and other Research Nurses attended 13 health events, raising awareness of the signs and symptoms of cancer and healthy lifestyle factors.

Building high profile support

In February CRUK held an early diagnosis event for MLAs and health professionals at Stormont. Over 40 MLAs attended and heard CRUK's calls for a cancer awareness campaign and the introduction of bowel scope in NI. In addition, attendees participated in a number of interactive activities hosted by our scientists and linked to the Centre's work, especially in genetics and imaging. In June the NI Assembly Health Committee visited the CCRCB for a tour and to hear about current research taking place here. They heard from Professors Manuel Salto-Tellez and Mark Lawler about the CCRCB strategy going forward and the important links between the research staff in the CCRCB and clinical staff at the Northern Ireland Cancer Centre.

About the Belfast Cancer Research UK Centre

The Belfast CRUK Centre is a partnership between Cancer Research UK, Queen's University Belfast, the Health and Social Care Research and Development Division of the Northern Ireland Public Health Agency, and the Belfast Health and Social Care Trust.

The Centre's public engagement strategy is delivered by Margaret Carr, Cancer Research UK's Research Engagement Manager, who is based in the CCRCB. She manages the CCRCB Engagement Committee and works closely with researchers to identify opportunities to promote our research to a wide audience throughout Northern Ireland.

If you want to find out more about our public engagement programme, please email margaret.carr@cancer.org.uk, or ring 028 9097 2715.

STAFF LISTING








New Appointments

GERRY HANNA
Clinical Senior Lecturer in Radiation Oncology

Dr Gerry Hanna was appointed as a Clinical Senior Lecturer at Queen's University Belfast in January 2014. Originally a Queen's University medical graduate in 1998, Dr Hanna went on to train in Clinical Oncology at the Northern Ireland Cancer Centre. At the end of this training he completed a clinical fellowship at Queen's University on the use of PET/CT for radiotherapy planning in lung cancer and was awarded his PhD in 2010. For work during his PhD fellowship, Dr Hanna was recognised with an Excellence Award for the best post graduate research student at the Medical School's 2010 annual celebration of excellence. Dr Hanna was also awarded the Royal College of Radiologist's Keith Durrant Travelling Fellowship to undertake research at the Free University Medical Centre (VUmc), Amsterdam comparing 4DCT and PET for target volume delineation in stereotactic radiotherapy. Following this and with the support of the Friends of the Cancer Centre Pearl Ewing Fellowship, Dr Hanna completed an observership at the MD Anderson Cancer Centre, Houston, Texas.

Since appointment as a consultant 4 years ago, Dr Hanna has provided clinical leadership on a number of the key technological advances at the cancer centre, such as 4DCT and the introduction of stereotactic ablative body radiotherapy (SABR). Dr Hanna's current research focuses are based on predictors and modulators of tumour resistance to radiotherapy, on clinical-translational research for both lung and breast cancer and on the use of SABR for both early stage lung cancer and oligometastatic disease.

RICHARD TURKINGTON
Clinical Senior Lecturer in Medical Oncology

Dr Richard Turkington was appointed a Clinical Senior Lecturer in Medical Oncology at CCRCB in August 2014 and an Honorary Consultant at the Northern Ireland Cancer Centre with an interest in oesophago-gastric cancer. Having graduated in medicine from Queen's University Belfast in 2001 he began specialty training in Medical Oncology in 2005. In 2007 he was awarded a Cancer Research UK Bobby Moore Clinical Research Fellowship to pursue a PhD in novel drug target discovery in colorectal cancer under the supervision of Professor Patrick Johnston. Following completion of his PhD in 2011 Dr Turkington was appointed as an Academic Clinical Lecturer in the field of oesophago-gastric cancer. In 2013 he became a Visiting Research Fellow at the Hutchison/MRC Cancer Unit at the University of Cambridge, under the supervision of Professor Rebecca Fitzgerald. His work has been published in high impact journals and in 2014 he received the American Society of Clinical Oncology Merit Award.

Dr Turkington's principle research interests include oesophago-gastric cancer and the analysis of genomic datasets for the discovery of biomarkers and mechanisms of resistance to chemotherapeutic agents. These discoveries are being translated into clinical advances through the implementation of biomarker-led clinical trials. As part of the oesophago-gastric cancer team at Queen's University Belfast Dr Turkington is seeking to transform the care of oesophago-gastric patients through the integration of laboratory discoveries, translational science and clinical research.

KARL BUTTERWORTH
Lecturer in Translational Radiation Biology

Dr Karl Butterworth was appointed as a lecturer in CCRCB in September 2014. Prior to taking up this post, Dr Butterworth was a key member of the multidisciplinary Advanced Radiotherapy Group where he carried out his postdoctoral research in the laboratory of Professor Kevin Prise. During this time he developed interests in preclinical radiobiology, in particular the role in radiation induced signaling effects in tumour and normal tissue responses, whilst maintaining his interests in nanomedicine. He has spent time as a visiting scientist at several international radiobiology laboratories including Massachusetts General Hospital, Boston and the Italian National Agency for New Technologies (ENEA), Rome. His research aims to improve radiotherapy outcomes by understanding the biology of advanced radiotherapy using in vivo models, combining radiation with novel targeted agents, and improving radiological imaging using nanoparticle based platforms.

EMMA EVERGREN
Lecturer in Molecular Pharmacology and Cell Signalling

Dr Emma Evergren was appointed to the post of Lecturer in Molecular Pharmacology and Cell Signalling and joined the Centre in December 2014. She obtained a Masters degree in Chemistry with a focus on biomedicine and pharmacology from University of Kalmar, Sweden in 2000. She then moved to Stockholm for her PhD at the Department of Neuroscience at the Karolinska Institute. Her work focused on the molecular mechanisms of clathrin-mediated endocytosis and synaptic vesicle recycling. She used the lamprey giant reticulospinal synapse as a model system in combination with electron microscopy. This led to the discovery that intersectin regulates dynamin activity and the release of clathrin-coated vesicles from the endocytic zone flanking the synaptic release site.

She did a short postdoc at the Karolinska institute where she collaborated with Professor Jonas Frisén to study the localisation and differentiation sites for neural stem cells in the brain and spinal cord following stroke or spinal cord injury. This is part of a larger study to explore the use of neural stem cells as therapeutic entities to aid the recovery of neural function after injury.

Emma then moved to Cambridge where she joined Dr Harvey McMahon's lab at the MRC Laboratory of Molecular Biology as an EMBO fellow. During her postdoc within this group she contributed significantly to the functional characterisation of two curvature-inducing proteins, FCHo2 and Epsin, required for coated vesicle formation. In the course of her research she has redefined clathrin-mediated endocytosis as a network of protein-protein and protein-lipid interactions existing in a dynamic equilibrium similar to that observed in signal transduction pathways. When this trafficking equilibrium is perturbed in diseases including cancer it can have profound effects on the distribution of important signalling molecules within the cells and the duration of their signals potentially leading to cellular transformation. Further exploring this relationship by defining how targeted disruption of the trafficking interactome affects the biology of cells forms the basis of her future studies.

NEIL GILLAN
Prostate Cancer UK Community Support Services Manager

Neil Gillan joined us as Prostate Cancer UK's new Community Support Services Manager for Northern Ireland at the beginning of February 2014.

As the Community Support Services Manager for Northern Ireland, Neil's role is to research, identify and address the needs of local men and their families affected by prostate cancer.

Before joining us, Neil was most recently a Community Project Manager for a charity and was responsible for delivering a range of services to a local community, including services to young people with autistic spectrum disorders and services to young people coming to the attention of the criminal justice system. Prior to that, Neil was a project co-ordinator with a sub-regional network and was responsible for researching, identifying and addressing the needs of local older people.

To contact Neil or find out more about his role please email: neil.gillan@prostatecanceruk.org or call: 028 9097 2370 or 07908 802902.

PAULA LANGHAM
Project Officer, Movember Centre for Excellence

Paula Langham joined us in November as the Project Officer for the Movember Centre for Excellence.

As Project Officer, Paula's role is to lead the successful planning and coordination of activities to ensure that this joint programme of research between the Centre for Cancer Research and Cell Biology and the University of Manchester is completed successfully within the agreed timeframe and budget constraints and to assist the team in securing further funding of the programme.

Before joining us, Paula was the Finance and Office Manager of Children in Northern Ireland (CiNI) with sole responsibility for managing all aspects of the finance function of CiNI as well as overseeing the management and general running of the office. Prior to that she was the Assistant Accountant of the East Belfast Partnership where she worked alongside the Company Accountant to manage the various funding streams allocated to the projects to ensure full accountability and value for money was always achieved.

To contact Paula or to find out more about her role please email: p.langham@qub.ac.uk or call 028 9097 5702.

Current Staff

(as at 31 December 2014)

ACADEMIC STAFF

Professors:

Professor Charles Campbell
Professor Karl Hale
Professor Peter Hamilton
Professor Paul Harkin
Professor Tim Harrison (McClay Professor of Medicinal Chemistry)
Professor Patrick Johnston
Professor Richard Kennedy (McClay Professor of Medical Oncology)
Professor Mark Lawler
Professor Dennis McCance
Professor Mary Frances McMullin
Professor Ken Mills
Professor Joe O'Sullivan
Professor Kevin Prise
Professor Manuel Salto-Tellez
Professor Chris Scott
Professor David Waugh
Professor Richard Wilson

Readers:

Dr Fred Currell
Dr Dan Longley
Dr Karen McCloskey
Dr Marie Migaud

Senior Lecturers:

Dr Vicky Coyle
Dr Mohamed El-Tanani
Dr Frank Emmert-Streib
Dr Gerry Hanna
Dr Suneil Jain (Friends of the Cancer Centre)
Dr Jackie James
Dr Paul Mullan
Dr Richard Turkington
Dr Sandra Van Schaeybroeck (CRUK Clinician Scientist Fellowship)
Dr Kate Williamson

Lecturers:

Dr Karl Butterworth
Dr Emma Evergren
Dr Simon McDade
Dr Konstantin Panov
Dr Kienan Savage (Cancer Focus NI)
Dr Alex Thompson
Dr Richard Williams
Dr Shu-Dong Zhang

HONORARY STAFF

Dr Ian Banks
Ms Ruth Boyd
Dr Mark Catherwood
Dr Tim Davison
Dr Glenn Dickson
Dr Brian Duggan
Dr Martin Eatock
Professor Dean Fennell
Dr Tom Flannery
Dr Alan Gilmore
Dr Ian Harley
Professor Alan Hounsell
Dr Sandra Irvine
Dr Colin James
Dr Iain James
Professor Terry Lappin
Dr Maurice Loughrey
Dr Tom Lynch
Dr Perry Maxwell
Professor Glenn McCluggage
Dr Conor McGarry
Mr Stuart McIntosh
Dr Damian McManus
Dr Stephen McQuaid
Dr Melanie Morris
Professor Patrick Morrison
Dr James Murray
Dr Declan O'Rourke
Dr Melanie Percy
Dr Giuseppe Schettino

SCIENTIFIC FELLOWS

Dr Stephen McMahon (EU)
Dr Niamh O'Brien (Breast Cancer Campaign)

CLINICAL RESEARCH FELLOWS

James Beirne (HSC R&D Division)
Catherine Davidson (CRUK)
Aya El-Helali (Almac)
Donna Graham (Tom Simms Bequest)
Ciara Lyons (Tom Simms Bequest)
Jane McClements (Tom Simms Bequest)
Angela O'Neill (HSC R&D Division)
Eileen Parkes (CRUK)
Philip Turner (Friends of the Cancer Centre)

RESEARCH STAFF

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Abdullah Alvi (CRUK)
Chris Armstrong (PCUK)
Peter Bankhead (Invest NI)
Paul Buchanan (QUB)
Basak Celtikci (CRUK)
Pankaj Chaudhary (MRC)
Lisa Crawford (BCH Charitable Funds)
Nyree Crawford (EU)
El Habib Dakir (Invest NI)
Sabine Dalleau (Invest NI)
Ravi Deevi (CRUK)
Ricardo de Matos Simoes (Invest NI)
Philip Dunne (CRUK)
Sharon Eddie (PCUK)
Mihaela Ghita (MRC)
Ivan Grishagin (Leukaemia & Lymphoma NI)
Matthew Helm (Almac/INI)
Catherine Higgins (Wellcome Trust)
Caitriona Holohan (CRUK)
Simon Horn (Friends of the Cancer Centre)
Kerry Anne Hughes (PCUK)
Gerald Li (Invest NI)
Fabio Liberante (Leukaemia & Lymphoma Research)
Joanna Majkut (Wellcome Trust)
Adnan Malik (Wellcome Trust)
Kyle Matchett (Leukaemia & Lymphoma NI)
Pamela Maxwell (CRUK)
Darragh McArt (QUB)
Cheryl McFarlane (Invest NI/McClay Foundation)
Melanie McKechnie (Invest NI/McClay Foundation)
Julia Miskelly (MRC)
Jessica Neisen (PCUK)
Zsuzsanna Nemeth (Wellcome Trust)
Paul O'Reilly (BBSRC)
Katy Orr (Cancer Focus NI)
Adam Pickard (MRC)
Keara Redmond (CRUK)
Kelly Redmond (MRC)
Soraia Rosa (EU Marie Curie)
Abi Savage (Invest NI)
Kirtiman Srivastava (MRC)
Gayathri Thillaiyampalam (CRUK)
Shailesh Tripathi (Invest NI)
Dharita Upadhyaya (Invest NI)

ALMAC SECONDED STAFF

Oliver Barker
Frank Burkamp
Gerald Gavory
Peter Hewitt
Dominic Janssen
Linda Jordan
Estelle McClean
Keeva McClelland
Mary McFarland
Hugues Miel
Krzysztofa Odrzywol
Colin O'Dowd
Natalie Page
Shane Rountree
Steven Shepherd
Graham Trevitt
Andrew Wilkinson

TECHNICAL STAFF

Ken Arthur
Conal Askin (CRUK/HSC R&D Division)
Victoria Bingham (CRUK)
Anne Carson (HSC R&D Division)
Gail Carson (Invest NI)
Alan Coffey
Josephine Dutton
Cathy Fenning (CRUK)
Marc-Aurel Fuchs (Friends of the Cancer Centre)
Paula Haddock (Breast Cancer Campaign)
Anne Jordan (Leukaemia & Lymphoma NI)
Oksana Lyubomska (MRC)
Angelina Madden (Cancer Focus NI)
Karen Magill Young (Invest NI)
John McCotter
David McGibbon
Claire McGready (CRUK)
Gordon McGregor
Kirsty McLaughlin (CRUK)
Rassel Md Al Mustasin Billah (Invest NI)
Tatiana Panova (Invest NI/McClay Foundation)
Gaurang Patel (CRUK)
Caroline Quinn (MRC)
Maria Rea

ADMINISTRATIVE

Margaret Carr (CRUK Research Engagement Manager)
Priscilla Clark (NI Biobank Administrator)
Caroline Crothers (Leukaemia & Lymphoma NI)
Sharon Dunwoody (CRUK Centre Administrator)
Neil Gillan (Prostate Cancer UK)
Beryl Graham (Centre Manager)
Julie Hunter (Clinical Trials Administrator, HaBio)
Paula Langham (Project Officer, Movember Centre of Excellence)

CLERICAL

Jane Arbuthnot
Claire Atchison (Leukaemia & Lymphoma NI)
Ruth Beattie
Jenni Byers (CRUK)
Frances McCormick
Anne McRoberts
Linda Megrath
Noreen Rafferty
Julie Skelly (Almac/Invest NI)
Katie Stewart

MAJOR SOURCES OF FUNDING

Funding Bodies

The work of our research groups would not be possible without the substantial grant funding from our sponsors and from generous donations. Our major sources of funding include:

Research Councils

Biotechnology and Biological Sciences Research Council (BBSRC)
Engineering and Physical Sciences Research Council (EPSRC)
Medical Research Council (MRC)

Charities

Action Cancer
Association for International Cancer Research (AICR)
Brainwaves Northern Ireland
Breast Cancer Campaign
British Heart Foundation
British Lung Foundation
Cancer Focus Northern Ireland
Cancer Research UK (CRUK)
Friends of the Cancer Centre
Leukaemia and Lymphoma NI
Leukaemia and Lymphoma Research
Nuffield Foundation
Prostate Cancer UK
Wellcome Trust

Companies

Almac Diagnostics
Almac Discovery
Amgen
Astex Therapeutics Ltd
Astra Zeneca
Boehringer Ingelheim Ltd
Bristol-Myers Squibb
Celgene
PathXL
Leica
Merck Serono
Pfizer Ltd
PharmaMar
Pierre Fabre
Randox
Roche

Government

British Council
Health and Social Care (HSC) Research and Development (R&D) Division of the Public Health Agency of Northern Ireland
Belfast Health and Social Care Trust (BHSCT)
EU Framework 7
EU Marie Curie Scheme
National Institute for Health Research (NIHR)
National Institutes of Health (NIH)
National Physics Laboratory (NPL)
UK Home Office

Societies

Association of the British Pharmaceutical Industry
Biochemical Society
European Haematology Association (EHA)
Haematology Association of Ireland
Pathological Society
Royal Society

Agencies

Invest Northern Ireland

Dr Kienan Savage receives a significant donation from Michelle Napier for the breast cancer research programme within CCRCB

New Research Grants Awarded

(from 1 January 2014 – 31 December 2014)

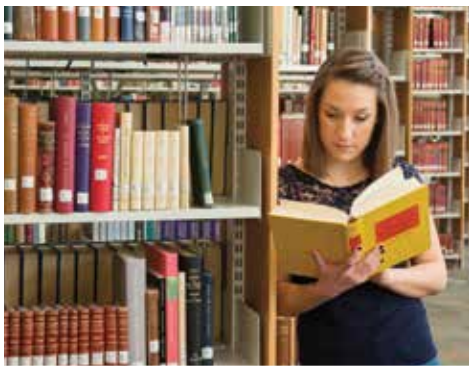
This section specifically highlights new grants awarded within 2014. The funding bodies of our numerous ongoing research programmes are acknowledged in the previous section.

Investigator(s)	Sponsor	Title of Project	Amount	Period
Campbell, Charles	MRC & Astra Zeneca	MRC CASE Studentship (Oncogenic deregulation of epithelial apical biogenesis as a unifying mechanism for colorectal cancer morphological heterogeneity)	£132,827	01/10/14 - 30/09/18
Cardwell, Chris*, Zhang, Shu-Dong*, Murray, Liam Mills, Ken Liberante, Fabio (* Joint Leads, CPH & CCRCB)	Cancer Research UK	A novel, integrated, bioinformatics and pharmacoepidemiology approach to identifying and testing medications with potential breast cancer carcinogenicity, or anti-cancer properties.	£194,051	01/10/14 - 30/09/17
Irvine, Sandra	Haematology Association of Ireland	Fellowship – Dr Lisa Crawford	£16,620	01/01/14 - 31/12/15
Jain, Suneil O'Sullivan, Joe Prise, Kevin Waugh, David	HSC R&D	Movember CoE Award	£500,000	01/07/14 - 30/06/19
Kennedy, Richard Wilson, Richard Harkin, Paul	Almac Group Ltd	Sir Allen McClay Clinical Fellowship	£192,500	01/09/14 - 31/08/17
Lappin, Terry El-Tanani, Mohamed	Invest NI	Horizon 2020 application PHC3-2015 call to study mechanisms common to different diseases	£14,915	01/01/14 - 31/12/14
Lawler, Mark	International Engagement Fund QUB	Collaborative Genomics Programme with National Cancer Institute USA and University of Pensylvania USA	€30,000	01/03/14 - 01/03/16
Lawler, Mark	ABPI	Evaluating clinical outcomes, health care costs and the potenetial value of innovation in Northern Ireland's Health Care System	£40,000	01/01/15 - 31/12/15
Longley, Dan Waugh, David	Astex Therapeutics Ltd	Rational targeting of inhibitor of apoptosis proteins (IAPs) for effective treatment of pro-inflamma	£53,391	01/01/15 - 30/06/15
McCloskey, Karen Prise, Kevin O'Sullivan, Joe	MRC	Mechanisms of radiation-induced bladder toxicity in prostate cancer treatment: correlation of urinary biomarkers with bladder pathophysiology	£514,518	01/02/15 - 31/01/18
McDade, Simon Johnston, Patrick Longley, Dan	QUB Foundation	Eamon Murphy Scholarship: 'Exploiting TP53 status to rationally design therapies to selectively target colon cancer cells'	£68,000	01/10/14 - 30/09/17

Investigator(s)	Sponsor	Title of Project	Amount	Period
Mills, Ken Savage, Kienan	Leukaemia & Lymphoma Research	The molecular and therapeutic relevance of SF3B1 in the aetiology of Myelodysplastic Syndromes	£125,959	01/02/14 - 31/01/16
Mills, Ken	Leukaemia & Lymphoma NI	Summer Studentships 2014	£6,000	01/07/14 - 30/09/14
Mills, Ken	Leukaemia & Lymphoma NI	Infrastructure grant – Golden Anniversary Research Award	£496,000	01/10/14 - 30/09/17
Mullan, Paul Scott, Chris Williams, Rich	Invest NI – Proof of Concept	Development of a novel 'lysotherapeutic' delivery system for targeting lysosomal proteases	£105,953	01/03/14 - 28/02/15
Mullan, Paul McDade, Simon	Darren Clarke Foundation	Heather Clarke PhD Scholarship: 'Characterisation of the oncogenic roles of p53 mutations in the pathogenesis of basal-like breast cancers'	£80,000	01/10/14 - 30/09/17
Mullan, Paul Williams, Rich McDade, Simon	Breast Cancer Campaign	Exploiting the TBX2 repression of CST6 as a novel treatment strategy for poor prognosis breast cancers	£193,552	01/03/15 - 28/02/18
O'Brien, Niamh Mullan, Paul	Breast Cancer Campaign	Characterisation of the propyl isomerase, PIN1, as a novel biomarker and therapeutic target	£94,907	01/10/14 - 30/09/17
O'Brien, Niamh McCloskey, Karen	BHSCT Charitable Funds	Investigating KCNK proteins as potential novel biomarkers and therapeutic targets in ovarian cancer	£44,748	01/02/15 - 31/01/16
Prise, Kevin	European Union FP7 - RadRes PRO	Fellowship – Stephen McMahon	£235,376	01/06/14 - 31/05/17
Prise, Kevin	National Physics Laboratory	Methodology for characterising use of Au nanoparticles as contrast agents in diagnostic medical imaging	£27,749	01/10/14 - 30/09/17
Salto-Tellez, Manuel	Cancer Research UK	ECMC Placement/Exchange	£5,000	01/10/14 - 30/09/15
Thompson, Alex Zhang, Shu-Dong	Leukaemia & Lymphoma NI	Repurposing approved drugs for blood cancer therapies	£104,000	01/10/14 - 30/09/16
Thompson, Alex	Leukaemia & Lymphoma NI	Collaborative drug development in AML	£104,000	01/10/14 - 30/09/16
Waugh, David	CRUK	Belfast CRUK Centre	£1,500,000	01/04/14 - 31/03/17
Waugh, David	CRUK	Senior Research Nurse	£76,339	01/04/14 - 31/03/15
Waugh, David O'Sullivan, Joe Prise, Kevin Salto-Tellez, Manuel Jain, Suneil McDade, Simon	Prostate Cancer UK	FASTMAN – Movember Centre of Excellence	£3,017,034	01/07/14 - 30/06/19

Investigator(s)	Sponsor	Title of Project	Amount	Period
Waugh, David Salto-Tellez, Manuel Wilson, Richard	Invest NI	Production and clinical validation of CXCR1 reagents for defining colorectal cancer sensitivity	£48,234	01/09/14 - 31/08/15
Waugh, David Salto-Tellez, Manuel Wilson, Richard	Invest NI	Commercialisation of CXCR1 marker diagnostic kits as a novel companion diagnostic for cancer therapy	£47,934	01/09/14 - 31/08/15
Waugh, David	CRUK	Clinical Research Fellowship	£260,000	01/01/15 - 31/12/17
Williamson, Kate	Randox	Haematuria Biomarker Study	£120,000	01/01/15 - 31/12/15
Wilson, Richard	NIHR-FOCUS 4	Molecular selection of therapy in metastatic colorectal cancer	£83,199	01/07/14 - 31/03/20

PUBLICATIONS






The following publications were published within the period of this report:

ACHEVA, A., GHITA, M., PATEL, G., PRISE, K.M., and SCHETTINO, G. (2014) Mechanisms of Response to Targeted Irradiation in 3D Organotypic Skin Cultures, *PLoS One*, 9(2): e86092.

AGNEW, A., AGNEW, C.E., GRATTAN, M.W., HOUNSELL, A.R. and McGARRY, C.K. (2014) Monitoring daily MLC positional errors using trajectory log files and EPID measurements for IMRT and VMAT deliveries, *Physics in Medicine and Biology*, 59(9):N49-63.

AGNEW, C.E., IRVINE, D.M., HOUNSELL, A.R. and McGARRY, C.K. (2014) Clinical Improvement in Step and Shoot IMRT Delivery Accuracy on an integrated Linear Accelerator Control System, *Practical Radiation Oncology*, 4(1), p43-49.

AGNEW, C.E., IRVINE, D.M. and McGARRY, C.K. (2014) Correlation of phantom-based and log file patient-specific QA with complexity scores for VMAT, *Journal Of Applied Clinical Medical Physics*, 15(6), p204-216.

AHMAD, J., ARTHUR, K., McMANUS, D., JOHNSTON, B.T., MAXWELL, P., KENNEDY, A. and MURRAY, L. (2014) A Cross Sectional Study of p504s, CD133 and Twist Expression in the Eesophageal Metaplasia Dysplasia Adenocarcinoma Sequence, *Diseases of the Esophagus*, 25 February 2014 (Epub ahead of print).

AHSAN, H., HALPERN, J., KIBRIYA, M.G., PIERCE, B.L., TONG, L., GAMAZON, E., MCGUIRE, V., FELBERG, A., SHI, J., JASMINE, F., ROY, S., BRUTUS, R., ARGOS, M., MELKONIAN, S., CHANG-CLAUDE, J., ANDRULIS, I., HOPPER, J.L., JOHN, E.M., MALONE, K., URSIN, G., GAMMON, M.D., THOMAS, D.C., SEMINARA, D., CASEY, G., KNIGHT, J.A., SOUTHEY, M.C., GILES, G.G., SANTELLA, R.M., LEE, E., CONTI, D., DUGGAN, D., GALLINGER, S., HAILE, R., JENKINS, M., LINDOR, N.M., NEWCOMB, P., MICHAILIDOU, K., APICELLA, C., PARK, D.J., PETO, J., FLETCHER, O., DOS SANTOS SILVA, I., LATHROP, M., HUNTER, D.J., CHANOCK, S.J., MEINDL, A., SCHMUTZLER, R.K., MÜLLER-MYHSOK, B., LOCHMANN, M., BECKMANN, L., HEIN, R., MAKALIC, E., SCHMIDT, D.F., BUI, Q.M., STONE, J., FLESCH-JANYS, D., DAHMEN, N., NEVANLINNA, H., AITTOMÄKI, K., BLOMQVIST, C., HALL, P., CZENE, K., IRWANTO, A., LIU, J., RAHMAN, N., TURNBULL, C.; FOR THE FAMILIAL BREAST CANCER STUDY, DUNNING, A.M., PHAROAH, P., WAISFISZ, Q., MEIJERS-HEIJBOER, H., UITTERLINDEN, A.G., RIVADENEIRA, F., NICOLAE, D., EASTON, D.F., COX, N.J. and WHITTEMORE, A.S. (2014) A Genome-wide Association Study of Early-Onset Breast Cancer Identifies PFKM as a Novel Breast Cancer Gene and Supports a Common Genetic Spectrum for Breast Cancer at Any Age, *Cancer Epidemiol Biomarkers Prev*, 23, p658-669.

ALMOUZNI, G., ALTUCCI, L., AMATI, B., ASHLEY, N., BAULCOMBE, D., BEAUJEAN, N., BOCK, C., BONGCAM-RUDLOFF, E., BOUSQUET, J., BRAUN, S., BRESSAC DE PAILLERETS, B., BUSSEMAKERS, M., CLARKE, L., CONESA, A., ESTIVILL, X., FAZELI, A., GRGUREVIC, N., GUT, I., HALAZONETIS, I., HEIJMANS, B.T., HERMOUET, S., HOUWING-DUISTERMAAT, J., IACOBUCCI, I., ILAS, J., KANDIMALLA, R., KRAUSS-ETSCHMANN, S., LASKO, P., LEHMANN, S., LINDROTH, A., MAJDIC, G., MARCOTTE, E., MARTINELLI, G., MARTINET, N., MEYER, E., MICELI, C., MILLS, K., MORENO-VILLANUEVA, M., MORVAN, G., NICKEL, D., NIESLER, B., NOWACKI, M., NOWAK, J., OSSOWSKI, S., PELIZZOLA, M., POCHET, R., POTOCNIK, U., RADWANSKA, M., RAES, J., RATTRAY, M., ROBINSON, M.D., ROELEN, B., SAUER, S., SCHINZER, D., SLAGBOOM, E., SPECTOR, T., STUNNENBERG, H.G., TILIGADA, E., TORRES PADILLA, M.E., TSONAKA, R., VAN SOOM, A., VIDAKOVIC, M., WIDSCHWENDTER, M. (2014) Relationship between genome and epigenome - challenges and requirements for future research, *BMC Genomics*, 15, p487-494.

ALTAY, G., KURT, Z., DEHMER, M. and EMMERT-STREIB, F. (2014) Netmes: assessing gene network inference algorithms by network-based measures, *Evol Bioinform Online*, 10, p1-9.

ANDERSON, C.L., BJORN, M.E., McMULLIN, M.F., HARRISON, C., SAMUELSSON, J., EJERBLAD, E., ZWEEGMAN, S., FERNANDES, S., BAREFORD, D., KNAPPER, S., LOFVENBERG, E., LINDER, O., ANDREASSON, B., AHLSTRAND, E., JENSON, M.K., BJERRUM, O.W., VESTERGAARD, H., LARSEN, H., KLAUSEN, T.W., MOURITS-ANDERSEN, T., SKOV, V., THOMASSEN, M., KRUSE, T., GRONBAEK, K. and HASSELBALCH, H.C. (2014) Circulating YKL-40 in patients with essential thrombocythemia and polycythemia vera treated with the novel histone deacetylase inhibitor vorinostat, *Leukemia Research*, 38(7), p816-821.

ANDERSON, L.A. and McMULLIN, M.F. (2014) Epidemiology of MPN: What do we know?, *Current Hematology Malignancy Reports*, 9(4), p340-349.

ANDREYEV, H.J.N., ROSS, P., DONNELLAN, C., LENNAN, E., LEONNARD, P., WATERS, C., WEDLAKE, L., BRIDGEWATER, J., GLYNNE-JONES, R., ALLUM, W., CHAU, I., WILSON, R. and FERRY, D. (2014) Practice guidance on the management of diarrhoea during cancer chemotherapy, *Lancet Oncology*, 15: e447–460.

ANNELS, N.E., SHAW, V.E., GABITASS, R.F., BILLINGHAM, L., CORRIE, P., EATOCK, M., VALLE, J., SMITH, D., WADSLEY, J., CUNNINGHAM, D., PANDHA, H., NEOPTOLEMOS, J.P. and MIDDLETON, G. (2014) The effects of gemcitabine and capecitabine combination chemotherapy and of low-dose adjuvant GM-CSF on the levels of myeloid-derived suppressor cells in patients with advanced pancreatic cancer, *Cancer Immunology, Immunotherapy*, 63(2), p175-183.

ASUR, R., BUTTERWORTH, K.T., PENAGARICANO, J.A., PRISE, K.M., and GRIFFIN, R.J. (2015) High dose bystander effects in spatially fractionated radiation therapy. *Cancer Letters*, 356(1), p52-57.

BAROSI, G., TEFFERI, A., BESSES, C., BIRGEGARD, G., CERVANTES, F., FINAZZI, G., GISSLINGER, H., GREISSHAMMER, M., HARRISON, C., HEHLMANN, R., HERMOUET, S., KILADJIAN, J.J., KROGER, N., MESA, R., McMULLIN, M.F., PARDANANI, A., PASSAMONTI, F., SAMUELSSON, J., VANNUCCHI, A.M., REITER, A., SILVER, R.T., VERSTOVEK, S., TOGNONI, G. and BARBUI, T. (2014) Clinical endpoints for drug trials in BCR-ABL-1-negative classic myeloproliferative neoplasms: consensus statements from European LeukemiaNET (ELN) and International Working Group-Myeloproliferative Neoplasms Research and Treatment (IWG-MRT), *Leukemia*, 25 August 2014 (Epub ahead of print).

BENTO, C., PERCY, M.J., GARDIE, B., MAIA, T.M., VAN WIJK, R., PERROTTA, S., RAGIONE, F.D., ALMEIDA, H., ROSSI, C., GIRODON, F., ASTRÖM, M., NEUMAN, D., SCHNITTGER, S., LANDIN, B., MINKOV, M., RANDI, M.L., CASADEVALL, N., VAINCHENKER, W., RIVES, S., HERMOUET, S., RIBEIRO, L., MCMULLIN, M.F. and CARIO, H. on behalf of ECE-Consortium (2014) Genetic basis of congenital erythrocytosis: mutation update and online databases, *Human Mutation*, 35(1), p15-26.

BOYLE, D.P., McART, D.G., IRWIN, G., WILHELM-BENARTZI, C.S., LIOE, T.F., SEBASTIAN, E., McQUAID, S., HAMILTON, P.W., JAMES, J.A., MULLAN, P.B., CATHERWOOD, M.A., HARKIN, D.P. and SALTO-TELLEZ, M. (2014) The prognostic significance of the aberrant extremes of p53 immunophenotypes in breast cancer, *Histopathology,* 65(3), p340-352.

BRIDGAM, M., CURRAN, S. and McMULLIN, M.F. (2014) Management of Hyperkalaemia, *Journal of the Royal College of Physicians of Edinburgh*, 44, p91-92.

BROWN, R., DONNELLY, D.E., ALLEN, D., LOUGHREY, M.B. and MORRISON, P.J. (2014) Familial urothelial cell carcinoma of the bladder with autosomal dominant inheritance and late onset phenotype, *SpringerPlus*, 3, p281.

BUCKLEY, N.E., D'COSTA, Z., KAMINSKA, M. and MULLAN, P.B. (2014) S100A2 is a BRCA1/p63 coregulated tumour suppressor gene with roles in the regulation of mutant p53 stability, *Cell Death Disease*, 5:e1070.

BURDAK-ROTHKAMM, S., ROTHKAMM, K., McCLELLAND, K., RASHID, S.T. and PRISE, K.M. (2014) BRCA1, FANCD2 and Chk1 are potential molecular targets for the modulation of a radiation-induced DNA damage response in bystander cells, *Cancer Lett.*, 356(2 Pt B), p454-461.

BURDAK-ROTHKAMM, S., SMITH, A., LOBACHEVSKY, P., MARTIN, R. and PRISE, K.M. (2014) Radioprotection of targeted and bystander cells by methylproamine, *Strahlenther Onkol.*, 23 September 2014 Sep (Epub ahead of print).

BUTTERWORTH, K.T., REDMOND, K.M., McMAHON, S.J., COLE, A.J., JAIN, S., McCARTHY, H.O., O'SULLIVAN, J.M., HOUNSELL, A.R. and PRISE, K.M. (2014) Conventional in vivo irradiation procedures are insufficient to accurately determine tumor responses to non-uniform radiation fields. *Int J Radiat Biol.*, 20 November 2014 (Epub ahead of print).

CAMPBELL, E., KENNEDY, F., RUSSELL, A., SMITHSON, W.H., PARSONS, L., MORRISON, P.J., LIGGAN, B., IRWIN, B., DELANTY, N., HUNT, S.J., CRAIG, J. and MORROW, J. (2014) Malformation risks of antiepileptic drug monotherapies in pregnancy: updated results from the UK and Ireland Epilepsy and Pregnancy Registers, *J Neurol Neurosurg Psychiatry*, 85, p1029-1034.

CARDWELL, C.R., COLEMAN, H.G., MURRAY, L.J., O'SULLIVAN, J.M. and POWE, D.G. (2014) Beta-blocker usage and prostate cancer survival: a nested case-control study in the UK Clinical Practice Research Datalink cohort, *Cancer Epidemiol.*, 38(3), p279-285.

CARDWELL, C.R., FLAHAVAN, E.M., HUGHES, C.M., COLEMAN, H.G., O'SULLIVAN, J.M., POWE, D.G. and MURRAY, L.J. (2014) Low-dose aspirin and survival in men with prostate cancer: a study using the UK Clinical Practice Research Datalink, *Cancer Causes Control*, 25(1), p33-43.

CHAUDHARY, P., MARSHALL, T.I., PEROZZIELLO, F.M., MANTI, L., CURRELL, F.J., HANTON, F., McMAHON, S.J., KAVANAGH, J.N., CIRRONE, G.A., ROMANO, F., PRISE, K.M. and SCHETTINO, G. (2014) Relative Biological Effectiveness Variation Along Monoenergetic and Modulated Bragg Peaks of a 62-MeV Therapeutic Proton Beam: A Preclinical Assessment, *Int J Radiat Oncol Biol Phys.*, 90(1), p27-35.

CLARK, G.R., SCIACOVELLI, M., GAUDE, E., WALSH, D.M., KIRBY, G., SIMPSON, M.A., TREMBATH, R.C., BERG, J.N., WOODWARD, E.R., KINNING, E., MORRISON, P.J., FREZZA, C. and MAHER, E.R. (2014) Germline FH mutations presenting with pheochromocytoma. *J Clin Endocrinol Metab.*, 99(10):E2046-50.

COLE, A.J., O'HARE, J.M., McMAHON, S.J., McGARRY, C.K., BUTTERWORTH, K.T., McALEESE, J., JAIN, S., HOUNSELL, A.R., PRISE, K.M., HANNA, G.G. and O'SULLIVAN, J.M. (2014) Investigating the Potential Impact of Four-dimensional Computed Tomography (4DCT) on Toxicity, Outcomes and Dose Escalation for Radical Lung Cancer Radiotherapy, *Clinical Oncology*, 26(3), p142-150.

COLE, A.J., HANNA, G.G., JAIN, S. and O'SULLIVAN, J.M. (2014) Motion Management for Radical Radiotherapy in Non-small Cell Lung Cancer, *Clin Oncol (R Coll Radiol)*, 26(2), p67-80.

COLE, A.J., McGARRY, C.K., BUTTERWORTH, K.T., McMAHON, S.J., HOUNSELL, A.R., PRISE, K.M. AND O'SULLIVAN, J.M. (2013), Investigating the influence of respiratory motion on the radiation induced bystander effect in modulated radiotherapy, *Physics in Medicine and Biology*, 58, p8311–8322.

CRAWFORD, L. and IRVINE, A.E. (2013) Targeting the Ubiquitin Proteasome System In Haematological Malignancies, *Blood Reviews*, 27, p297-304.

CRAWFORD, L., CHAN, E.T., AUJAY, M., HOLYOAKE ,T., MELO, J.V., JORGENSON, H.G., SURESH, S., WALKER, B. and IRVINE, A.E. (2014) Synergistic Effects Of Proteasome Inhibitor Carfilzomib In Combination With Tyrosine Kinase Inhibitors In Imatinib Sensitive And Resistant Chronic Myeloid Leukaemia Models, *Oncogenesis,* 3(2): e90.

CRAWFORD, N., STASIK, I., HOLOHAN, C., MAJKUT, J., McGRATH, M., JOHNSTON, P.G., CHESSARI, G., WARD, G.A., WAUGH, D.J., FENNELL, D.A. and LONGLEY, D.B. (2013) SAHA overcomes FLIP-mediated inhibition of SMAC mimetic-induced apoptosis in mesothelioma, *Cell Death Dis.*, 4:e733.

CREE, I.A., DEANS, Z., LIGTENBERG, M.J., NORMANNO, N., EDSJÖ, A., ROULEAU, E., SOLÉ, F., THUNNISSEN, E., TIMENS, W., SCHUURING, E., DEQUEKER, E., MURRAY, S., DIETEL, M., GROENEN, P. and VAN KRIEKEN, J.H.; for the European Society of Pathology Task Force on Quality Assurance in Molecular Pathology and the Royal College of Pathologists (2014) Guidance for laboratories performing molecular pathology for cancer patients, *J Clin Pathol*, 67(11), p923-931.

D'COSTA, Z.C., HIGGINS, C., ONG, C.W., IRWIN, G.W., BOYLE, D., McART, D.G., McCLOSKEY, K., BUCKLEY, N.E., CRAWFORD, N.T., THIAGARAJAN, L., MURRAY, J.T., KENNEDY, R.D., MULLIGAN, K.A., HARKIN, D.P., WAUGH, D.J., SCOTT, C.J., SALTO-TELLEZ, M., WILLIAMS, R. and MULLAN, P.B. (2014) TBX2 represses CST6 resulting in uncontrolled legumain activity to sustain breast cancer proliferation: a novel cancer-selective target pathway with therapeutic opportunities, *Oncotarget*, 5(6), p1609-20.

DEELEN, J. *et al.* (2014) Genome-wide association meta-analysis of human longevity identifies a novel locus conferring survival beyond 90 years of age, *Hum Mol Genet*, 23(16), p4420 – 4432.

DEHMER, M., EMMERT-STREIB, F. and SHI, Y. (2014) Interrelations of graph distance measures based on topological indices, *PLoS One*, 9(4):e94985.

DONNELLY, D.E. and MORRISON, P.J. (2104) Hereditary Gigantism – the biblical giant goliath and his brothers, *Ulster Med J*, 83(2), p86-88.

DUFFY, S., RICHARDS, M., SELBY, P. and LAWLER, M. (2013) Addressing cancer disparities in Europe: a multifaceted problem that requires interdisciplinary solutions, *Oncologist*, 18(12):e29-30.

DUNNE, P.D., McART, D.G., BLAYNEY, J.K., KALIMUTHO, M., GREER, S., WANG, T., SRIVASTAVA, S., ONG, C.W., ARTHUR, K., LOUGHREY, M., REDMOND, K., LONGLEY, D.B., SALTO-TELLEZ, M., JOHNSTON, P.G. and VAN SCHAEYBROECK S. (2014) AXL is a key regulator of inherent and chemotherapy-induced invasion and predicts a poor clinical outcome in early stage colon cancer, *Clinical Cancer Research*, 20(1), p164-175.

EATOCK, M.M., TEBBUTT, N.C., BAMPTON, C.L., STRICKLAND, A.H., VALLADARES-AYERBES, M., SWIEBODA-SADLEJ, A., VAN CUTSEM, E., NANAYAKKARA, N., SUN, Y-N., ZHONG, Z.D., BASS, M.B., ADEWOYE, A.H. and BODOKY, G. (2013) Phase II randomized, double-blind, placebo-controlled study of AMG 386 (trebananib) in combination with cisplatin and capecitabine in patients with metastatic gastro-oesophageal cancer, *Ann Oncol*, 24, p710-718.

EDDIE, S.L., QUARTUCCIO, S.M., ZHU, J., SHEPHERD, J.A., KOTHARI, R., KIM, J.J., WOODRUFF, T.K. and BURDETTE, J.E. (2014) Three-dimensional modelling of the human fallopian tube fimbriae, *Gynecol Oncol*, 10 December 2014 (Epub ahead of print).

EMMERT-STREIB, F. (2014) Enhancing our understanding of ways to analyze metagenomes, *Front Genet*, 5, p108.

EMMERT-STREIB, F., DE MATOS SIMOES, R., GLAZKO, G., McDADE, S., HAIBE-KAINS, B., HOLZINGER, A., DEHMER, M. and CAMPBELL, F. (2014) Functional and genetic analysis of the colon cancer network, *BMC Bioinformatics*, 15 Suppl 6:S6.

EMMERT-STREIB, F., DE MATOS SIMOES, R., MULLAN, P., HAIBE-KAINS, B. and DEHMER, M. (2014) The gene regulatory network for breast cancer: integrated regulatory landscape of cancer hallmarks, *Front Genet*, 5, p15.

EMMERT-STREIB, F., DEHMER, M. and HAIBE-KAINS, B. (2014) Gene regulatory networks and their applications: understanding biological and medical problems in terms of networks, *Front Cell Dev Biol.*, 2, p38.

EMMERT-STREIB, F., DEHMER, M. and HAIBE-KAINS, B. (2014) Untangling statistical and biological models to understand network inference: the need for a genomics network ontology, *Front Genet.*, 5:299.

EMMERT-STREIB, F., ZHANG, S.-D. and HAMILTON, P. (2014) Dry computational approaches for wet medical problems, *Journal of Translational Medicine*,12, p26.

EMMERT-STREIB, F., ZHANG, S.D. and HAMILTON, P. (2014) Report from the 2nd Summer School in Computational Biology organized by the Queen's University of Belfast, *Genomics Data*, Volume 2, p37-39.

FLYNN, C., JAMES, J., MAXWELL, P., McQUAID, S., ERVINE, A., CATHERWOOD, M., LOUGHREY, M.B., McGIBBEN, D., SOMERVILLE, J., McMANUS, D.T., GRAY, M., HERRON, B. and SALTO-TELLEZ, M. (2014) Integrating molecular diagnostics into histopathology training: the Belfast model, *J Clin Pathol.*, 67(7), p632-636.

GARETH, E.D., NISHA, K., YIT, L., SOUJANYE, G., EMMA, H., MASSAT, N.J., MAXWELL, A.J., SARAH, I., ROSALIND, E., LEACH, M.O., MARIBS GROUP, ANTHONY, H. and STEPHEN, D. (2014) MRI breast screening in high-risk women: cancer detection and survival analysis, *Breast Cancer Res Treat.*, 145(3), p663-672.

GLASSPOOL, R.M., BROWN, R., GORE, M.E., RUSTIN, G.J., McNEISH, I.A., WILSON, R.H., PLEDGE, S., PAUL, J., MACKEAN, M., HALL, G.D., GABRA, H., HALFORD, S.E., WALKER, J., APPLETON, K., ULLAH, R. and KAYE, S. (2014) A randomised, phase II trial of the DNA-hypomethylating agent, 5-Aza-2′-deoxycytidine (Decitabine) in combination with carboplatin, versus carboplatin alone in patients with recurrent, partially platinum-sensitive ovarian cancer, *British Journal of Cancer*, 110(8), p1923-1929.

GOODY, R.B., HANNA, G.G. and HARRISON, C. (2014) Audit of Clinical Outcomes following Definitive Chemoradiotherapy for Oesophageal Cancer following the Introduction of a Regional Specialist Multidisciplinary Team Meeting, *Clinical Oncology*, 26, Supplement 1, S5-6.

GROSS, M. BEN-CALIFA, N., McMULLIN, M.F., PERCY, M.J., BENTO, C., CARIO, H., MINKOV, M. and NEUMANN, D. (2014) Polycythaemia-inducing mutations in the erythropoietin receptor (EPOR): mechanism and function as elucidated by epidermal growth factor-EPOR chimeras, *British Journal of Haematology*, 164(4), p519-528.

HAIBE-KAINS B. and EMMERT-STREIB F. (2014) Quantitative assessment and validation of network inference methods in bioinformatics, *Front Genet*, 5, p221.

HALE, K.J., GRABSKI, M., MANAVIAZAR, S. and MACZKA, M. (2014) Asymmetric Total Synthesis of (+)-Inthomycin C Via O-Directed Free Radical Alkyne Hydrostannation with Ph3SnH and Catalytic Et3B: Reinstatement of the Zeeck-Taylor (3R)-Structure for (+)-Inthomycin C, *Org. Lett.*, 16, p1164-1167.

HALE, K.J., HATAKEYAMA, S., URABE, F., ISHIHARA, J., MANAVIAZAR, S., GRABSKI, M. and MACZKA, M. (2014) The Absolute Configuration for Inthomycin C. Revision of Previously Published Work with a Reinstatement of the (3R)-Configuration for (-)-Inthomycin C, *Org. Lett.*, 16, p3536-3539.

HALE, K.J., MACZKA, M., KAUR, A., MANAVIAZAR, S., OSTOVAR, M. and GRABSKI, M. (2014) Synthesis of the C(7)-C(22)-Sector of (+)-Acutiphycin Via O-Directed Double Free Radical Alkyne Hydrostannation with Ph3SnH/Et3B, Double I-Sn Exchange and Double Stille Coupling, *Org. Lett.*, 16, p1168-1171.

HALE, K.J. and WANG, L. (2014) A New Stereocontrolled Total Synthesis of the Mast Cell inhibitory Alkaloid, (+)-Monanchorin, Via the Wittig Reaction of a Stabilized Ylide with a Cyclic Guanidine Hemiaminal, *Org. Lett.*, 16, p2154-2157.

HAMILTON, P.W., BANKHEAD, P., WANG, Y., HUTCHINSON, R., KIERAN, D., McART, D.G., JAMES, J. and SALTO-TELLEZ, M. (2014) Digital pathology and image analysis in tissue biomarker research, *Methods*, 70(1), p59-73.

HANNA, G.G., SIVA, S., PLUMRIDGE, N., SOLOMON, B. and BALL, D.L. (2014) Preoperative chemotherapy for non-small-cell lung cancer, *Lancet*, 384(9939), p232-233.

HARRISON, C.N., BUTT, N., CAMPBELL, P., CONNEALLY, E., DRUMMOND, M., GREEN, A.R., MURRIN, R., RADIA, D.H., MEAD, A., REILLY, J.T., CROSS, N.C. and McMULLIN, M.F. (2014) Modification of British Committee for Standards in Haematology diagnostic criteria for essential thrombocythaemia, *British Journal of Haematology*, 167(3), p421-423.

HARRISON, C.N. and McMULLIN, M.F. (2014) Update in the myeloproliferative Neoplasms, *Clin. Med.*, 14(Suppl 6), p66-70.

HASLAM, K., LANGABEER, S.E., MOLLOY, K., McMULLIN, M.F. and CONNEALLY, E. (2014) Assessment of CALR mutations in myelofibrosis patients, post-allogeneic stem cell transplantation, *British Journal of Haematology*, 166(5), p800-802.

HASSAWI, M., SHESTAKOVA, E.A., FOURNIER, M., LEBERT-GHALI, C.E., VAISSON, G., FRISON, H., SINNETT, D., VIDAL, R., THOMPSON, A. and BIJL, J.J. (2014) Hoxa9 collaborates with E2A-PBX1 in mouse B cell leukemia in association with Flt3 activation and decrease of B cell gene expression, *Dev Dyn.*, 243(1), p145-158.

HIGGINS, C., BOUAZZAOUI, S., GADDALE, K., D'COSTA, Z., TEMPLEMAN, A., O'ROURKE, M., YOUNG, A., SCOTT, C., HARRISON, T., MULLAN, P. and WILLIAMS, R. (2014) P3 SAR exploration of biphenyl carbamate based Legumain inhibitors, *Biorganic Medicinal Chemistry Letters*, 24(11), p2521-2524.

HIGGINS, P.A., BRADY, A., DOBBS, S.P., SALTO-TELLEZ, M., MAXWELL, P. and McCLUGGAGE, W.G. (2013) Epidermal growth factor receptor (EGFR), HER2 and insulin-like growth factor-1 receptor (IGF-1R) status in ovarian adult granulosa cell tumours, *Histopathology*, 64(5), p633-638.

HOLOHAN, C., VAN SCHAEYBROECK, S., LONGLEY, D.B. and JOHNSTON, P.G. (2013) Cancer drug resistance: an evolving paradigm, *Nat Rev Cancer*, 13(10), p714-26.

HORN, S., BARNARD, S., BRADY, D., PRISE, K.M., and ROTHKAMM, K. (2013) Combined analysis of gamma-H2AX/53BP1 foci and caspase activation in lymphocyte subsets detects recent and more remote radiation exposures, *Radiation Research*, 180, p603-609.

HOSKIN, P., SARTOR, O., O'SULLIVAN, J.M., JOHANNESSEN, D.C., HELLE, S.I., LOGUE, J., BOTTOMLEY, D., NILSSON S., VOGELZANG, N.J., FANG, F., WAHBA, M., AKSNES, A.K. and PARKER, C. (2014) Efficacy and safety of radium-223 dichloride in patients with castration-resistant prostate cancer and symptomatic bone metastases, with or without previous docetaxel use: a prespecified subgroup analysis from the randomised, double-blind, phase 3 ALSYMPCA trial, *Lancet Oncol.*, 15(12), p1397-406.

HUANG, Y.H., AL-AIDAROOS, A.Q., YUEN, H.F., ZHANG, S.D., SHEN, H.M., ROZYCKA, E., McCRUDDEN, C.M., TERGAONKAR, V., GUPTA, A., LIN, Y.B., THIERY, J.P., MURRAY, J.T. and ZENG, Q. (2014) A role of autophagy in PTP4A3-driven cancer progression, *Autophagy*, 10(10), p1787-800.

HUMPHREY, A., MACLEAN, C., PLOUBIDIS, G.B., GRANADER, Y., CLIFFORD, M., HASLOP, M., NEVILLE, B.G., YATES, J.R. and BOLTON, P.F. (2014) Tuberous Sclerosis 2000 Study Group. Intellectual development before and after the onset of infantile spasms: a controlled prospective longitudinal study in tuberous sclerosis, *Epilepsia*, 55(1), p108-116.

HUSSEIN, K., PERCY, M., MCMULLIN, M.F., SCHWARZ, J., PORRET, N., MARTINEZ-AVILES, L.M., PARICIO, B.B., GIRAUDIER, S., SKODA, R., LIPPERT, E., HERMOUET, S. and CARIO, H. (2014) Clinical utility gene card for : Hereditary thrombocythemia, *European Journal of Human Genetics*, 22(2).

HYLAND, W.B., McMAHON, S.J., BUTTERWORTH, K.T., COLE, A., KING, R.B., REDMOND, K.M., PRISE, K.M., HOUNSELL, A.R. and McGARRY, C.K. (2014) Investigating the Radiobiological Consequences of Pre-Treatment Verification Imaging with MV X-rays, *British Journal of Radiology*, 87(1036): 20130781.

JAGAN, I.C., DEEVI, R.K., FATEHULLAH, A., TOPLEY, R., EVES, J., STEVENSON, M., LOUGHREY, M., ARTHUR, K. and CAMPBELL, F.C. (2013) PTEN Phosphatase-Independent Maintenance of Glandular Morphology in a Predictive Colorectal Cancer Model System, *Neoplasia*, 15, p218-1230.

JAIN, S., COULTER, J.A., BUTTERWORTH, K.T., HOUNSELL, A.R., MCMAHON, S.J., HYLAND, W.B., MUIR, M.F., DICKSON, G.R., PRISE, K.M., CURRELL, F.J., HIRST, D.G. and O'SULLIVAN, J.M. (2014) Gold nanoparticle cellular uptake, toxicity and radiosensitisation in hypoxic conditions, *Radiother Oncol.*, 110(2), p342-347.

JAMES, J.A. and SALTO-TELLEZ, M. (2014) The training of future tissue pathologists in a changing world, *J Clin Pathol*, 67(7), p549.

JONES, C., BADGER, S.A., STEVENSON, M., DIAMOND, T., McKIE, L.D., TAYLOR, M.A., WILSON, R.H. and LYNCH, T.B. (2014) PET-CT as a predictor of outcome in colorectal liver metastases, *European Journal of Gastroenterology & Hepatology*, 26(4), p466-472.

JEFFERS, L., MORRISON, P., McCAUGHAN, E. and FITZSIMONS, D. (2014) Maximising survival: the main concern of women with hereditary breast and ovarian cancer who undergo genetic testing for BRCA1/2 (2014) *Eur J Oncol Nursing*, 18, p411-18.

KAPLAN, R., MAUGHAN, T., CROOK, A., FISHER, D., WILSON, R.H., BROWN, L. and PARMAR, M. (2013) Evaluating many treatments and biomarkers in oncology: a new design, *Journal of Clinical Oncology*, 31(36), p4562-4568.

KENNEDY, J. and LAWLER, M. (2014) European Cancer Patient Bill of Rights dedicated to the memory of Visionary Irish Radiation Oncologist, *Oncologist (European Edition)*, 19, p10.

KEOHANE C, McMULLIN, M.F. and HARRISON C. (2013) The diagnosis and management of erythrocytosis, *BMJ*, 18 November 2013, p347.

KHADIM, M.F., EASTWOOD, P., PRICE, J., MORRISON, P. and KHAN, K. (2013) Multidisciplinary one-stage risk-reducing gynaecological and breast surgery with immediate reconstruction in BRCA-gene carrier women, *Eur J Surg Oncol.*, 39(12), p1346-50.

KIM, C.S., HWANG, S. and ZHANG, S.D. (2014) RMA with quantile normalization mixes biological signals between different sample groups in microarray data analysis, *Bioinformatics and Biomedicine (BIBM),* 2014 IEEE International Conference on Bioinformatics and Biomedicine, 2-5 November 2014, p139-143.

KIM, C.S., WEN, Q. and ZHANG, S.D. (2014) Integrative analysis of chemo-transcriptomic profiles for drug-feature specific gene expression signatures, *Bioinformatics and Biomedicine (BIBM),* 2014 IEEE International Conference on Bioinformatics and Biomedicine, 2-5 November 2014, p113-118.

KNAUL, F.M., PLEIC, M., LAWLER, M. (2014) Cancer in Low- and Middle-Income Countries – We Need to Close the Divide, *Oncologist (European Edition)*, 19(2), p1-2.

LAPPIN, T.R., (2014) Sibling synergy, *Stem Cells.*, 11 December 2014 (Epub ahead of print).

LAU, W.M., TENG, E., CHONG, H.S., LOPEZ, K.A., TAY, A.Y., SALTO-TELLEZ, M., SHABBIR, A., SO, J.B. and CHAN, S.L. (2014) CD44v8-10 is a cancer-specific marker for gastric cancer stem cells, *Cancer Res*, 74(9), p2630-41.

LAWLER, M., SELBY, P., AAPRO, M.S. and DUFFY, S. (2014) Ageism in cancer care, *BMJ*, 348:g1614.

LAWLER, M., LE CHEVALIER, T., MURPHY, M.J. JR, BANKS, I., CONTE, P., DE LORENZO, F., MEUNIER, F., PINEDO, H.M., SELBY, P., ARMAND, J.P., BARBACID, M., BARZACH, M., BERGH, J., BODE, G., CAMERON, D.A., DE BRAUD, F., DE GRAMONT, A., DIEHL, V., DILER, S., ERDEM, S., FITZPATRICK, J.M., GEISSLER, J., HOLLYWOOD, D., HØJGAARD, L., HORGAN, D., JASSEM, J., JOHNSON, P.W., KAPITEIN, P., KELLY, J., KLOEZEN, S., LA VECCHIA, C., LÖWENBERG, B., OLIVER, K., SULLIVAN, R., TABERNERO, J., VAN DE VELDE, C.J., WILKING, N., WILSON, R., ZIELINSKI, C., ZUR HAUSEN, H. and JOHNSTON, P.G.(2014) A Catalyst for Change: The European Cancer Patient's Bill of Rights, *Oncologist*, 19(3), p217-224.

LAWLER, M., LE CHEVALIER, T., BANKS, I., CONTE, P., DE LORENZO, F., MEUNIER, F., PINEDO, H.M., SELBY, P., MURPHY, M.J. and JOHNSTON, P.G.; on behalf of the European Cancer Concord (ECC) (2014) A Bill of Rights for patients with cancer in Europe, *Lancet Oncol.*, 13, p70552-7.

LAWLER, M., DUFFY, S., LA VECCHIA, C., LE CHEVALIER, T., SELBY, P.J., SULLIVAN, R. and JOHNSTON, P.G. (2013) America's cancer crisis; is Europe any better? *Lancet*, 382(9905), p1628.

LEWIS, E., O'KEEFFE S., GRATTAN, M., HOUNSELL, A., McCARTHY, D., WOULFE, P., CRONIN, J., MIHAI, L., SPOREA, D., SANTHANAM, A. and AGAZARYAN, N., (2014) Terbium-doped gadolinium oxysulfide (Gd2O2S:Tb) scintillation-based polymer optical fibre sensor for real time monitoring of radiation dose in oncology, *Proc. SPIE,* 9141 Optical Sensing and Detection III, 914113.

LOGAN, G.E., MOR-VAKNIN, N., BRAUNSCHWEIG, T., JOST, E., MARKOVITZ, D.M., MILLS, K.I., KAPPES, F. and PERCY, M.J. (2014) The DEK oncogene is differentially expressed during normal hematopoiesis and undergoes reduced expression in Acute Myeloid Leukemia (AML), *Blood Cells Molecular and Disease*, 54 (1), p 123-132.

LOH, M., LIEM, N., VAITHILINGAM, A., LIM, P.L., SAPARI, N.S., ELAHI, E., MOK, Z.Y., CHENG, C.L., YAN, B., PANG, B., SALTO-TELLEZ, M., YONG, W.P., IACOPETTA, B. and SOONG, R. (2014) DNA methylation subgroups and the CpG island methylator phenotype in gastric cancer: a comprehensive profiling approach, *BMC Gastroenterol*, 14, p55.

MACGREGOR, T.P., GILLIES, R.S., SAHGAL, N., CHETTY, R., WANG, L.M., TURKINGTON, R.C., MAYNARD, N.D., McHUGH, P.J., KENNEDY, R.D., MIDDLETON, M.R. and SHARMA, R.A. (2014) Discovery of prognostic and predictive tissue biomarkers in patients with resectable esophageal cancer, *Journal of Clinical Oncology*, 32;3s, p45.

MAJKUT, J.*, SGOBBA, M.*, HOLOHAN, C.*, CRAWFORD, N., LOGAN, A.E., KERR, E., HIGGINS, C.A., REDMOND, K.L., RILEY, J.S., STASIK, I., FENNELL, D.A., VAN SCHAEYBROECK, S., HAIDER, S., JOHNSTON, P.G., HAIGH, D. and LONGLEY, D.B. (2014) Differential affinity of FLIP and procaspase 8 for FADD's DED binding surfaces regulates DISC assembly, *Nat Comms*, 5:3350 (*joint first authors).

MANDA, K., KAVANAGH, J., BUTTLER, D., PRISE, K.M. and HILDEBRANDT, G. (2014) Low dose effects of ionizing radiation on normal tissue stem cells, *Mutation Research Reviews*, 22 February 2014 (Epub ahead of print).

MARIOTTI, L.G., PIROVANO, G., SAVAGE, K.I., GHITA, M., OTTOLENGHI, A., PRISE, K.M., and SCHETTINO, G. (2013), Use of the γ-H2AX assay to investigate DNA repair dynamics following multiple radiation exposures, *PLoS One*, 8, e79541.

MARSH, J.C., PEARCE, M., KOH, M.B., LIM, Z., PAGLIUCA, A., MUFTI, G.J., PERRY, J., SNOWDON, J.A., VORA, A.J., WYNN, R.T., RUSSELL, N., GIBSON, M., MILLIGAN, D., VEYS, P., SAMARASINGHE, S., MCMULLIN, M., KIRKLAND, K. and COOK, G. (2014) Retrospective study of alemtuzumab vs ATG-based conditioning without irradiation for unrelated and matched sibling donor transplants in acquired severe aplastic anemia: a study from the British Society for Blood and Marrow Transplantation, *Bone Marrow Transplantation*, 49(1): p42-48.

MATCHETT, K.B., McFARLANE, S., HAMILTON, S.E., ELTUHAMY, Y.S.A., DAVIDSON, M.A., MURRAY, J.T., FAHEEM, A.M. and EL-TANANI, M. (2014) Ran GTPase in Nuclear Envelope Formation and Cancer Metastasis, *Adv Exp Med Biol.*, 773, p323-351.

MATCHETT, K.B. and LAPPIN, T.R. (2014) Cancer Stem Cells: From Concept to Cure, *Stem Cells*, 32, p2563-70.

MAUGHAN, T.S., MEADE, A.M., ADAMS, R.A., RICHMAN, S.D., BUTLER, R., FISHER, D., WILSON, R.H., JASANI, B., TAYLOR, G.R., WILLIAMS, G.T., SAMPSON, J.R., SEYMOUR, M.T., NICHOLS, L.L., KENNY, S., NELSON, A., SAMPSON, C.M., HODGKINSON, E., BRIDGEWATER, J.A., FURNISS, J.L., ROY, R., POPE, M.J., POPE, J.K., PARMAR, M., QUIRKE, P. and KAPLAN, R.S. (2014) A feasibility study testing four hypotheses with phase II outcomes in advanced colorectal cancer (MRC FOCUS 3): A paradigm for randomised controlled trials in the era of personalised medicine?, *British Journal of Cancer* , 110(9), p2178-2186.

MAXWELL, P., MELENDEZ-RODRÍGUEZ, F., MATCHETT, K.B., ARAGONES, J., BEN-CALIFA, N., JAEKEL, H., HENGST, L., LINDNER, H., BERNARDINI, A., BROCKMEIER, U., FANDREY, J., GRUNERT, F., OSTER, H.S., MITTELMAN, M., EL-TANANI, M., THIERSCH, M., SCHNEIDER GASSER, E.M., GASSMANN, M., DANGOOR, D., CUTHBERT, R.J., IRVINE, A., JORDAN, A., LAPPIN, T., THOMPSON, J. and NEUMANN, D. (2014) Novel antibodies directed against the human erythropoietin receptor: creating a basis for clinical implementation, *British Journal of Haematology*, 4 October 2014 (Epub ahead of print).

MAXWELL, P.J., NEISEN, J., MESSENGER, J. and WAUGH, D.J. (2014) Tumor-derived CXCL8 signaling augments stroma-derived CCL2-promoted proliferation and CXCL12-mediated invasion of PTEN-deficient prostate cancer cells, *Oncotarget*, 5(13), p4895-908.

McDADE, S.S., PATEL, D., MORAN, M., CAMPBELL, J., ORR, N.J., FENWICK, K., KOZAREWA, I., LORD, C.J., ASHWORTH, A. and McCANCE, D.J. (2014) Genome wide characterization reveals complex interplay between TP53 and TP63 in response to genotoxic stress, *Nucleic Acids Research*, 42(10), p6270-6285.

McGARRY, C.K., BOKRANTZ, R., O'SULLIVAN, J.M. and HOUNSELL, A.R. (2014) Advantages and limitations of navigation-based multicriteria optimization (MCO) for localized prostate cancer IMRT planning. *Medical Dosimetry*, 12 March 2014.

McGARRY, C.K., O'CONNELL, B.F., GRATTAN, M.W.D., AGNEW, C.E., IRVINE, D.M. and HOUNSELL, A.R. (2013) Octavius 4D characterization for flattened and flattening filter free rotational deliveries, *Medical Physics*, 40, 091707.

McMULLIN, M.F. (2014) Secondary Erythrocytosis, *Hematology*, 19(3), p183-4.

MILLS, K.I. and McMULLIN, M.F. (2014) Mutational Spectrum defines primary and secondary Myelofibrosis, *Haematologica*, 99(1):2-3.

MOLIFE, L.R., OMLIN, A., JONES, R.J., KARAVASILIS, V., BLOOMFIELD, D., LUMSDEN, G., FONG, P.C., OLMOS, D., O'SULLIVAN, J.M., PEDLEY, I., HICKISH, T., JENKINS, P., THOMPSON, E., OOMMEN, N., WHEATLEY, D., HEATH, C., TEMPLE, G., PELLING, K. and DE BONO, J.S. (2014) Randomized Phase II trial of nintedanib, afatinib and sequential combination in castration-resistant prostate cancer, *Future Oncol.*, 10(2), p219-31.

MØLLER, L.B., REA, G., YASMEEN, S., SKJØRRINGE, T., THORBORG, S.S., MORRISON, P.J. and DONNELLY, D.E. (2013) A silent nucleotide substitution in the ATP7A gene in a child with Menkes disease, *Mol Genet Metab.*, 110(4), p490-492.

MORENO, V., OLMOS, D., GOMEZ-ROCA, C., CASSIER, P.A., MORALES, R., DEL CONTE, G., GALLERANI, E., BRUNETTO, A., SCHÖFFSKI, P., MARSONI, S., SCHELLENS, J., PENEL, N., VOEST, E., EVANS, T.R.J., PLUMMER, R., WILSON, R.H., SORIA, J.C., TABERNERO, J., VERWEIJ, J. and KAYE, S.B. on behalf of the EDDN (2014) Dose-response relationship in phase I clinical trials: a European Drug Development Network collaboration study, *Clinical Cancer Research*, 20: p5663-5671.

MORRISON, P.T., DONNELLY, D.E. and MORRISON, P.J. (2014) Umbilical pigmentation in Peutz–Jeghers syndrome, *Clin Dysmorphol*, 23, p114-115.

MULGREW, N.M., KETTYLE, L.M., RAMSEY, J.M., CULL, S., SMYTH, L.J., MERVYN, D.M., BIJL, J.J. and THOMPSON, A. (2014) c-Met inhibition in a HOXA9/Meis1 model of CN-AML, *Dev Dyn.*, 243(1), p172-81.

MULLIGAN, J.M., HILL, L.A., DEHARO, S., IRWIN, G., BOYLE, D., KEATING, K.E., RAJI, O.Y., MCDYER, F.A., O'BRIEN, E., BYLESJO, M., QUINN, J.E., LINDOR, N.M., MULLAN, P.B., JAMES, C.R., WALKER, S.M., KERR, P., JAMES, J., DAVISON, T.S., PROUTSKI, V., SALTO-TELLEZ, M., JOHNSTON, P.G., COUCH, F.J., HARKIN, D.P. and KENNEDY, R.D. (2014) Identification and validation of an anthracycline/cyclophosphamide-based chemotherapy response assay in breast cancer, *J Natl Cancer Inst.*, 106(1):djt335.

O'CONNELL, B., IRVINE, D.M., COLE, A., HANNA, G.G. and MCGARRY, C.K. (2014) Optimizing geometric accuracy of four dimensional CT scans acquired using the wall and couch mounted Varian® Real-Time Position Management™ camera systems, *British Journal of Radiology,* 88:20140624.

O'DWYER, M.E., SWORDS, R., NAGLER, A., MCMULLIN, M.F., LECOUTRE, P.D., LANGABEER E., ALVAREZ-IGLESIAS, A., FAN, H., WOODMAN, R.C., GILES, F.J., and CONNEALLY, E. (2014) Nilotinib 300mg BID as frontline treatment of CML: Prospective analysis of the Xpert BCR-ABL monitor system and significance of 3-month molecular response, *Leukemia Research,* 38(3) p310-315.

O'KEEFFE, S., GRATTAN, M., HOUNSELL, A., MCCARTHY, D., WOULFE, P., CRONIN, J. and LEWIS, E. (2013) Radiotherapy dosimetry based on plastic optical fibre sensors, *Proc. SPIE 8794, Fifth European Workshop on Optical Fibre Sensors*, 879418, 20 May 2013.

OLSEN, C., BONTEMPI, G., EMMERT-STREIB, F., QUACKENBUSH, J. and HAIBE-KAINS, B. (2014) Relevance of different prior knowledge sources for inferring gene interaction networks, *Front Genet*, 5, p177.

OLSEN, C., FLEMING, K., PRENDERGAST, N., RUBIO, R., EMMERT-STREIB, F., BONTEMPI, G., HAIBE-KAINS, B. and QUACKENBUSH, J. (2014) Inference and validation of predictive gene networks from biomedical literature and gene expression data, *Genomics*, 103(5-6), p329-336.

OSORIO, A. *et. al.* (2014) DNA Glycosylases Involved in Base Excision Repair May Be Associated with Cancer Risk in BRCA1 and BRCA2 Mutation Carriers, *PLoS Genet*, 10(4):e1004256.

PAQUET, N., BOX, J.K., ASHTON, N.W., SURAWEERA, A., CROFT, L.V., URQUHART, A.J., BOLDERSON, E., ZHANG, S.D., O'BYRNE, K.J., and RICHARD, D.J. (2014) Néstor-Guillermo Progeria Syndrome: a biochemical insight into Barrier-to-Autointegration Factor 1, alanine 12 threonine mutation, *BMC Molecular Biology,* 15(1), p27.

PETROUSI, N., COPLEY, R.R., LAPPIN, T.R., HAGGAN, S.E., BENTO, C.M., CARIO, H., PERCY, M.J., CONSORTIUM, T.W., RATCLIFFE, P.J., ROBBINS, P.A. and McMULLIN, M.F. (2014) Erythrocytosis associated with a novel missense mutation in the BPGM gene, *Haematologica*, 99(10):e201-204.

POOLEY, K.A., McGUFFOG, L., BARROWDALE, D., FROST, D., ELLIS, S.D., FINEBERG, E., PLATTE, R., IZATT, L., ADLARD, J., BARDWELL, J., BREWER, C., COLE, T., COOK, J., DAVIDSON, R., DONALDSON, A., DORKINS, H., DOUGLAS, F., EASON, J., HOUGHTON, C., KENNEDY, M.J., McCANN, E., MIEDZYBRODZKA, Z., MURRAY, A., PORTEOUS, M.E., ROGERS, M.T., SIDE, L.E., TISCHKOWITZ, M., WALKER, L., HODGSON, S., ECCLES, D.M., MORRISON, P.J., EVANS, D.G., EELES, R., ANTONIOU, A.C., EASTON, D.F. and DUNNING, A.M. (2014) Lymphocyte telomere length is longer in BRCA1 and BRCA2 mutation carriers but does not affect subsequent cancer risk. *Cancer Epidemiol Biomarkers Prev.*, 23, p1018-1024.

PRISE, K,M. and MARTIN S.G. (2014), BJR radiobiology special feature. *Br J Radiol.*, 87(1035): 20140074.

RAHMATALLAH, Y., EMMERT-STREIB, F. and GLAZKO, G. (2014) Gene Sets Net Correlations Analysis (GSNCA): a multivariate differential coexpression test for gene sets, *Bioinformatics*, 30(3), p360-8.

RAHMATALLAH, Y., EMMERT-STREIB, F. and GLAZKO, G. (2014) Comparative evaluation of gene set analysis approaches for RNA-Seq data, *BMC Bioinformatics*, 15(1), p397.

REILLY, J.T., McMULLIN, M.F., BEER, P.A., BUTT, N., CONNEALLY, E., DUNCOMBE, A.S., GREEN, A.S., MIKHAEEL, G., GILLEECE, M.H., KNAPPER, S., MEAD, A.J., MESA, R.A., SEKHAR, M. and HARRISON, C.N. (2014) Use of JAK inhibitors in the management of myelofibrosis: a revision of the British Committee for Standards in Haematology guidelines for investigation and management of Myelofibrosis 2012, *British Journal of Haematology*, 167(3), p418-420.

RILEY, J.S., HUTCHINSON, R., McART, D.G., CRAWFORD, N., HOLOHAN, C., PAUL, I., VAN SCHAEYBROECK, S., SALTO-TELLEZ, M., JOHNSTON, P.G., FENNELL, D.A., GATELY, K., O'BYRNE, K., CUMMINS, R., KAY, E., HAMILTON, P., STASIK, I. and LONGLEY, D.B. (2013) Prognostic and therapeutic relevance of FLIP and procaspase-8 overexpression in non-small cell lung cancer, *Cell Death Dis.*, 4:e951.

ROONEY, K.P., HANNA, G.G., HARNEY, J., EAKIN, R.L., YOUNG, V.A.L., DUNN, M., JOHNSTON, R.E. and McALEESE, J. (2014) The impact of peer review on the radiotherapy treatment planning process in the treatment of lung cancer, *Lung Cancer*, 83(2):S58-S59.

ROONEY, K.P., HANNA, G.G., HARNEY, J., EAKIN, R.L., YOUNG, V.A. LINDA, DUNN, M., JOHNSTON, R.E. and McALEESE, J. (2014) The Impact of Colleague Peer-review on the Radiotherapy Treatment Planning Process in the Radical Treatment of Lung Cancer, *Clinical Oncology*, 26, Supplement 1, S3.

ROWSHANFARZAD, P, McGARRY, C.K., BARNES, M.P., SABET, M. and EBERT, M.A. (2014) An EPID-based method for comprehensive verification of gantry, EPID and the MLC carriage positional accuracy in Varian linacs during arc treatments, *Radiation Oncology*, 9, p249.

RUDDOCK, M.W., REID, C.N., MCREYNOLDS, D., LAMONT, J.V., FITZGERALD, S.P., and WILLIAMSON, K.E. (2014) Immunodetection of cytoplasmatic membrane-bound thrombomodulin in formalin-fixed paraffin-embedded human tissue microarrays, *J Mol Genet Med,* 8, p4.

SALOMAA, S., PRISE, K.M., ATKINSON, A.J., WOJCIK, A., AUVINEN, A., GROSCHE, B., SABATIER, L., JOURDAIN,J-R., SALMINEN, E., BAATOUT,S., KULKA, U., RABUS, H., BLANCHARDON, E., AVERBECK, D. and WEISS W., (2014) Reply to "State of the art in research into the risk of low dose radiation exposure", *Journal of Radiological Protection*, 34, p259-60.

SALPEA, P., HORVATH, A., LONDON, E., FAUCZ, F.R., VETRO, A., LEVY, I., GOURGARI, E., DAUBER, A., HOLM, I.A., MORRISON, P.J., KEIL, M.F., LYSSIKATOS, C., SMITH, E.D., SANIDAD, M.A., KELLY, J.C., DAI, Z., MOWREY, P., FORLINO, A., ZUFFARDI, O. and STRATAKIS, C.A. (2014) Large deletions of the PRKAR1A locus at 17q24.2-q24.3 in Carney complex: genotype-phenotype correlations and implications for genetic testing, *J Clin Endocrinol Metab.*, 99(1):E183-8.

SALTO-TELLEZ, M. and DE CASTRO, D.G. (2014) Next Generation Sequencing: A Change of Paradigm in Molecular Diagnostic Validation, *J Pathol*, 234(1), p5-10.

SALTO-TELLEZ, M., JAMES, J.A. and HAMILTON, P.W. (2014) Molecular pathology - The value of an integrative approach, *Molecular Oncology*, 8(7), p1163-1168.

SANCEY, L., LUX, F., KOTB, S., ROUX, S., DUFORT, S., BIANCHI, A., CRÉMILLIEUX, Y., FRIES, P., COLL, J.L., RODRIGUEZ-LAFRASSE, C., JANIER, M., DUTREIX, M., BARBERI-HEYOB, M., BOSCHETTI, F., DENAT, F., LOUIS, C., PORCEL, E., LACOMBE, S., LE DUC, G., DEUTSCH, E., PERFETTINI, J.L., DETAPPE, A., VERRY, C., BERBECO, R., BUTTERWORTH, K.T., McMAHON, S.J., PRISE, K.M., PERRIAT, P. and TILLEMENT, O. (2014) The use of theranostic gadolinium-based nanoprobes to improve radiotherapy efficacy, *Br J Radiol.*, 87(1041), p20140134.

SARTOR, O., COLEMAN, R., NILSSON, S., HEINRICH, D., HELLE, SI., O'SULLIVAN, J.M., FOSSÅ SD, CHODACKI, A., WIECHNO, P., LOGUE, J., WIDMARK, A., JOHANNESSEN, D.C., HOSKIN, P., JAMES, N.D., SOLBERG, A., SYNDIKUS, I., VOGELZANG, N.J., O'BRYAN-TEAR, C.G., SHAN, M., BRULAND, Ø.S. and PARKER, C. (2014) Effect of radium-223 dichloride on symptomatic skeletal events in patients with castration-resistant prostate cancer and bone metastases: results from a phase 3, double-blind, randomised trial, *Lancet Oncol.*, 15(7) p738-746.

SAVAGE, K.I., GORSKI, J.J., BARROS, E.M., IRWIN, G.W., MANTI, L., POWELL, A.J., PELLAGATTI, A., LUKASHCHUK, N., McCANCE, D.J., McCLUGGAGE, W.G., SCHETTINO, G., SALTO-TELLEZ, M., BOULTWOOD, J., RICHARD, D.J., McDADE, S.S. and HARKIN, D.P. (2014) Identification of a BRCA1-mRNA Splicing Complex Required for Efficient DNA Repair and Maintenance of Genomic Stability, *Molecular Cell,* 54**,** p445-59.

SAVAGE, K.I.*, MATCHETT, K.B*., BARROS, E.M., COOPER, K.M., IRWIN, G.W., GORSKI, J.J., ORR, K.S., VOHHODINA, J., KAVANAGH, J.N., MADDEN, A.F., POWELL, A., MANTI, L., McDADE, S.S., PARK, B.H., PRISE, K.M., McINTOSH, S.A., SALTO-TELLEZ, M., RICHARD, D.J., ELLIOTT, C.T. and HARKIN, D.P. (2014) BRCA1 Deficiency Exacerbates Estrogen-Induced DNA Damage and Genomic Instability, *Cancer Research,* 74**,** p2773-84 (*joint first authors).

SCHMID, D., JARVIS, G.E., FAY, F., SMALL, D.M., GREENE, M.K., MAJKUT, J., SPENCE, S., McLAUGHLIN, K.M., McCLOSKEY, K.D., JOHNSTON, P.G., KISSENPFENNIG, A., LONGLEY, D.B. and SCOTT, C.J. (2014) Nanoencapsulation of ABT-737 and camptothecin enhances their clinical potential through synergistic antitumor effects and reduction of systemic toxicity, *Cell Death Dis.*, 5:e1454.

SEEDHOUSE, C.H., MILLS, K.I., AHLUWALIA, S., GRUNDY, M., SHANG, S., BURNETT, A.K., RUSSELL, N.H. and PALLIS, M (2014) Distinct poor prognostic subgroups of acute myeloid leukaemia, FLT3-ITD and P-glycoprotein-positive, have contrasting levels of FOXO1, *Leukaemia Research*, 38, p131-137.

SHARPE, D.J., ORR, K.S., MORAN, M., WHITE, S.J., McQUAID, S., LAPPIN, T.R.J., THOMPSON, A. and JAMES, J.A. (2014) POU2F1 activity regulates HOXD10 and HOXD11 promoting a proliferative and invasive phenotype in Head and Neck cancer, *Oncotarget*, 5(18), p8803-8815.

SHIN, E.M., SIN HAY, H., LEE, M.H., GOH, J.N., TAN, T.Z., SEN, Y.P., LIM, S.W., YOUSEF, E.M., ONG, H.T., THIKE, A.A., KONG, X., WU, Z., MENDOZ, E., SUN, W., SALTO-TELLEZ, M., LIM, C.T., LOBIE, P.E., LIM, Y.P., YAP, C.T., ZENG, Q., SETHI, G., LEE, M.B., TAN, P., GOH, B.C., MILLER, L.D., THIERY, J.P., ZHU, T., GABOURY, L., TAN, P.H., HUI, K.M., YIP, G.W., MIYAMOTO, S., KUMAR, A.P. and TERGAONKAR, V. (2014) DEAD-box helicase DP103 defines metastatic potential of human breast cancers, *J Clin Invest*, 124(9), p3807-24.

STEWART, J., JAMES, J., McCLUGGAGE, G.W., McQUAID, S., ARTHUR, K., BOYLE, D., MULLAN, P., McART, D., YAN, B., IRWIN, G., HARKIN, D.P., ZHENGDENG, L., ONG, C.W., YU, J., VIRSHUP, D.M. and SALTO-TELLEZ, M. (2014) Analysis of

wntless (WLS) expression in gastric, ovarian, and breast cancers reveals a strong association with HER2 overexpression, *Mod Pathol.*, 26 September 2014 (Epub ahead of print).

TAGGART, L.E., McMAHON S.J., CURRELL F.J., PRISE K.M. and BUTTERWORTH, K.T. (2014) The role of mitochondrial function in gold nanoparticle mediated radiosensitisation, *Cancer Nanotechnol.*, 5(1), p5.

TAN, S.S., KHIN, L.W., WONG, L., YAN, B., ONG, C.W., DATTA, A., SALTO-TELLEZ, M., LAM, Y. and YAP, C.T. (2014) Sphingosine kinase 1 promotes malignant progression in colon cancer and independently predicts survival of patients with colon cancer by competing risk approach in South asian population, *Clin Transl Gastroenterol*, 5:e51.

TITMARSH, G.J., DUNCOMBE, A., McMULLIN, M.F., O'RORKE, M., MESA, R., DE VOCHT, F., HORAN, S., FRITSCHI, L., CLARKE, M. and ANDERSON, L.A. (2014) How Common are Myeloproliferative Neoplasms? A systematic review and meta-analysis, *American Journal of Hematology,* 89(6): p581-587.

TITMARSH, G.J., McMULLIN, M.F., McSHANE, C.M., CLARKE, M., ENGELS, E.A. and ANDERSON, L.A. (2014) Community acquired infections and their association with myeloid malignancies, *Cancer Epidemiology*, 38(1) p56-61.

THIBAULT, I., POON, I., YEUNG, L., ERLER, D., KIM, A., KELLER, B., LOCHRAY, F., JAIN, S., SOLIMAN, H. and CHEUNG, P. (2014) Predictive Factors for Local Control in Primary and Metastatic Lung Tumours after Four to Five Fraction Stereotactic Ablative Body Radiotherapy: A Single Institution's Comprehensive Experience, *Clinical Oncology*, 26(11), p713-719.

TRIPATHI, S., DEHMER, M. and EMMERT-STREIB, F. (2014) NetBioV: an R package for visualizing large network data in biology and medicine, *Bioinformatics*, 30(19), p2834-2836.

TURKINGTON, R.C., BLAYNEY, J.K., JALIL, A., GOODY, R.B., PAPAFILI, A., HENDERSON, C., McMANUS, D., JOHNSTON, P., KENNEDY, R.D. and EATOCK, M.M., (2014) A preoperative clinical staging and metabolic imaging model to predict prognosis in early-stage esophageal adenocarcinoma, *Journal of Clinical Oncology*, 32;3s, p63.

TURKINGTON, R.C., HILL, L.A., McMANUS, D.T., McQUAID, S., ARTHUR, K., JAMES, J., SALTO-TELLEZ, M., DAVISON, T.S., HARRISON, C., PURCELL, C., WILSON, R.H., McGREGOR, T.P., SHARMA, R.A., FITZGERALD, R.C., JOHNSTON, P.G., HARKIN, P.D., EATOCK, M.M. and KENNEDY R.D., (2014) Association of a DNA Damage Response Deficiency (DDRD) assay and prognosis in early stage Esophageal Adenocarcinoma, *Journal of Clinical Oncology,* 32;5s: p.4015.

TURKINGTON, R.C., LONGLEY, D.B., ALLEN, W.L., STEVENSON, L., McLAUGHLIN, K., DUNNE, P.D., BLAYNEY, J.K., SALTO-TELLEZ, M., VAN SCHAEYBROECK, S. and JOHNSTON, P.G. (2014) Fibroblast growth factor receptor 4 (FGFR4): a targetable regulator of drug resistance in colorectal cancer, *Cell Death Dis.*, 5:e1046.

TURKINGTON, R.C., PURCELL, C., JAMES, C.R., MILLAR, J.R., NAPIER, E., LAW, D., GALLAGHER, R., MORRIS, M., WILSON, R.H. and EATOCK, M.M. (2014) A Phase I Trial of Bortezomib in Combination with Epirubicin, Carboplatin and Capecitabine in Advanced Gastric and Gastro-oesophageal Junction Adenocarcinoma, *Investigational New Drugs* , 32(2), p250-260.

TURNER, P.G. and O'SULLIVAN, J.M. (2014) Radium 223 for the treatment of metastatic prostate cancer, *Expert Opin Pharmacother,* 15(14), p2105-11.

VALLE, J.W., EATOCK, M., CLUEIT, B., GABRIEL, Z., FERDINAND, R. and MITCHELL, S. (2014) A systematic review of non-surgical treatments for pancreatic neuroendocrine tumours, *Cancer Treatment Reviews*, 40, p376–389.

VAN SCHAEYBROECK, S., KALIMUTHO, M., DUNNE, P.D., CARSON, R., ALLEN, W., JITHESH, P.V., REDMOND, K.L., SASAZUKI, T., SHIRASAWA, S., BLAYNEY, J., MICHIELI, P., FENNING, C., LENZ, H.J., LAWLER, M., LONGLEY, D.B. and JOHNSTON, P.G. (2014) ADAM17-Dependent c-MET-STAT3 Signaling Mediates Resistance to MEK Inhibitors in KRAS Mutant Colorectal Cancer, *Cell Rep.,* 7(6), p1940-1955.

VAN SCHAEYBROECK, S., LAWLER, M. and JOHNSTON, P.G. (2014) Pancreatic Cancer. In *Treatment of Cancer* (6th Edition) Eds. Sikora, K and Price, P, CRC Press.

WANG, T., BUHARI, S.A., PANG, B., PUTTI, T.C. and SALTO-TELLEZ, M. (2013) One-step nucleic acid amplification assay also predicts axillary lymph node status in breast cancer patients: further molecular diagnostic evidence, *Eur J Cancer*, 49(18), p3945-6.

WASAN, H.S., MEADE, A., ADAMS, R.A., WILSON, R.H., PUGH, C., FISHER, D., MADI, A., SIZER, B., BUTLER, R., KAPLAN, R.S. and MAUGHAN, T.S.; on behalf of the MRC COIN-B Trial Investigators (2014) Results of the two-arm phase II randomised MRC COIN-B (CR11) trial: Intermittent chemotherapy plus continuous or intermittent cetuximab in the first-line treatment of advanced colorectal cancer, *Lancet Oncology*, 15(6), p631-639.

WILLIAMS, F., HUNTER, S., BRADLEY, L., CHAHAL, H.S., STORR, H., AKKER, S.A., KUMAR, A.V., ORME, S.M., EVANSON, J., MORRISON, P.J., KORBONITS, M. and ATKINSON, A.B. (2014) Clinical experience in the screening and management of a large kindred with familial isolated pituitary adenoma due to an aryl hydrocarbon receptor interacting protein (AIP) mutation, *J Clin Endocrinol Metab*, 99(4), p1122-31.

WONG, N.A., GONZALEZ, D., SALTO-TELLEZ, M., BUTLER, R., DIAZ-CANO, S.J., ILYAS, M., NEWMAN, W., SHAW, E., TANIERE, P. and WALSH, S.V. (2014) RAS testing of colorectal carcinoma-a guidance document from the Association of Clinical Pathologists Molecular Pathology and Diagnostics Group, *J Clin Pathol.*, 67(9), p751-757.

WOULFE, P., O'KEEFFE, S., McCARTHY, D., GRATTAN, M., HOUNSELL, A., CRONIN, J. and LEWIS, E. (2014) Characterisation of radioluminesence based optical fibre dosimeter in radiotherapy beam applications, *Proc. SPIE*, 9157, 23rd International Conference on Optical Fibre Sensors, 915799.

WOULFE, P., O'KEEFFE, S., McCARTHY, D., GRATTAN, M., HOUNSELL, A., CRONIN, J. and LEWIS, E. (2013) Characterisation of radioluminesence based optical fibre dosimeter in radiotherapy beam applications, *SENSORS, IEEE 2013*, p1-4.

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