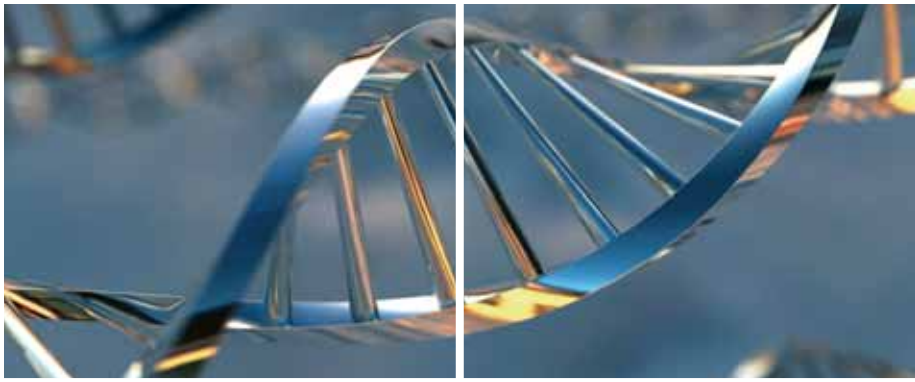
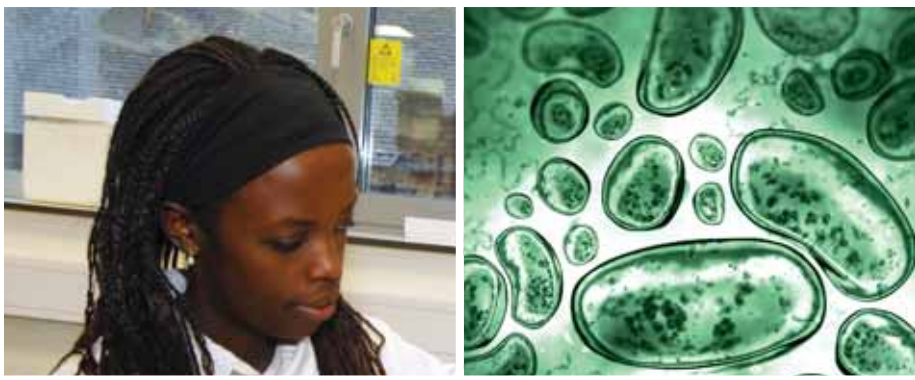
CCRCB
Centre for
Cancer Research
& Cell Biology

Annual Report 2010 - 2011




Queen's University
Belfast

CONTENTS

DIRECTOR'S INTRODUCTION

Dennis McCance, Director

This annual report outlines the research activities of the Centre over the past twelve months (1 August 2010 – 31 July 2011) and highlights some of the outstanding achievements of our scientists.

During the year, we have made two appointments to build on our research focus. We were delighted to welcome Professor Manuel Salto-Tellez, a world leader in Molecular Pathology from the University of Singapore, and Dr Shozeb Haider from the London School of Pharmacy, appointed to a Senior Lectureship in Molecular Modelling within the Centre.

There were a number of developments over the course of the year. The Northern Ireland Biobank, led by Dr Jackie James, has commenced collecting fixed and frozen tissue from seven commonly occurring cancers and is housed in the basement of the CCRCB building. Due to the successful research programmes of our staff, CCRCB became part of the Belfast Cancer Research UK (CR-UK) Centre, which is a CR-UK national initiative to bring scientists and clinicians together in the fight against the effects of cancer. To this end the Belfast and Dundee Cancer Centres had a joint meeting in Dundee on 12-13 May 2011, where presentations were made by scientists and clinicians from both Centres and resulted in a number of potential collaborations being identified.

CCRCB continues to be involved in the network of Experimental Cancer Medicine Centres (ECMC) in the UK, led by Professor Ken Mills. A number of collaborative studies have been made possible between Astra Zeneca, Amgen, Pfizer, Almac, Celgene, Ortho Biotech, AGI Therapeutics and the Belfast ECMC.

Bioinformatics, one of the enabling technologies within CCRCB, had a Scientific Review in January 2011, chaired by Professor Chris Pontin (University of Oxford) and included in the review panel were Professors John Quackenbush (Harvard University) and Des Higgins (University College Dublin). The review was extremely encouraging and the panel were impressed with progress, particularly for a unit that has only been active for two years.

The principal investigators in CCRCB have been recognised for their research nationally and internationally. Professor Patrick Johnston has been appointed the Chair of the Translational Research Group of the Medical Research Council (MRC), where he will oversee the strategy for translational research throughout the UK. Professor Kevin Prise has been invited to join the Radiation and Cancer Biology Committee and the newly formed Particle Therapy Committee of the British Institute of Radiology. He has also been appointed as the Deputy Editor (Radiobiology) of the British Journal of Radiology and has joined the Committee of the Irish Radiation Research Society. Furthermore, Kevin is a member of the Management Committee of the EU COST Action, Nano-scale Insights on Ion-Beam Therapy (Nano-IBCT). Dr Giuseppe Schettino has been elected onto the Committee for the UK Association for Radiation Research. Finally, Dr Dean Fennell has been elected to the Board of Directors of the International Mesothelioma Interest Group (IMIG) and was invited to the Faculty and Planning Committee, ASCO NCI EORTC Molecular Markers Meeting 2010, Holywood, Florida.

Our young trainees continue to carry out internationally competitive research as witnessed by Conor McGarry, a PhD student, supervised by Professor Kevin Prise and Dr Alan Hounsell, who was awarded the ESTRO (European Society for Therapeutic Radiology and Oncology) – Jack Fowler University of Wisconsin Award for 2011. Conor received his award and gave a talk at the ESTRO Anniversary Congress held in London on 8-12 May 2011. Dr Karl Butterworth, a postdoctoral fellow with Professor Kevin Prise, was awarded a Young Scientist Award to attend the Annual Meeting of the Radiation Research Society (USA) in Maui, Hawaii in September 2010. Dr Adam Pickard and Dr Simon McDade won the European Associated Cancer Research (EACR) Young Scientist Awards and presented their work at the Irish Association for Cancer Research (IACR) meeting in Cork in March 2011. Congratulations are also due to Dr Michael Moran (Academic Clinical Fellow in ENT) and Dr Gareth Irwin (Academic Training Fellow in Surgery) on both being awarded Clinical Fellowships from the Health and Social Care (HSC) Research and Development (R&D) Division of the Public Health Agency of Northern Ireland to carry out research towards a PhD.

During 2010/11, a number of international conferences were organized by members of CCRCB. The Second International Conference in Quantitative Biology and Bioinformatics for Modern Medicine on 7-8 February 2011 was hosted by University College Dublin at the Conway Institute and was organised by Professor Peter Hamilton and Dr Frank Emmert-Streib from CCRCB and Professor Des Higgins from the Conway Institute. The meeting was funded by the Department for Employment and Learning, through its "Strengthening the All-island Research Base" initiative. Another meeting funded by the Department for Employment and Learning initiative was on "Small Molecule and Biological Strategies in the Molecular-Targeted Era" organized by Dr David Waugh, Dr Richard Williams and Professor David Haigh. This meeting was held in Cork on 2 March 2011 as a satellite meeting of the Irish Association for Cancer Research.

Several other meetings were organized by CCRCB staff. The Sixth International CCN Workshop which was held in Newcastle, Northern Ireland from 20-24 October 2010, was organized by Dr Sandra Irvine and the EU-FP7 Consortium INComb Annual meeting was held in Belfast from 19-21 January 2011. INComb is the first EU funded consortium in the field of Urology and has as its research focus, "Combating Incontinence from Basic Science to Clinical Practice". The Belfast meeting, hosted by Dr Karen McCloskey from CCRCB comprised over twenty participants from ten partners including Karolinska Institutet in Stockholm and Pfizer UK. INComb provides substantial funding (€900,000) to the McCloskey laboratory in CCRCB, currently working on models of dysfunctional bladder including post-radiation damage.

Finally, congratulations to Dr Karen McCloskey and Dr Richard Wilson who have been promoted to Readers and to Dr Dan Longley who has been promoted to Senior Lecturer in 2011. A complete list of the CCRCB staff and their research profiles can be found on our website: http://www.qub.ac.uk/ccrcb/.

RESEARCH STRATEGY

Our mission is to improve patient care through the development of:

- **biomarkers for prognosis, prediction and markers of response;**
- **biologically determined targeted therapies.**

To achieve our mission we are pursuing the highest quality clinical and basic science research programmes. The hallmark of our research programme is a close collaborative interaction between clinical and laboratory research experts that ultimately enhances the quality and scope of our integrated research programmes in cancer.

Our goals are:

- to provide an internationally competitive, interdisciplinary research centre of the highest quality;
- to foster and generate scientific knowledge and to share that knowledge with researchers, clinicians, patients and the public through educational activities, local engagement, outreach activities, training programmes and publications;
- to improve patient care through clinical trial research and the translation of applied basic science into the clinical arena;
- to educate and train future clinical and scientific leaders in cancer research;
- to develop strong collaborative interactions with research organisations, nationally and internationally;
- to support commercialisation of our research and accelerate the translation of our discovery to clinical implementation and patient care.

STRUCTURE AND GOVERNANCE

The Centre comprises two divisions – Cancer Cell and Molecular Biology (CCMB) and Experimental Cancer Medicine (ECM) – each with its own Head of Division and research focus. Strong emphasis is placed on the value of collegiality and investigators meet monthly to discuss specific topics and grant submissions. The Heads of the Divisions report to the CCRCB Directorate Board. Research activities in the Centre are promoted and monitored by the CCRCB Directorate and Strategy Group, chaired by the Scientific Director, and future research initiatives are discussed and developed. Peer review of research is the responsibility of an external Scientific Advisory Board. This expert panel carries out site visits, reviews progress and provides advice on strategy and overall direction.

Underpinning the two divisions within the Centre, a new initiative has been the launch of six translationally specific focus groups:

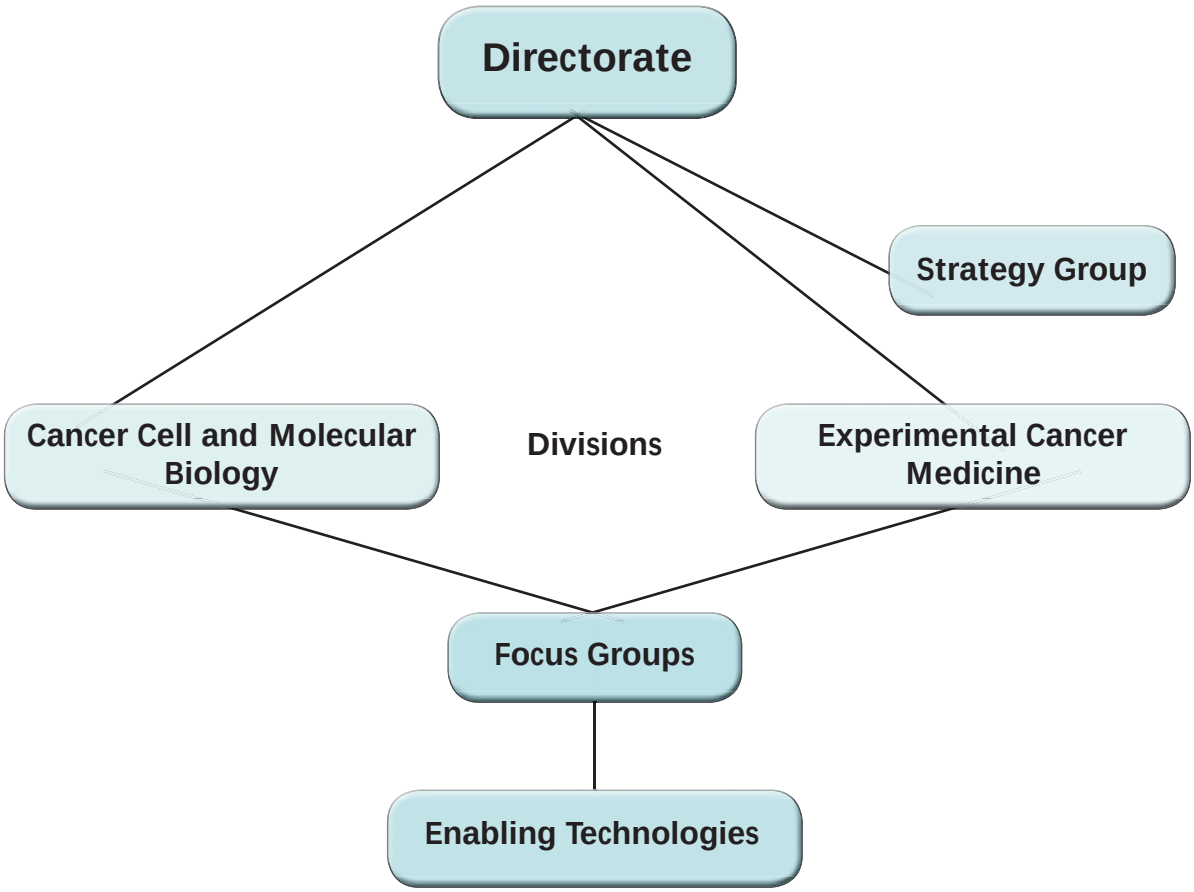
- Breast and Ovarian
- Gastrointestinal
- Haematological Malignancies
- Prostate and Bladder
- Radiation Sciences
- Thoracic Oncology

The focus groups feed into the two main research divisions – Cancer Cell and Molecular Biology and Experimental Cancer Medicine. The overall strategic aims of cancer research within the Centre are to combine strengths in basic cancer research with emerging technologies and to link science and clinical activities in a synergistic manner, with translational and discovery science at the heart.

The focus groups are supported in their research by four enabling technologies within the Centre:

- Bioinformatics and Imaging
- Northern Ireland Cancer Trials Centre
- Drug Discovery
- Molecular Pathology and Biobanking

These enabling technologies serve to strengthen the clinical and basic science research programmes by providing expertise in specialised areas.



RESEARCH DIVISIONS

CANCER CELL & MOLECULAR BIOLOGY

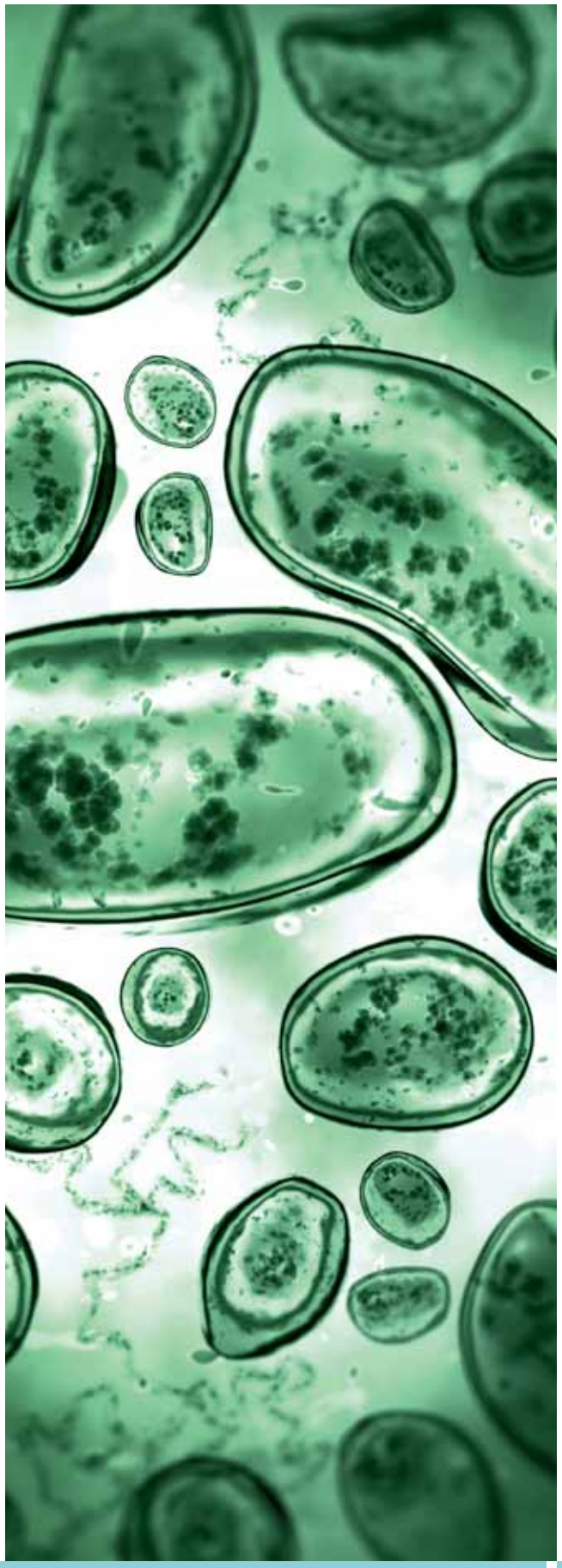
David Waugh, Head of Division

The principal investigators in the Cancer Cell and Molecular Biology division conduct a variety of activities designed to promote basic and clinical research in cancer and other serious diseases. Strong emphasis is placed on the elucidation of the mechanisms of disease and translational research.

Cancer research in the post-genomic era is aimed at the prevention, elimination and modulation of the disease. Key to these aspirations is a deep understanding of the cellular, genetic, epigenetic and molecular mechanisms in the pathogenesis of cancer and this is reflected in the ongoing research efforts in the Centre. These include:

- basic studies of biological processes such as cell signalling and gene regulation;
- the identification of molecular defects responsible for disease;
- the identification of molecular signatures of cancer cells; and
- translational research concerned with monitoring disease and the identification of drug targets.

New translational technologies are providing useful links in building the bridge between basic science and clinical research for better patient care. In Cancer Cell and Molecular Biology the "Omics Revolution" is clearly in evidence as investigators have embraced advances in genomics, proteomics, transcriptomics, metabolomics molecular imaging and bioinformatics. In particular, microarrays are being used in early disease screening; tumour classification, diagnosis and staging; prediction of outcome to therapy and toxicity; and the identification of novel drug targets.



EXPERIMENTAL CANCER MEDICINE

Ken Mills, Head of Division

The CCRCB Experimental Cancer Medicine (ECM) division aims to adhere to the strategy of the CCRCB by applying scientific advances into novel diagnostic and therapeutic strategies in the clinic. These advances can include molecular or cellular biomarker studies, bio-imaging studies and bioinformatic advances. The research studies within the Experimental Cancer Medicine (ECM) division are applying our understanding of the pathophysiology of disease to develop enhanced diagnostics and treatments for cancer.

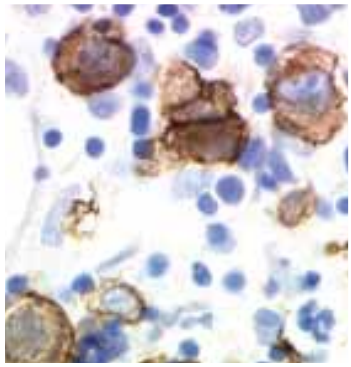
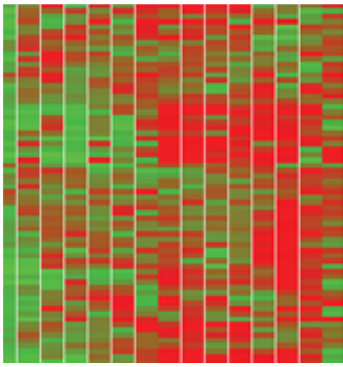
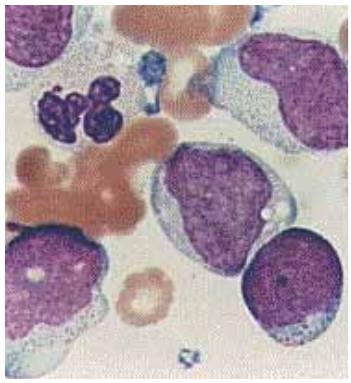
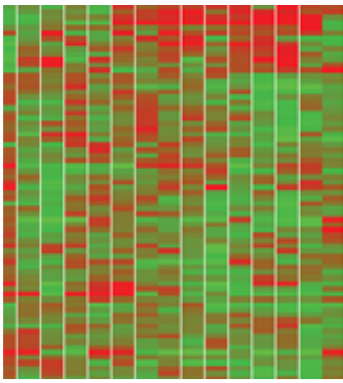
The ECM research division integrates clinical and scientific translational studies across pharmacology, haematology, pathology, radiation and oncology with pre-clinical and early phase clinical trials. The role of ECM is to conduct high quality experimental cancer medicine research, to integrate clinical science into our basic and translational science research programmes and to facilitate access to clinical material for these programmes.

The ECM works in close collaboration with the Northern Ireland Clinical Cancer Centre and the Northern Ireland Cancer Trials Centre (NICTC). Several members of the ECM are also involved in the Belfast Experimental Cancer Medicine Centres (ECMC) Network, and are integral to the implementation of early phase clinical trials. Clinical trials are a key component of our research within ECM and our studies represent a growing proportion of the trials portfolio within the NICTC. Early phase clinical trials are open for patients with advanced solid tumours but there are also disease-specific phase I and II trials in first, second and third-line treatment of common solid and haematological cancers.

The ECM membership recognize that the effective translation between laboratory studies and clinical studies is bi-directional with experimental studies into later phase clinical research equally as important as the generation of new hypotheses to be explored in the laboratory.

FOCUS GROUPS





BREAST AND OVARIAN

Paul Mullan, Chairperson

Focus Group Membership:		
Dr Jaine Blayney	Professor Dennis McCance	Dr Hilary Russell
Dr Alison Clayton	Professor Glenn McCluggage	Professor Manuel Salto-Tellez
Dr Mohamed El-Tanani	Dr Stuart McIntosh	Dr Steven Walker
Professor Paul Harkin	Dr James Murray	Dr David Waugh
Dr Ian Harley	Dr Kostantin Panov	Dr Richard Williams
Dr Gareth Irwin	Professor Kevin Prise	Dr Shu-Dong Zhang
Dr Colin James	Dr Jennifer Quinn	
Professor Richard Kennedy	Dr Tracey Robson	

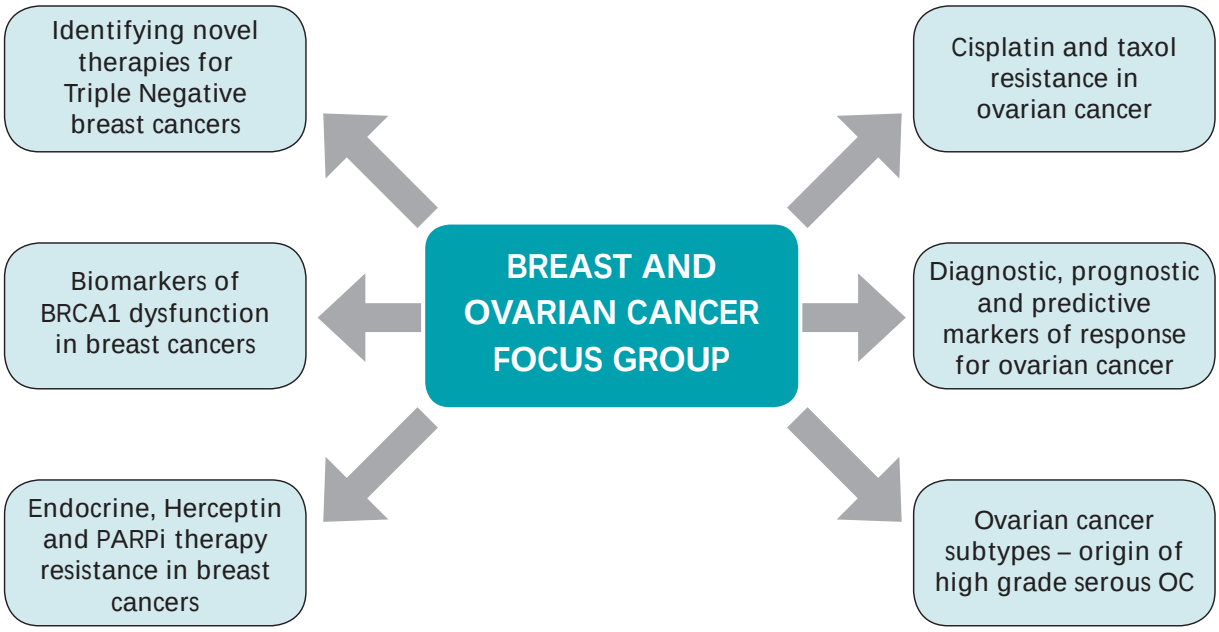
The Breast and Ovarian focus group has over twenty members covering disciplines ranging from basic science, medical oncology, surgery and pathology. The aim of the group is to identify specific clinical problems within the breast and ovarian cancer disease settings and to facilitate and drive translational research in these areas.

There are two collaborative projects already underway. The first project involves the identification of genes/pathways responsible for causing chemoresistance in triple-negative breast cancer (TNBC), a subtype which shows the highest relapse rates and lowest survival rates. The second project involves the investigation of the fallopian tube fimbriae as the source of high grade serous ovarian cancers (HGSOC). Both TNBC and HGSOC represent types of cancers with the highest death rates in their respective disease settings.

Other areas of focus include:

- Development of markers of pathogenesis in TNBCs;
- Resistance to endocrine therapies in ERα positive breast cancers;
- The biology and treatment of high grade endometrial cancers;
- Identifying pathways aberrantly activated in BRCA1 mutant breast cancers;
- The identification of early warning blood-borne markers of breast and ovarian cancer;
- The identification of BRCA1/p63 co-regulated genes.

Ultimately this focus group aims to translate research findings such as the identification of novel biomarkers or the development of novel therapies and incorporate them into prospective clinical trials based in Belfast.



GASTRO-INTESTINAL

Sandra Van Schaeybroeck, Chairperson

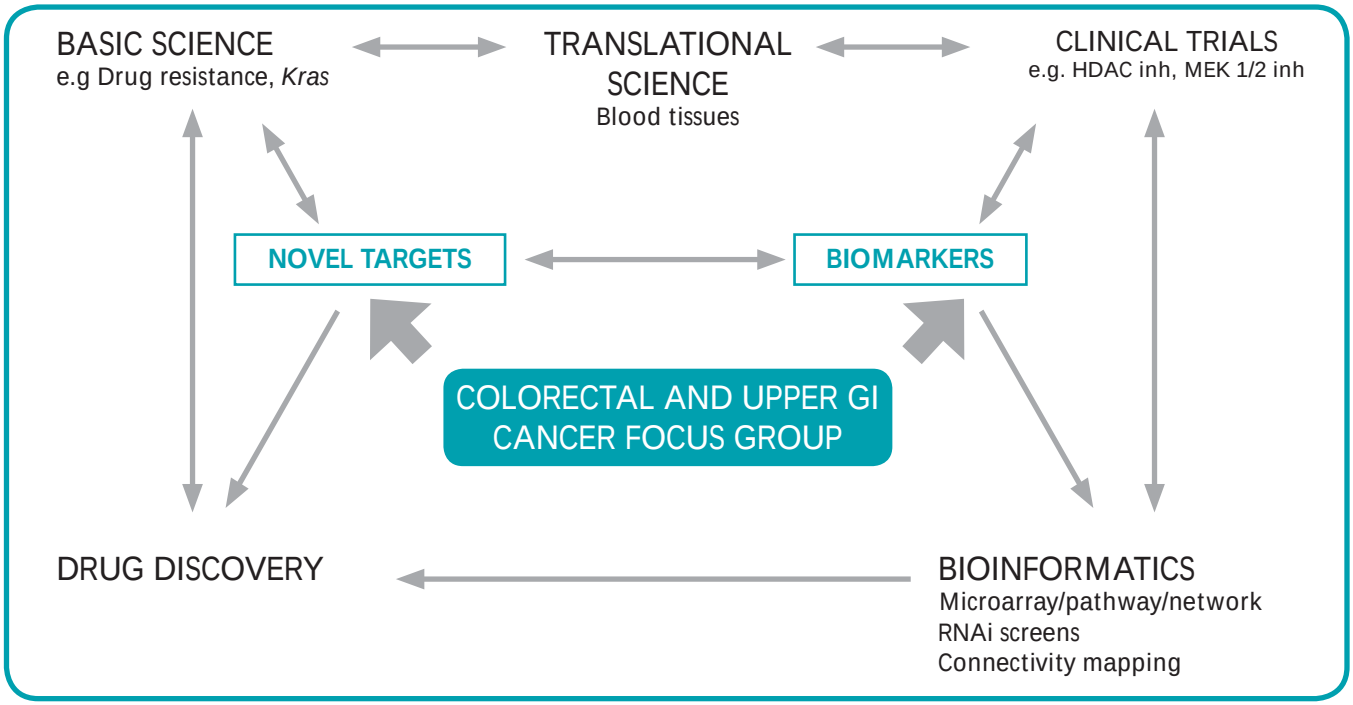
Focus Group Membership:		
Dr Wendy Allen	Dr Brian Johnston	Dr Colin Purcell
Dr Aidan Armstrong	Professor Patrick Johnston	Professor Manuel Salto-Tellez
Professor Charles Campbell	Dr Paul Kelly	Dr Richard Turkington
Dr Declan Carey	Dr Jack Lee	Dr David Waugh
Dr Mark Catherwood	Dr Dan Longley	Dr Richard Williams
Dr Vicky Coyle	Dr Maurice Loughrey	Dr Richard Wilson
Dr Martin Eatock	Professor Dennis McCance	Dr Shu-Dong Zhang
Dr Mohamed El-Tanani	Dr Damian McManus	
Professor David Haigh	Dr James Murray	

The Gastro-Intestinal focus group addresses a number of important clinical problems within the colorectal and gastro-oesophageal cancer early and advanced disease settings. The major goals of the focus group are the identification of novel targets, in particular for specific molecular subtypes (eg: mutant *Kras* and mutant *Braf*), the identification of biomarkers for response to chemotherapy and novel targeted agents and the implementation of both research approaches into novel adaptive clinical trial designs. The focus group involves basic scientists, clinician scientists, academic clinicians from CCRCB and the Belfast Health and Social Care Trust (BHSCT), pathologists, bio-informaticians and medicinal chemists.
An example of the studies already underway in the Gastro-Intestinal focus group is the identification of novel targets and pathways involved in chemotherapy resistance in colorectal cancer.

Other areas of focus include:

- Identification and targeting of clinically relevant molecular and genetic subtypes in early stage colorectal cancer;
- Development of gene signatures to predict response to chemotherapy treatment in colorectal cancer and gastro-oesophageal cancer;
- *Kras* biology and identification of novel targets synthetic lethal for *Kras* mutant colorectal cancer tumours;
- FLIP as a target and prognostic/predictive biomarker;
- ADAM17 as a target and prognostic/predictive biomarker in *Kras*WT/MT colorectal cancer;
- Development of investigator initiated clinical studies (eg: MEK1/2 inhibitory agents, HDAC inhibitors in GI tumours).

Members of this group are also involved as clinical or scientific partners in several national and international phase I-III trials and are part of the NCRI colorectal/upper GI clinical studies groups and/or EORTC GI group.



HAEMATOLOGICAL MALIGNANCIES

Ken Mills, Chairperson

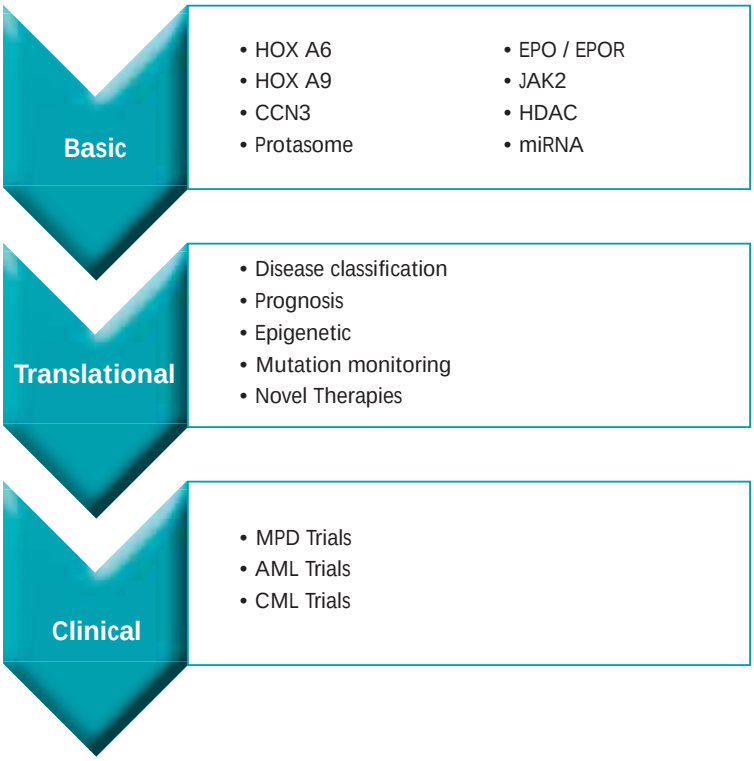
Focus Group Membership:	
Dr Andreas Albrecht	Professor Mary Frances McMullin
Dr Mark Catherwood	Dr Alex Thompson
Dr Glenn Dickson	Dr Melanie Percy
Dr Frank Emmert-Streib	Dr Lakshmi Venkatraman
Dr Sandra Irvine	Dr Shu-Dong Zhang

The Haematological Malignancies focus group has the strategy of moving basic research studies and observations into translational biomarker or novel therapies approach with the potential to implement these in clinical trials. The focus group involves basic and clinical scientists, bio-informaticians, medicinal chemists, pathologists and academic clinicians from the CCRCB and the Belfast Trust with interests spanning a number of leukaemia sub groups including Acute Myeloid Leukaemia (AML), Myelodysplastic Syndromes (MDS), Chronic Lymphoid and Myeloid Leukaemia (CLL and CML).

The areas of research focus cover the spectrum from basic studies through to clinical trials. For example, studies are being undertaken that include the development of model systems to distinguish between molecular events, particularly the HOX genes, involved in the initiation of leukaemia from those that are involved in maintenance of the leukaemia phenotype. Other studies include the role of EPOR and ASB proteins in specific types of leukaemia.

In the translational area, integrative studies involving connectivity mapping, RNA and miRNA expression profiling and epigenetic data are identifying potential diagnostic, prognostic or predictive bio-markers markers. Pre-clinical studies are evaluating several therapeutic agents including demethylating agents, HDAC inhibitors, proteasome inhibitors, novel drugs against, for example, CCN3 as a target in CML and the use of therapies for other diseases such as mental illness or cardiac illness as anti-leukaemia agents.

Finally, within the experimental cancer area, several group members are involved as clinical or scientific partners in national and international trials and networks for CML, MPD and AML. Members of the focus group have been appointed to one of the network of national Leukaemia Lymphoma Research (LLR) Therapeutic Accelerated Programme (TAP) Centres. In addition, members of the focus group are involved in EU networks for HOX-TALE studies in leukaemia; Myeloproliferative Neoplasms; epigenetic and expressions studies in AML and MDS; and the European LeukemiaNet.



PROSTATE AND BLADDER

David Waugh, Chairperson

Focus Group Membership:	
Dr Mark Catherwood	Dr Joe O'Sullivan
Professor David Haigh	Dr Declan O'Rourke
Dr James Murray	Professor Kevin Prise
Dr Karen McCloskey	Dr Richard Williams
Professor Stephanie McKeown	Dr Kate Williamson

The research portfolio of the Genito-Urinary Cancer focus group encompasses the scientific and clinical research being conducted in the areas of prostate and bladder cancer. Our major focus is to address areas of major clinical unmet need in each disease through inter-disciplinary, project-focused teams comprising cell biologists, radiation biologists, medicinal chemists, pathologists, clinical oncologists and urologists.

These teams and projects have been constituted on the basis of either the ability to exploit a unique resource at our disposal that provides us with a competitive advantage or in areas where we have internationally-recognised linkages to supporting expertise. Currently, our projects are focused on defining biomarkers that can reliably stratify indolent from life-threatening prostate cancers, identifying novel treatments for application in castrate-resistant prostate cancer, and developing novel therapeutics for treatment of overactive bladder.

RADIATION SCIENCES

Kevin Prise, Chairperson

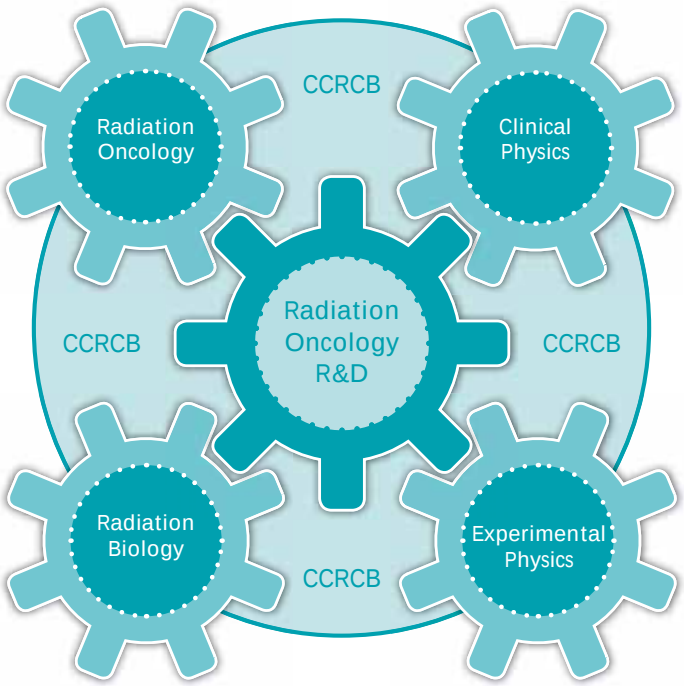
Focus Group Membership:	
Dr Darren Brady	Professor Dennis McCance
Dr Aidan Cole	Dr Karen McCloskey
Dr Fred Currell	Mr Conor McGarry
Dr Glenn Dickson	Dr Marie Migaud
Dr Tom Flannery	Dr Michael Moran
Dr Tom Gardiner	Dr Joe O'Sullivan
Dr Gerry Hanna	Dr Daksha Patel
Dr Fionnula Houghton	Dr Giuseppe Schettino
Dr Alan Hounsell	Dr Chris Scott
Dr Jackie James	Dr Kate Williamson

The Radiation Sciences focus group is multidisciplinary having strengths in radiation physics, radiotherapy physics, cell biology, chemistry, radiation biology, neuro-oncology, bladder physiology, pathology, surgery, tissue research and radiation oncology and the membership includes basic scientists, clinical scientists and clinicians. Some aspects of the work are disease specific, particularly around prostate and more recently head and neck cancers with some members also contributing to other focus groups such as breast and thoracic oncology. The objectives of the Radiation Sciences focus group are to maximise our input into Radiation Oncology Research and Development by:

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

Our research is focussed in three areas:

- Advanced radiotherapies where we are developing new biological-based models to increase their efficacy in tumours and protect surrounding normal tissues;
- Radiation-drug interactions studying interactions between various small molecule agents and radiotherapies and including new approaches with gold nanoparticles;
- A developing area around radionuclide therapy which includes new approaches targeting radionuclides with multicombinatorial approaches to bone metastasis.



THORACIC ONCOLOGY

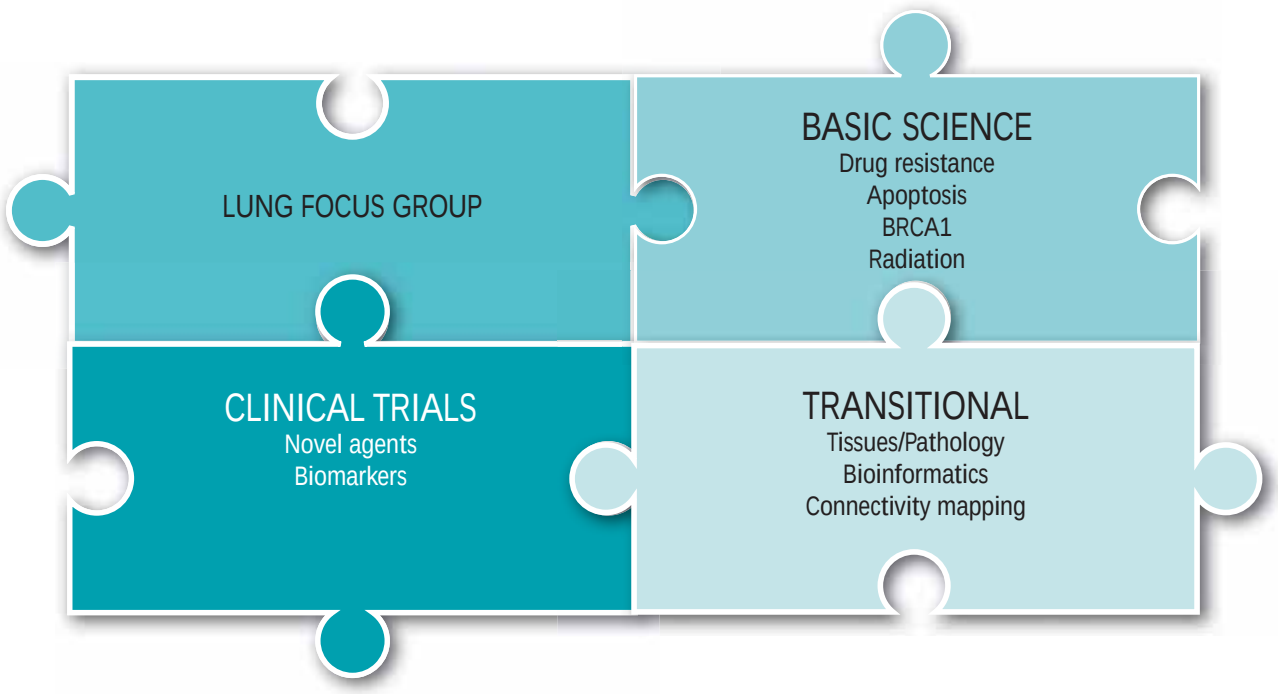
Dan Longley, Chairperson

Focus Group Membership:	
Dr Lynn Campbell	Dr Jonathon McAleese
Dr Mohamed El-Tanani	Dr Kieran McManus
Dr Dean Fennell	Dr Ian Paul
Dr Gerry Hanna	Professor Kevin Prise
Professor David Haigh	Dr Jennifer Quinn
Professor Peter Hamilton	Dr Paula Scullin
Dr Jane Hurwitz	Dr David Waugh
Dr Jackie James	Dr Shu-Dong Zhang

The Thoracic Oncology focus group brings together experienced researchers from complementary scientific and medical disciplines working in the area of thoracic oncology, particularly non-small cell lung cancer (NSCLC) and malignant pleural mesothelioma. The ultimate goal of the focus group is to translate basic research into novel clinical trials in lung cancer. At the heart of the group are several molecular biologists, who underpin the basic scientific research effort. However, the group not only facilitates basic research but also enables translational lung cancer research. This is achieved by the presence of medical oncologists and pathologists in the group. With regard to pathology, we have several lung cancer tissue microarrays and access to tissues from important ongoing clinical trials. Also embedded in the group are experts in bioinformatics, who provide critical support for the basic and translational research efforts. As radiation is an important therapeutic modality in NSCLC, the group contains individuals with expertise in the areas of basic and clinical radiation oncology. A particular strength of the group is its numerous external national and international collaborations and presence on the European Organisation for Research and Treatment of Cancer (EORTC) Lung group.

Areas of research include:

- Targeting drug resistance due to dysfunctional apoptosis signalling in NSCLC and mesothelioma (Dan Longley/Dean Fennell);
- BRCA1 as a determinant and biomarker of response to DNA damaging agents (including PARP inhibitors) and microtubule poisons in NSCLC and mesothelioma (Jennifer Quinn/Dean Fennell);
- The role of Ran-GTP as a therapeutic target and biomarker in NSCLC (Mohamed El-Tanani/Dean Fennell);
- Overcoming resistance to ionizing radiation in NSCLC (Kevin Prise/Dan Longley);
- Connectivity mapping to identify novel approaches to targeting clinically relevant genes and pathways (Shu-Dong Zhang).



ENABLING TECHNOLOGIES

BIOINFORMATICS AND IMAGING

Peter Hamilton, Lead Investigator

The Cancer Bioinformatics (CBI) group, established in 2009, forms part of the Experimental Cancer Medicine Research division. The group consists of scientists with expertise across a broad spectrum ranging from Computational Biology, Computer Vision and Machine Learning to Systems and Network Biology. In the era of high-throughput data, quantitative methods are key for elucidating biological processes. For complex diseases like cancer the deciphering of molecular signatures and networks for diagnostic and treatment modalities form major challenges for translational and experimental cancer research. The aim of the group is to develop novel computational and statistical methods and to engage in interdisciplinary collaborative research by working closely together with biologists and clinicians across the CCRCB, providing the interface between data and understanding. Developing innovative research programmes in Cancer Bioinformatics is a priority of the team.

Key research areas include:

- Computational Biology and Biostatistics;
- Pathway analysis, causal inference of regulatory networks and integration of genetics and genomics data;
- Tissue Imaging, Analytics and Biomarker Discovery;
- High-throughput analysis of genomic and image data;
- Quantitative methods in disease-genes-drugs connection discovery;
- Biomolecular Structure Prediction;
- Data integration.

The research of the group spans a wide range from basic research and method development to their applications. The group has specific interests in drug resistance and various types of complex diseases like lung cancer, colorectal cancer, cervical cancer and haematological malignancies.

In addition, 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 quantitative methods as needed to cope with the data revolution in biology and medicine. Furthermore, the group aims to generate a public awareness of the current exiting developments in quantitative cancer research.

NORTHERN IRELAND CANCER TRIALS CENTRE

Richard Wilson, Lead Investigator

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

The Northern Ireland Cancer Trials Centre (NICTC), formerly known as the Northern Ireland Cancer Clinical Trials Unit (NICCTU) was formally established in 1999 following the signing of the National Cancer Institute-Ireland-Northern Ireland Cancer Agreement. Our local Northern Ireland DHSSPS Research and Development Office (now the Health and Social Care (HSC) Research and Development (R&D) Division of the Public Health Agency of Northern Ireland) provided funding for the initial infrastructure to be put in place. Today the HSC R&D Division of the Public Health Agency of Northern Ireland provides core funding in support of the NICTC's continued expansion with significant additional funding being provided by several Cancer Research UK grants and from local charities such as the Friends of the Cancer Centre.

The role of the 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 Northern Ireland Cancer Trials Network (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 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 19 such centres appointed within the UK.

DRUG DISCOVERY

David Haigh, Lead Investigator

Despite over fifty years of research in the field of anticancer drug discovery, ranging from DNA modifying agents such as N-mustards and platinum cross-linking agents; anti-metabolite and natural products including Methatrexate and Paclitaxel to more recent anti-hormonal drugs such as Tamoxifen, the challenge of identifying clinically useful oncology medicines remains daunting. During the last twenty years, as knowledge of the heterogeneity of cancer as a disease has increased, greater emphasis has been placed on new molecularly-targeted drugs, designed to inhibit enzymes resulting from over-expression of aberrant genes, or that interfere with signalling pathways that are also related to aberrant gene expression. Some notable successes include Gleevec and Tykerb. As our understanding of the relationships between these genes and the biology of cancer continues to grow, new opportunities for targeted therapy will continue to emerge.

Working in synergy with members of both the Cancer Cell and Molecular Biology and the Experimental Cancer Medicine divisions, the remit of the Drug Discovery group is to pursue these emerging novel and innovative biological targets through the early stages of the drug discovery process. These stages define the transition from basic molecular biological understanding of disease targets towards the identification of appropriate small-molecule "tool" and "hit" compounds, capable of modulating the biological activities of those targets and the initiation of "hit-to-lead" and early "lead-optimisation" research programmes. Research is currently focussed on the discovery of inhibitors of protease enzymes and on disrupting protein-protein interactions, targets in several pathways associated with aberrant control of oncogenic activity, dysregulation of protein trafficking, control of nucleocytoplasmic transport or regulation of cellular apoptosis. Based on these initial drug discovery efforts, it is anticipated that molecules will emerge that may be developable into the next generation of clinical medicines. The multidisciplinary environment within CCRCB offers a significant opportunity for chemists, biologists and computer modellers to combine heir expertise in in-silico design, organic synthesis, bioassay design and screening, thus facilitating the drug discovery process.

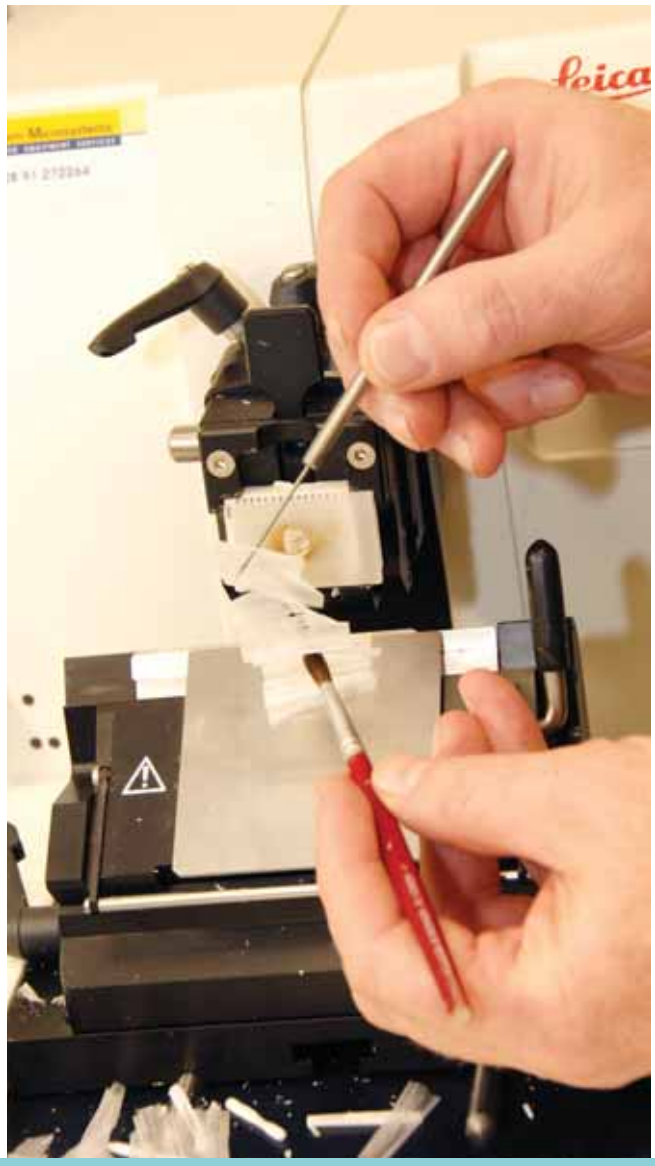
MOLECULAR PATHOLOGY AND BIOBANKING

Manuel Salto-Tellez and Jackie James, Lead Investigators

CCRCB is creating a Molecular Pathology Hub in the basement of the CCRCB building. The plans for the refurbishment of the laboratory, the incorporation of new equipment and the consolidation of Molecular Pathology staff in the new operation are well ahead. Before the end of 2011, we are aiming to have a self-contained, purpose-designed, internationally accreditable hybrid operation capable of performing molecular pathology translational research and molecular diagnostics of solid tumours. The molecular pathology diagnostic unit will be a partnership between CCRCB and the Belfast Health and Social Care Trust (BHSCT).

The technologies available will be tissue and nucleic acid based, and will 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 Gen Sequencing, laser capture microdissection and tissue bioimaging. The laboratory environment will ensure the proper SoPs, procedure manuals and QA/QC schemes to exercise its hybrid role. This laboratory will be 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.

Molecular Pathology research in Belfast involves academics at Queen's University Belfast and clinicians within the BHSCT Tissue Pathology laboratories and is underpinned by the new Northern Ireland Biobank (NIB). The NIB is funded by the Health and Social Care (HSC) Research and Development (R&D) Division of the Public Health Agency of Northern Ireland and a local charity, Friends of the Cancer Centre; it is also supported through the CR–UK Centre grant. The NIB will enhance translational cancer research associated with our phase I-III trials through the collection of tissues and blood samples linked to reliable clinical and pathological data sets. The Belfast ECMC previously had project-based but no systematic tumour tissue collection capabilities. The NIB will complement current activities by establishing a unique targeted collection of tissues and bodily fluids, including normal and tumour tissues, for translational studies. The NIB has developed a secure, independent sophisticated information management system based on CaTISSUE suite from NCI/NIH, but 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.



EDUCATION AND TRAINING

POSTGRADUATE PROGRAMME

Karen McCloskey, Associate Director for Postgraduate Studies

An important aim of the CCRCB is to train research leaders of the future. The purpose of our clinician/graduate training programme is to give students and clinical fellows starting in research, an opportunity to work in state-of-the-art laboratories. The training of our postgraduate research students is achieved by offering both three and four year PhD studentships. Currently there are 64 postgraduate students within the Centre.

The postgraduate programme integrates training in cancer research with the transferable skills necessary for the communication of science and career development as an independent scientist. All students receive training in safe working practices, good laboratory practice, project report writing and communication/presentation skills. Students are given the opportunity to present posters on their work at national and international conferences to enhance their network of scientific contacts. Where appropriate, students undertake short visits to collaborators' laboratories in the UK, Europe or the USA to work on unique sample sets or to access new methodologies.

Four-year PhD studentships are supported by the McClay Trust and CR-UK. These prestigious studentships enable students to take short rotations in a number of CCRCB laboratories during their first year and then to develop a project proposal within the laboratory of their choice. There are currently six McClay Trust and five CR-UK supported students within CCRCB.

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

- Anna Acheva was awarded a European Radiation Research Society Travel Award both in October 2010 to attend the European Radiation Research Society meeting in Stockholm and again in 2011 and will attend the 14th International Congress of Radiation Research being held in Warsaw, Poland from 28 August – 1 September 2011;

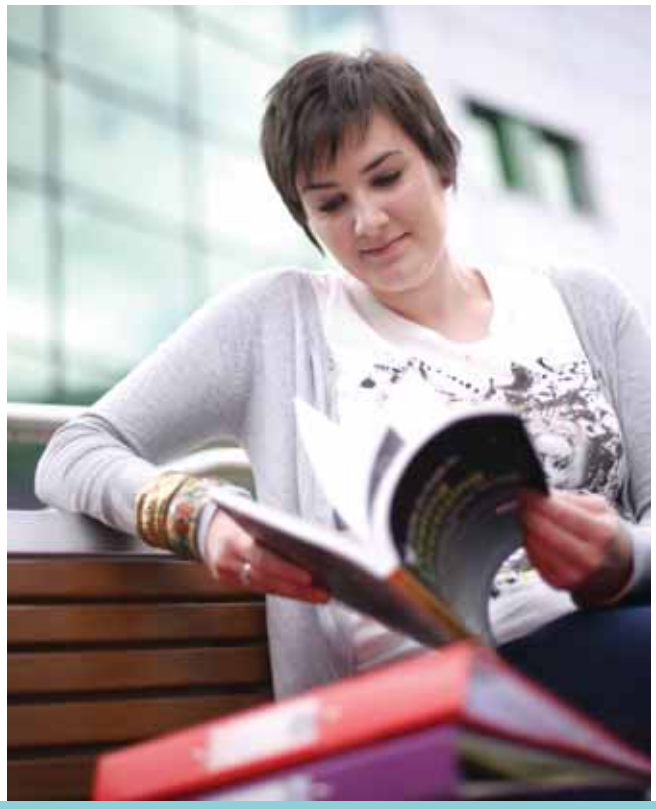
- Marie Breen won the 2010 Roche Prize for her presentation entitled "Epor over-expression in TEL-AML1 positive ALL: Critical Roles for DNA Methylation, GATA-2 or microRNAs?" and received a medal and bursary of £400. Marie was also selected to represent CCRCB at the Roche Research of the Year Award ceremony at the Westbury Hotel, Dublin on 25 November 2010.

- Joanna Majkut won the best poster prize in the Molecular Biology category entitled "RXDL conserved binding motifs of DED domains in cFLIPs are critical for its functioning" at the Cancer TRG annual meeting, held at University of Ulster, Jordanstown campus on 15 October 2010;

- Colman Trainor won the best poster prize at the Irish Radiation Research Society meeting in Dublin in October 2010;

- Colman Trainor and Martin Lawlor were awarded Radiation Research Society (US) Scholars in Training awards to attend the 14th International Congress of Radiation Research being held in Warsaw, Poland from 28 August – 1 September 2011;

- Elena Zeharieva won the best poster prize at the European Radiation Research Society meeting held in Stockholm in October 2010.



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

POSTGRADUATE SCIENTISTS:

Name	Degree Awarded	Date	Thesis Title
Crosbie-Staunton, Kieran	MPhil	July 2011	Evaluation of the role played by BRCA1 as a regulator of estrogen receptor alpha (Era) inhibitors (Supervisors: P Mullan/P Harkin)
Cunniffe, Grainne	PhD	December 2010	Development of a NanoHydroxyapatite-Collagen composite scaffold for bone tissue engineering (Supervisors: G Dickson/F O'Brien)
D'Costa, Zenobia	PhD	July 2011	The identification of novel therapeutic targets for the treatment of TBX2-driven breast cancers (Supervisors: P Mullan/P Harkin)
Jeganathan, Reubendra	MCh	July 2011	PET-CT of oesophageal cancer: its role in clinical management (Supervisors: C Campbell/J McGuigan)
Jithesh, Puthen Veettil	PhD	December 2010	Enabling clinical cancer informatics through grid computing (Supervisors: P Johnston/D Fennell)
Ma, Jiao	PhD	December 2010	Studies of the determinants of expression and sub-cellular location of Anillin (Supervisors: H Russell/P Hall)
Matchett, Kyle Brian	PhD	December 2010	Independent regulation and function of SEPT9 splice variants (Supervisors: H Russell/P Hall)
McCleary, David Andrew	MPhil	December 2010	A high performance framework for the rapid analysis of tissue microarrays (Supervisors: P Hamilton/J Diamond)
McCoy, Francis Gerard Patrick	PhD	December 2010	Development and validation of targeted all hydrocarbon stapled pro-apoptotic BH3 peptidomimetics as selective de-repression BAK activators in lung cancer and mesothelioma (Supervisors: D Fennell/D Longley)
McKee, Karla	PhD	July 2011	The role of p53 in SEPT9 regulation (Supervisors: H Russell/P Hall)
Montgomery, Nicola	PhD	July 2011	Importance of prostate cancer cell-derived interleukin-8 promoting the establishment of bone mocrometastasis (Supervisors: D Waugh/P Mullan)
Pivato, Geraldine	PhD	July 2011	The role of the Sterile Alpha Motif (SAM) domain of ΔNp63 in keratinocytes (Supervisors: D McCance/D Patel)
Pretel Fumado, Bibiana	PhD	July 2011	Mathematical modelling of ductal carcinoma in situ (Supervisors: F Shearer/P Johnston)
Ravindranath, Amod	PhD	December 2010	Tcf-4 regulates osteopontin-mediated malignant transformation in human breast cancer (Supervisors: M El-Tanani/P Johnston)
Robb, Andrew William	PhD	December 2010	Assessment of the role of vitamin D receptor polymorphisms in the pathogenesis of early onset inflammatory bowel disease (Supervisors: C Campbell/W McCallion)
Tkocz, Dorota	PhD	July 2011	The identification of pathways responsible for driving the profileration of basal breast cancers (Supervisors: D Waugh/P Mullan)

CLINICAL RESEARCH FELLOWS:

Name	Degree Awarded	Date	Thesis Title
Campbell, Lynn Rachel	MD	December 2010	The role of the HER-targeted therapies on chemosensitization in gastro-oesophageal cancer (Supervisors: P Johnston/M Eatock)
Fenton, Audrey	MD	December 2010	The role of oncogenic *Kras* as a determinant of response to EGFR/HER2 targeted therapies (Supervisors: P Johnston/A Hughes/S Van Schaeybroeck)
Hurwitz, Jane	MD	July 2011	Mechanisms underlying sensitivity and resistance to the BCL-2 family inhibitor GX15-070 in small cell lung cancer (Supervisors: D Fennell/D Longley)
Jain, Suneil	PhD	December 2010	Gold nanoparticles as novel sensitisers for radiation therapy (Supervisors: J O'Sullivan/D Hirst)
Olabode, Oladipo	PhD	July 2011	The role of interleukin-8 signalling in the resistance of colorectal cancer to chemotherapy (Supervisors: D Waugh/R Wilson)

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 Training Agency (NIMDTA) and the Belfast Health and Social Care Trust (BHSCT) in 2008 to provide a unique opportunity for highly motivated individuals who want to excel in both clinical and academic training. There are three programmes available. The 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.

In CCRCB we have successfully had trainees on all levels of the CAT Programme as illustrated in the table below:

Programme	Name	Period
AF2	Corrigan, Elaine	1 December 2010 – 5 April 2011
ACF	Irwin, Gareth	1 August 2009 – 31 August 2011 Now successfully received R&D Fellowship and will commence PhD in CCRCB in August 2011
ACF	Moran, Michael	1 August 2009 – 31 August 2011 Now successfully received R&D Fellowship and will commence PhD in CCRCB in August 2011
ACL	Coyle, Vicky	5 August 2009 – 30 September 2010 Returned to hospital medicine

New trainees in 2011:		
ACL	Turkington, Richard	To commence August 2011 – has just completed a CR-UK funded PhD

SUMMER STUDENTSHIPS

The CCRCB Summer Research Programme has been running on a formal basis for three years and provides promising young students the opportunity to work in a research laboratory for eight weeks over the summer period. Students from science, medical and computational biology backgrounds are assigned to a supervisor and an original research project. In addition to learning laboratory techniques, data analysis and interpretation, the participants also write a research report and present their work at a CCRCB symposium. In 2010, twenty students participated in our programme, funded by the School of Medicine, Dentistry and Biomedical Sciences, Wellcome Trust, Learned Societies, Northern Ireland Leukaemia Research Fund and the Nuffield Foundation. There are currently twenty three students enrolled on the 2011 summer programme.

POST DOCTORAL PROGRAMME

Kevin Prise, 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 steps 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 but also to generate new ideas in a stimulating research environment.

As part of the post-doctoral programme within the Centre, we run a weekly seminar programme where post-docs present their work to their peers and colleagues and gain skills in introducing speakers and leading questions from the audience.

The career development of our post-doctorate is of utmost importance and we have recently launched 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. Currently nine post-docs have entered the programme and several are already submitting fellowship applications to funders including Cancer Research UK, the Medical Research Council and the Breast Cancer Campaign. Already two of our postdoctoral research fellows within the Centre are funded by their own research fellowships – Dr Jennifer Quinn (Breast Cancer Campaign) and Dr Paula Hyland (NCI Cancer Prevention).

The Centre's post-doctorate have also been the driving force behind the setting up of a School-wide Post-Doctoral Society, initially chaired by Dr Simon McDade and now chaired by Dr David Foley. This 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 Annual Postdoctoral Symposium was held on 20 May 2011 in the Great Hall, Queen's University Belfast and included a combination of scientific and career related talks.

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

- Dr Karl Butterworth was awarded a Young Scientist Award to attend the Annual Meeting of the Radiation Research Society in Maui, Hawaii (September 2010);

- Mr Conor McGarry was awarded the European Society for Therapeutic Radiation and Oncology (ESTRO) – Jack Fowler University of Wisconsin Award for 2011. Conor received his award and gave a talk at the ESTRO Anniversary Congress held in London on 8-12 May 2011;

- Dr Adam Pickard won the best poster in the Cell Biology category entitled "The stromal function of the retinoblastoma protein in controlling differentiation and cancer cell invasion" at the Cancer TRG Annual Meeting, held at the University of Ulster, Jordanstown campus on 15 October 2010;

- Dr Adam Pickard and Dr Simon McDade won the European Associated Cancer Research (EACR) Young Scientists Awards and presented their work at the Irish Association for Cancer Research (IACR) meeting in Cork in March 2011;

- Dr Kienan Savage was nominated by the Belfast Media Group for one of its "Top 40 under 40" awards for his work chairing the Belfast Relay for Life for Cancer Research UK which raised over £12,000 for the charity.

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 18 November 2010. The lecture was given by **Professor Frank McCormick**, from the UCSF Helen Diller Family Comprehensive Cancer Centre. Professor McCormick's talk was entitled "Success and Failure on the RAS Pathway".

This year's prestigious **CR-UK Lecture**, held annually as part of the Belfast Cancer Research UK Centre initiative was delivered on 23 June 2011 by **Dr Andrew Tutt**, from the Breakthrough Breast Cancer Research Unit, King's College London. The talk was entitled "Targeting the DNA Damage Response in Triple Negative Breast: Platinums and PARPS – An Update".

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

Dr Chris Bakkenist,
University of Pittsburgh
"ATM kinase inhibition is a monotherapy for breast, lung and pancreatic cancers";

Professor Margaret Frame,
Institute of Genetics and Molecular Medicine, Edinburgh Cancer Research Centre
"Targeting and imaging invasion, metastasis and drug responses";

Professor Conly Rieder,
New York State Department of Health's Wadsworth Center
"Specific poisons (Taxol), the mitotic checkpoint, and the importance of direct data";

Professor Jim Johnston,
Centre for Infection and Immunity, Queen's University Belfast
"Mischievous macrophages and their importance in cancer";

Dr Nicholas Leslie,
Division of Molecular Physiology, College of Life Sciences, University of Dundee
"The regulation and functions of the PTEN tumour suppressor";

Dr Roger Barraclough,
University of Liverpool
"Proteins associated with cancer metastasis";

Dr Liam Murray,
Centre for Public Health, Queen's University Belfast
"Risk of oesophageal and other cancers in users of bisphosphonates";

Professor Hochhauser,
University College London Cancer Institute
"Optimising combination of EGFR inhibitors and chemotherapy";

Professor Alan Stitt,
Centre for Vision and Vascular Science, Queen's University Belfast
"Vascular stem cells and angiogenesis – bad for cancer but good for retinopathy";

Dr Farzin Farzaneh,
King's College London
"An immune edited leukaemia versus a leukaemia edited immune system – prospects for immune therapy of acute myeloid leukaemia";

Dr John Stingl,
Cancer Research UK Cambridge Research Institute
"Mammary stem and progenitor cells: understanding the cellular context of breast cancer";

Dr Rob Bristow,
University of Toronto
"Contextual synthetic lethality: studies of hypoxia and DNA repair within the tumour microenvironment";

Dr Rob Clark,
University of Manchester
"Targeting stem cell activity in breast cancer";

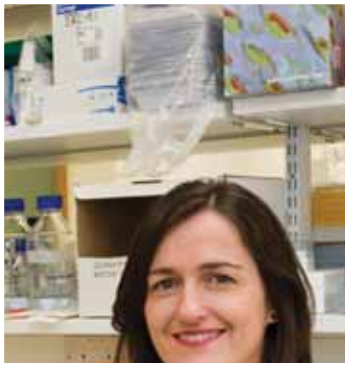
Professor Pascal Meier,
Institute of Cancer Research Chester Beatty Laboratories, London
"Inhibitor of apoptosis proteins: from caspase inhibitors to modulators of NF-kappa B, inflammation and cancer";

Professor Robert Slany,
University of Erlangen-Nuremberg
"HOX genes in normal and malignant hematopoiesis";

Professor Jonathon Frampton,
University of Birmingham
"c-Myb regulates the balance between normal and aberrant stem cell behaviour in the development of myeloid disease";

Dr Gareth Inman,
Biomedical Research Institute, University of Dundee
"Switching TGF-beta from tumour suppressor to tumour promoter".







PUBLIC ENGAGEMENT ACTIVITIES

PUBLIC ENGAGEMENT ACTIVITIES

CCRCB, in partnership with the Health and Social Care (HSC) Research and Development (R&D) Division of the Public Health Agency of Northern Ireland and the Belfast Health and Social Care Trust (BHSCT), was designated a Cancer Research UK Centre in 2009. This brings together scientists, doctors and nurses who, by sharing knowledge and expertise, will rapidly develop lab-based discoveries into treatments that will benefit patients in Northern Ireland and beyond. Part of the Belfast CR-UK Centre strategy is a programme of public engagement, with scientists who receive funding from the charity being regularly involved in outreach activities.

The programme is led by the Local Engagement and Development Manager for the CR-UK Centre, Ms Helen Barnes, who is based in CCRCB. During the report period, eighty-five researchers attended over 200 events reaching an audience of more than 12,000.

The engagement programme aims both to take the researchers out into the community to meet the local fundraisers and supporters of the charity and to bring various groups from across the community into the research environment so that they can gain insight into the work ongoing locally. The types of events attended externally have ranged from coffee mornings, community health information events, golf tournaments, gala dinners, fashion shows, a pink vintage tractor run round Slemish Mountain and the Sentinus Young Innovators event at the Odyssey Arena. A team of six researchers demonstrated to several hundred school children how to extract DNA from strawberries and make double helixes from jelly babies and cocktail sticks.

More than thirty researchers took part in the two CR-UK Race for Life events at Stormont at the end of May, mingling with the 6,500 ladies who were taking part and giving out medals at the finish line. Dr Dean Fennell gave the thank you speech to the ladies taking part and everyone was keen to get their photo taken with a scientist. A further six researchers and research nurses travelled to Coleraine in June for the smaller Race for Life event for 1,200 ladies who enjoyed hearing from Dr Paul Mullan, a native of Limavady. Experience has shown that the engagement activities are particularly successful when the researchers who attend actually come from that locality.

Continued efforts have been made to raise awareness of the value of cancer research in the local media and the political arena, with researchers featuring in several articles in the Belfast Telegraph and other regional press and four representatives from CCRCB attending a lunch in Stormont for the MLAs and their offices.

There have been eight lab tours during the year for a variety of audiences. Groups attending have included volunteers from the local CR-UK shops, individual and corporate fundraisers, volunteers from the Macmillan Support & Information Centre, representatives from Rotary Clubs across Northern Ireland and members of a cancer support group from Enniskillen, all of whom were cancer survivors. The feedback from these tours has been extremely positive, with both those attending and the researchers taking part, finding the experience motivational and inspirational.

Following on from a popular new initiative in spring 2010, two further workshops have been held for AS level Biology students. Fifty students from more than sixteen schools across Belfast had the opportunity to spend the day in the labs working alongside researchers, carrying out practical experiments based on topics taken from the current AS level syllabus. These were heavily oversubscribed and there are plans to hold a further workshop in November for students from schools outside Belfast.

As a spin off from these events, CCRCB hosted an information day on gene technology in June for Biology teachers. Fifty teachers attended from all over Northern Ireland and enjoyed a morning of seminars on DNA technology and personalised medicine before heading to the Medical Biology Centre laboratories for an afternoon of practical lab sessions. Such was the success and demand for this event that it will now become an annual fixture in the CCRCB calendar.

Another important aspect of the engagement programme is to fulfil one of CR-UK's goals around reducing the number of deaths from cancer and to take the message about the importance of screening and living a healthy lifestyle to low income communities where the incidence of cancer is higher. The Cancer Research UK Senior Research Nurse has taken part in health information events across Belfast, disseminating the CR-UK health information and carrying out health checks. The most recent event was a Men's Health Day in the City Hall in June organised by the Belfast Trust and attended by more than 150 men of all ages. Links have also been established with the various Belfast Healthy Living Centres and the Health Improvement teams in the Belfast and South East Trusts, leading to more opportunities to raise awareness and improve cancer outcomes for Northern Ireland.

Other charities which provide funding to the Centre also contribute to the public engagement activities and outreach programmes. For example, CCRCB regularly welcomes supporters and volunteers of local charities such as the Northern Ireland Leukaemia Research Fund, Friends of the Cancer Centre, Ulster Cancer Foundation and many other national charities.

The value of the public engagement programme is recognised and fully endorsed across CCRCB and it will be even more important in coming months in helping to demonstrate the impact of research to the local community and local cancer patients.








STAFF LISTING

NEW APPOINTMENTS

Manuel Salto-Tellez,
Professor in Molecular Pathology

Manuel Salto-Tellez was appointed to the post of Professor in Molecular Pathology and joined the Centre in March 2011. Over the last twenty-five years, Professor Salto-Tellez's medical and research pursuits have taken him from his native Spain to different parts of the world. Professor Salto-Tellez started his medical education at the Universities of Oviedo (Spain), Aachen (Germany) and Leiden (Netherlands), and he went on to train as a histopathologist in the UK, and a molecular pathologist in UPENN. For the last ten years, he was an Associate Professor of Pathology, consultant pathologist and research scientist at the National University of Singapore and its hospital. Professor Salto-Tellez said: "I am now delighted to come to Belfast to be part of the Centre for Cancer Research and Cell Biology and Queen's University and I am proud to be joining the scientific and the pathology communities of Northern Ireland."

Since 2001, Professor Salto-Tellez's main activity in science and diagnostics has been the integration of the phenotypic and genotypic dimensions of disease, primarily cancer. To have a fuller understanding of disease pathology, he believed that one had to go beyond its conventional, morphological aspects, actively involving molecular biology in translational research and tissue diagnostics. Professor Salto-Tellez said: "I look forward to working on this morpho-molecular integration in all aspects of science, diagnostics and therapeutics here in Belfast. I hope that this approach will contribute to advancing research in the Centre for Cancer Research and Cell Biology and Queen's University Belfast, and that it helps alleviate the pain of to cancer sufferers."

Shozeb Haider,
Senior Lecturer in Molecular Modelling

Shozeb Haider joined CCRCB in January 2011 having been appointed to the position of Senior Lecturer in Molecular Modelling. He originally completed his BSc and MSc in Biochemistry from Aligarh University, India before moving to the UK to join the MRes programme in Bioinformatics at Leeds University. He followed this with a PhD in Molecular Biophysics at the Institute of Cancer Research, London studying the structure and dynamics of guanine quadruplexes. Dr Haider was able to solve the first crystal structure of a guanine quadruplex in complex with an anti-cancer drug.

Dr Haider then moved as a postdoc to Oxford University studying the structural mechanism of KATP K+ ion channels. In the absence of any crystal structures, he was able to construct models that explained the structure-function relationship in detail. For this work he was invited to the prestigious "Emerging Scientists of the Next Decade" symposium organised by Roche pharmaceuticals. Prior to joining CCRCB, he held the position of CR-UK Senior Research Fellow at the London School of Pharmacy working on anti-cancer target validation using computational methodologies. Recently he has also proposed a mechanism of the open and closed states of a Cytochrome P450 involved in prostate cancer.

Apart from running his projects, Dr Haider will be providing collaborative support in computational chemistry to colleagues in CCRCB. He has also initiated collaboration with Professor Zholos at the Centre for Vision and Vascular Science. Dr Haider said: "I am absolutely delighted to begin my career at CCRCB and look forward to working with eminent names in the field of cancer research here at the Centre."

Dr Haider is a member of the Royal Society for Chemistry and is also an accredited Chartered Chemist. He is currently a member of the Management Committee of Molecular Modelling and Graphics Society, Royal Society for Chemistry (Molecular Modelling Group) and pan-European Cooperation in Science and Technology MP0802 programme.

CURRENT STAFF (as at 31 July 2011)

Academic Staff

Professors:

Professor Charles Campbell
Professor David Haigh
Professor Karl Hale
Professor Peter Hamilton
Professor Paul Harkin
Professor Patrick Johnston
Professor Richard Kennedy (Visiting McClay Professor)
Professor Dennis McCance
Professor Mary Frances McMullin
Professor Ken Mills
Professor Kevin Prise
Professor Manuel Salto-Tellez

Readers:

Dr Andreas Albrecht
Dr Fred Currell
Dr Dean Fennell (CR-UK Clinician Scientist Fellowship)
Dr Karen McCloskey
Dr Marie Migaud
Dr Hilary Russell
Dr David Waugh (Ulster Cancer Foundation)
Dr Richard Wilson

Senior Lecturers:

Dr Glenn Dickson
Dr Mohamed El-Tanani
Dr Tom Flannery
Dr Shozeb Haider
Dr Jackie James
Dr Dan Longley
Dr Joe O'Sullivan
Dr Chris Scott
Dr Sandra Van Schaeybroeck (CR-UK Clinician Scientist Fellowship)
Dr Kate Williamson

Lecturers:

Dr Frank Emmert-Streib
Dr Paul Mullan
Dr James Murray
Dr Kostantin Panov
Dr Daksha Patel
Dr Giuseppe Schettino
Dr Alex Thompson
Dr Richard Williams
Dr Shu-Dong Zhang

Honorary Staff

Ms Ruth Boyd
Dr Mark Catherwood
Dr Alison Clayton
Dr Martin Eatock
Dr Alan Hounsell
Dr Sandra Irvine
Professor Terry Lappin
Dr Tom Lynch
Dr Perry Maxwell
Professor Glenn McCluggage
Dr Stephen McQuaid
Dr Melanie Morris
Professor Patrick Morrison
Dr Melanie Percy
Dr Paul Winter

Scientific Fellows

Dr Paula Hyland (NCI Cancer Prevention)
Dr Jennifer Quinn (Breast Cancer Campaign)

Clinical Research Fellows

Darren Brady (Friends of the Cancer Centre)
Aidan Cole (CR-UK)
Sonali Dasgupta (CR-UK)
Conor McGarry (HSC R&D Division)
Ian Paul (HSC R&D Division)
Muireann Roche (HSC R&D Division)
Richard Turkington (CR-UK)

Research Staff

Olga Abramczyk (Wellcome Trust)
Wendy Allen (CR-UK)
Shahnaz Al Rashid (CR-UK)
Jaine Blayney
Sara Busacca (HSC R&D Division/NCI)
Karl Butterworth (CR-UK)
Alex Chacko (CR-UK)
Ka Kui Chan (CR-UK)
Jonathan Coulter (CR-UK)
Lisa Crawford (Leukaemia & Lymphoma Research)
Nyree Crawford (Breast Cancer Campaign)
Paula Cunnea (Well Being of Women)
Zenobia D'Costa (Breast Cancer Campaign)
Ricardo de Matos Simoes (EPSRC)
Kishore Gaddale Devanna (MRC)
Glenda Dickson (Leukaemia & Lymphoma Research)
Sarah Dolan (CR-UK)
Philip Dunne (Ulster Cancer Foundation)
Francois Fay (CR-UK)
Rebecca Gallagher (CR-UK and HSC R&D Division)
Mihaela Ghita (CR-UK)
Claire Grills
Mary Harte (McClay Foundation/INI)
Catherine Higgins (MRC)
Caitriona Holohan (CR-UK)
Louise Johnston (EU)
Murigan Kalimutho (CR-UK)
Kyle Matchett (HSC R&D Division)
Pamela Maxwell (CR-UK)
Darragh McArt
Ashleigh McClatchey (AICR)
Simon McDade (MRC)
Stephen McMahon (CR-UK)
Niall McTavish (CR-UK)
Julia Miskelly (CR-UK)
Kevin Monaghan (EU)
Niamh O'Brien (HSC R&D Division)
Kathleen O'Hagan
Deepu Oommen (CR-UK)
Gaurang Patel (CR-UK)
Kerry Pettigrew (HSC R&D Division)
Adam Pickard (Wellcome Trust)
Keara Redmond (British Lung Foundation)
Kelly Redmond (Breast Cancer Campaign)
Kienan Savage (CR-UK)
Miriam Sgobba (MRC)
Danny Sharpe (MRC)
Izabela Stasik (British Lung Foundation)
Leanne Stevenson (HSC R&D Division)
Dorota Tkocz (HSC R&D Division)
Yinhai Wang

Technical Staff

Conal Askin (CR-UK and HSC R&D Division)
Victoria Bingham (CR-UK and HSC R&D Division)
Gail Carson (CR-UK)
Martin Clulow
Alan Coffey
Josephine Dutton
Cathy Fenning (HSC R&D Division)
Paula Haddock (Breast Cancer Campaign)
Anne Jordan (NILRF)
Claire Kitson (CR-UK and HSC R&D Division)
John McCotter
David McGibbon
Kirsty McLaughlin (CR-UK)
Susan Price
Maria Rea

Administrative Staff

Helen Barnes (CR-UK Lead Engagement & Development Manager)
Priscilla Clark (NI Biobank Administrator)
Sharon Dunwoody (CR-UK Centre Administrator)
Beryl Graham (Centre Manager)

Clerical Staff

Andrea Conway
Eileen Gray
Susie Hart
Julie Hunter
Frances McCormick
Linda Megrath
Margaret-Rose Mervyn
Katie Orr (part funded NILRF)
Frances Parker (NILRF)
Noreen Rafferty

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)
Breast Cancer Campaign
British Heart Foundation
British Lung Foundation
Cancer Research UK (CR-UK)
Friends of the Cancer Centre
Leukaemia and Lymphoma Research
Northern Ireland Leukaemia Research Fund (NILRF)
Nuffield Foundation
Ulster Cancer Foundation (UCF)
Wellcome Trust

Companies

Almac Diagnostics
Amgen
Astra Zeneca
Boehringer Ingelheim Ltd
Bristol-Myers Squibb
Celgene
i-Path Diagnostics Ltd
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 Institutes of Health (NIH)
UK Home Office

Societies

Biochemical Society
Royal Society

Agencies

Invest Northern Ireland

NEW RESEARCH GRANTS AWARDED
(from 1 August 2010 – 31 July 2011)

Investigator(s)	Sponsor	Title of Project	Amount	Period
J James P Hamilton K Williamson D McCance	HSC R&D Division	Northern Ireland Biobank	£1,495,414	01/07/2010 – 30/06/2015
P Johnston	Ulster Cancer Foundation	Core funding	£120,000	01/08/2010 – 31/07/2011
D Waugh	Cancer Research UK	Role of PTEN-Regulated CXC-Chemokine Signalling in Modulating the Prostate Tumour Microenvironment and its Response to Radiotherapy	£197,870	01/08/2010 – 31/07/2013
A Thompson	International Union Against Cancer	UICC Yamagiwa-Yoshida Memorial International Cancer Study Grant (Dr Glenda Dickson)	£3,906	01/08/2010 – 31/10/2010
K Mills	Northern Ireland Leukaemia Research Fund	Core funding	£153,303	01/09/2010 – 31/10/2011
J James P Hamilton	Friends of the Cancer Centre	Implementation of an IT Management System to the Northern Ireland Biobank	£58,163	01/09/2010 – 31/08/2013
D Fennell	Pierre Fabre	Vinorelbine versus best Supportive Care in Second Line Treatment of Mesothelioma: A Phase III Trial and Development of a Companion Diagnostic	£20,000	01/09/2010 – 31/08/2012
T Flannery	Irish Institute of Clinical Neuroscience	Investigation of the Role of Cathepsins in Astrocytoma Invasion and Angiogenesis in Vivo using an Orthotopic Rodent Glioma Model	€10,000	01/09/2010 – 31/08/2011
F Emmert-Streib	Engineering and Physical Sciences Research Council	Detecting Pathological Pathways of Complex Diseases	£101,130	01/09/2010 – 31/12/2011
K Mills M Percy	Northern Ireland Leukaemia Research Fund	The Role of Ankyrin Repeat and SOCS Box Proteins (ASBs) in Acute Myeloid Leukaemia (PhD Studentship)	£104,983	01/09/2010 – 31/08/2014

Investigator(s)	Sponsor	Title of Project	Amount	Period
P Mullan	Breast Cancer Campaign	Characterising the Repression of Cystatin 6 by TBX2 – Implications for Growth Control and Breast Tumorigenesis	£184,912	01/10/2010 – 30/09/2013
M Migaud C Hardacre B Gilmore C Scott K Prise C Taggart	Engineering and Physical Sciences Research Council	Cross-disciplinary Feasibility Account – Enabling Phosphorous and Peptide Based Chemical Biology using Ionic Liquids	£201,658	01/10/2010 – 31/12/2011
T Flannery C Scott	Royal College of Surgeons of Edinburgh	Investigate the Effect of Cathepsin Inhibitors as an Anti-invasive Strategy in an Orthotopic Mouse Glioma Model	£7,000	01/11/2010 – 31/10/2011
G Schettino L Manti	Royal Society	Evaluation and Comparison of the DNA Damage and Resulting Biological Effects Therapeutically Relevant Ion Beams on Live Cells	£2,895	01/11/2010 – 29/02/2011
D Fennell K Prise S Zhang J Quinn	British Lung Foundation	Synthetic Lethal Targeting of BRCA1 Deficient Non-Small Cell Lung Cancer for Effective Therapy	£119,953	01/01/2011 – 31/12/2012
G Schettino	Engineering and Physical Sciences Research Council	Development of a Hard X-Ray Microfocus Apparatus for Radiobiological Studies	£125,000	01/03/2011 – 28/02/2013
K Prise G Schettino	European Union FP7	EPIRADBIO – Combining Epidemiology and Radiobiology to assess Cancer Risks in the Breast, Lung, Thyroid and Digestive Tract after Exposure to Ionizing Radiation with Total Doses in the order of 100mSc or below	£242,056	01/04/2011 – 31/03/2014
K Williamson P Hamilton J O'Sullivan M Stevenson F Emmert-Streib	Randox	Bladder Biomarker Trial	£382,706	01/04/2011 – 31/03/2014
K Prise J O'Sullivan	UK Home Office	Triage of Radiation Casualties using Protein Biomarkers	£159,000	01/04/2011 – 31/03/2014
D Timson G Schettino F Currell	Engineering and Physical Sciences Research Council	Ion Beam Radiotherapies: Comparison of Heavy Ions Antiprotons	£29,000	01/05/2011 – 30/04/2012
D McCance D Patel J James	Medical Research Council	The Role of p63 Isoforms in Head and Neck Cancers	£849,842	01/06/2011 – 31/05/2015

Investigator(s)	Sponsor	Title of Project	Amount	Period
T Lappin	FP7-HEALTH (Adverse Drug Reaction Research)	Gaining Sage on the Epoietins' Saga: Assessing Long Term Risks and Advancing towards better Epoietin Treatment Modalities	€2,995,104	01/06/2011 – 31/05/2015
K Mills	Northern Ireland Leukaemia Research Fund	Support for 4 Summer Studentships	£4,800	01/07/2011 – 31/08/2011
J Murray	Wellcome Trust	Analysis of the Mechanism by which the Pseudokinase, hVps15, binds to and activates the Lipid Kinase, hVps34 (Summer Studentship)	£1,440	01/07/2011 – 31/08/2011
R Kennedy	Invest NI/McClay Foundation	Almac-QUB Cancer Target, Biomarker and HIT Finding Programme	£1,295,040	01/07/2011 – 02/05/2014
T Flannery	Irish Institute of Clinical Neuroscience	Targeting Radiation Resistance in Glioblastoma (Travel Award – Dr Pankaj Singh)	£7,900	01/07/2011 – 30/09/2011
S Zhang	Biotechnology and Biological Sciences Research Council	Gene-expression Connectivity Mapping and its Application in Phenotypic Targeting	£239,570	01/07/2011 – 30/06/2014
P Harkin C James J Quinn P Mullan	HSC R&D Fellowship	Molecular Characterisation of Poor Prognosis Triple Negative Breast Cancers (Gareth Irwin)	£187,755	01/08/2011 – 31/07/2014
K Mills	Northern Ireland Leukaemia Research Fund	NILRF Co-ordinator	£55,884	01/08/2011 – 31/07/2013
P Mullan	Breast Cancer Campaign	Investigating the Role of p53 Gain of Function Mutations in the Pathogenesis of Basal-like Breast Cancer	£19,830	01/08/2011 – 31/12/2012
D McCance J James	HSC R&D Fellowship	Differences in Gene Methylation due to Human Papillomavirus Infection in Oropharyngeal Squamous Cell Carcinoma (Michael Moran)	£187,876	08/08/2011 – 07/08/2014
P Hamilton	EU FP7 Marie Curie	FAST-PATH: High Throughput Tissue Imaging for Biomarker Discovery and Tissue Analysis in Prostate Cancer	€1,960,000	01/09/2011 – 31/08/2015
A Thompson K Mills	Leukaemia & Lymphoma Research	Criticality of the HOXA Cluster in Normal and Malignant Haematopoiesis (PhD Studentship)	£130,400	01/10/2011 – 30/09/2015

Investigator(s)	Sponsor	Title of Project	Amount	Period
K Prise R Kennedy	Prostate Cancer Charity	Optimal Radiation Targeting of PTEN Deficiency in Castrate Resistant Prostate Cancer in Combination with Modulators of DNA Damage and Repair (PhD Studentship)	£99,273	01/10/2011 – 30/09/2014
P Hamilton	RVH Charitable Funds	Biomarkers for Malignant Progression in Barrett's Oesophagus (Yinhai Wang)	£23,399	01/10/2011 – 31/03/2012
K Prise G Schettino J O'Sullivan	Friends of the Cancer Centre	Support for an Image Guided Irradiation Platform	£500,000	01/10/2011 – 30/09/2012
M Salto-Tellez J James R Wilson	Friends of the Cancer Centre	Employment of a Research Nurse for Translational Research	£118,497	01/12/2011 – 30/11/2014
G Schettino K Prise F Currell	Medical Research Council	Biological Effectiveness of Ion Beams for Cancer Therapy	£497,644	01/12/2011 – 30/11/2014
S Van Schaeybroeck	Cancer Research UK (Renewal of Clinical Scientist Fellowship)	Evaluation of ADAM17 as a Novel Drug Target and Potential Biomarker in Colorectal Cancer	£688,624	01/01/2012 – 31/12/2014

PUBLICATIONS

PUBLICATIONS

The following list of publications were either published or accepted for publication within the period of this report for the Centre:

ABOGUNRIN, A., O'KANE, H.F., RUDDOCK, M.W., STEVENSON, M., REID, C., O'SULLIVAN, J., ANDERSON, N.H., O'ROURKE, D., DUGGAN, B., LAMONT, J.V., BOYD, R.E., HAMILTON, P., NAMBIRAJAN, T. and WILLIAMSON, K. (2011) The impact of biomarkers in multivariate algorithms for bladder cancer diagnosis in patients with hematuria, *Cancer*, (In press).

AGRAWAL-SINGH, S., KOSCHMIEDER, S., GELSING, S., STOCKING, C., STEHLING, M., THIEDE, C., THOENISSEN, N., KÖHLER, G., VALK, P.J.M., DELWEL, R., MILLS, K.I., BÄUMER, N., TICKENBROCK, L., HANSEN, K., BERDEL, W.E., MÜLLER-TIDOW, C. and SERVE, H. (2010) Pim2 cooperates with PML-RARα to induce acute myeloid leukemia in a bone marrow transplantation model, *Blood*, 115(22), p4507-4516.

ALBERT, B., LEGER-SILVESTRE, I., NORMAND, C., OSTERMAIER, M.K., PEREZ-FERNANDEZ, J., PANOV, K.I., ZOMERDIJK, J.C., SCHULTZ, P. and GADAL, O. (2011) RNA polymerase I-specific subunits promote polymerase clustering to enhance the rRNA gene transcription cycle, *The Journal of Cell Biology*, 192(2), p277-293.

ALBRECHT, A.A., CHASHKIN, A.V., ILIOPOULOS, C.S., KASIM-ZADE, O.M., LAPPAS, G. and STEINHOFEL, K. (2010) A note on *a priori* estimations of classification circuit complexity, *Fundamenta Informaticae*, 104, p1-17.

ALBRECHT, A.A., LANE, P.C.R. and STEINHOFEL, K. (2010) Analysis of local search landscapes for k-SAT instances, *Mathematics in Computer Science*, 3(4), p465-88.

ALBRECHT, A.A., KAPSOKALIVAS, L. and STEINHOFEL, K. (2010) Uphill unfolding of native protein conformations in cubic lattices, *Journal of Computational Science*, 1, p6-12.

ALLEN, W.L., JITHESH, P.V., OLIVER, G.R., PROUTSKI, I., LONGLEY, D.B., LENZ, H.J., PROUTSKI, V., HARKIN, P. and JOHNSTON, P.G. (2011) The colorectal cancer disease-specific transcriptome may facilitate the discovery of more biologically and clinically relevant information, *BMC Cancer*, 10, p687.

ALTAY, G. and EMMERT-STREIB, F. (2010) Inferring the conservative causal core of gene regulatory networks, *BMC Systems Biology*, 28(4), p132.

ALTAY, G. and EMMERT-STREIB, F. (2010) Local network-based measures to assess the inferability of different regulatory networks, *IET Systems Biology*, 4(4), p277-88.

ALTAY, G. and EMMERT-STREIB, F. (2010) Revealing differences in gene network inference algorithms on the network level by ensemble methods, *Bioinformatics*, 26(14), p1738-44.

ALTAY, G. and EMMERT-STREIB, F. (2011) Structural Influence of gene networks on their inference, *Analysis of C3NET Biology Direct*, 6, p31.

ANTONIOU, A.C. and MORRISON, P.J. (2010) on behalf of CIMBA, Common Breast Cancer Susceptability Alleles and the Risk of Breast Cancer for BRCA1 and BRCA2 Mutation Carriers: Implications for Risk Prediction, *Cancer Res*, 70(23), p9742-54.

BAROSI, T., BARBUI, G., CERVANTES, F., FINAZZI, G., GREISSHAMMER, M., HARRISON, C., HASSELBALCH, H.C., HEHLMANN, R., HOFFMAN, R., KILADJIAN, J-J., KROEGER, N., MESA, R., McMULLIN, M.F., PARDANI, A., PASSAMONTI, F., VANNUCCHI, S., REITER, A., SILVER, R.T., VERSTOVSEK, S. and TEFFERI, A. (2011) Philadelphia-negative classical myeloproliferative neoplasma: Critical concepts and management recommendations from European LeukemiaNet, *Journal of Clinical Oncology*, 29(6), p761-70.

BUCKLEY, N.E., CONLON, S.J., JIRSTROM, K., KAY, E.W., CRAWFORD, N.T., O'GRADY, A., SHEEHAN, K., McDADE, S.S., WANG, C.W., McCANCE, D.J., JOHNSTON, P.G., KENNEDY, R.D., HARKIN, D.P. and MULLAN, P.B. (2011) The ΔNp63 proteins, key allies of BRCA1 in the prevention of basal-like breast cancer, *Cancer Research*, 71(5), p1933-44.

BURNETT, A.K., HILLS, R.K., HUNTER, A., MILLIGAN, D., KELL, J., WHEATLEY, K., YIN, J., McMULLIN, M.F., CAHALIN, P., CRAIG, J., BOWEN, D. and RUSSELL, N. (2011) The addition of arsenic trioxide to low-dose Ara-C in older patients with AML does not improve outcome, *Leukemia*, 25, p1122-1127.

BURNETT, A.K., RUSSELL, N.H., KELL, J., DENNIS, M., MILLIGAN, D., PAOLINI, S., YIN, J., CULLIGAN, D., JOHNSTON, P., MURPHY, J., McMULLIN, M.F., HUNTER, A., DAS-GUPTA, E., CLARK, R., CARR, R. and HILLS, R.K. (2010) European development of Clofarabine as treatment for older patients with acute myeloid leukaemia considered unsuitable for intensive chemotherapy, *Journal of Clinical Oncology*, 28(14), p2389-95.

BUTTERWORTH, K.T., COULTER, J.A., JAIN, S., FORKER, J., McMAHON, S.J., SCHETTINO, G., PRISE, K.M., CURRELL, F.J. and HIRST, D.G. (2010) Evaluation of cytotoxicity and radiation enhancement using 1.9 nm gold particles: potential application for cancer therapy, *Nanotechnology*, 21(29), p295101.

BUTTERWORTH, K.T., McGARRY, C.K., TRAINOR, C., O'SULLIVAN, J., HOUNSELL, A.R. and PRISE, K.M. (2011) Out-of-field cell survival following exposure to intensity-modulated radiation fields, *International Journal of Radiation Oncology Biology and Physics*, doi:10.1016/j.ijrobp.2010.11.034 (In press).

CAIRNS, M.L., DICKSON, G.R., ORR, J.F., FARRAR, D., HAWKINS, K. and BUCHANAN, F.J. (2011) Electron-beam treatment of poly (lactic acid) to control degradation profiles, *Polymer Degradation and Stability*, 96, p76–83.

CAIRNS, M., SYKES, A., DICKSON, G.R., ORR, J.F., FARRAR, D., DUMBA, A. and BUCHANAN, F.J. (2011) Through-thickness control of polymer bioresorption via electron beam irradiation, *Acta Biomaterialia*, 7(2), p548-57.

CAMPBELL, F.C. (2010) Isolation and culture of mouse intestinal cells, *Methods Mol Biol*, 633, p197-206.

CAMPBELL, F.C., XU, H., EL-TANANI, M., CROWE, P. and BINGHAM, V. (2010) The yin and yang of vitamin D receptor (VDR) signaling in neoplastic progression: operational networks and tissue-specific growth control, *Biochem Pharmacol*, 79, p1-9.

CAMPER, N., MIGAUD, M.E. and SCOTT, C. (2010) Synthesis of an analogue of the bisphosphonate drug Ibandronate for targeted drug-delivery therapeutic strategies, *New Journal of Chemistry*, 34, p949-955.

CHACKO, A.D., LIBERANTE, F., PAUL, I., LONGLEY, D.B. and FENNELL, D.A. (2011) Voltage dependent anion channel-1 regulates death receptor mediated apoptosis by enabling cleavage of caspase-8, *BMC Cancer*, 10, p380.

CHAHAL, H.S., STALS, K., UNTERHÄLTER, M., BALDING, D.J., THOMAS, M.G., KUMAR, A.V., BESSER, G.M., ATKINSON, A.B., MORRISON, P.J., HOWLETT, T.A., LEVY, M.J., ORME, S.M., AKKER, S.A., BELL, R.A., GROSSMAN, A.B., BURGER, J., ELLARD, S. and KORBONITS, M. (2011) AIP mutation in pituitary adenomas in the 18th century and today, *N Engl J Med*, 364, p43-50.

CHANG, T.L., ITO, K., KO, T.K., LIU, Q., SALTO-TELLEZ, M., YEOH, K.G., FUKAMACHI, H. and ITO, Y. (2010) Claudin-1 has tumor suppressive activity and is a direct target of RUNX3 in gastric epithelial cells. *Gastroenterology*, 138(1), p255-65. e1-3. Epub 2009 Aug 23.

COYLE, V.M. and JOHNSTON, P.G. (2010) Genomic markers for decision making: what is preventing us from using markers? *Nat Rev Clin Oncol*, 7(2), p90-7.

CRAWFORD, N., CHACKO, A.D., SAVAGE, K.I., MCCOY, F., REDMOND, K., LONGLEY, D.B. and FENNELL, D.A. (2011) Platinum resistant cancer cells conserve sensitivity to BH3 domains and obatoclax induced mitochondrial apoptosis, *Apoptosis*, 16, p311-20.

CUNNIFFE, G.M., DICKSON, G.R., PARTAP, S., STANTON, K.T. and O'BRIEN, F.J. (2010) Development and characterisation of a collagen nano-hydroxyapatite composite scaffold for bone tissue engineering, *Journal of Materials Science: Materials in Medicine*, 21, p2293-2298.

CUNNIFFE, G.M., O'BRIEN, F.J., PARTAP, S., LEVINGSTONE, T., STANTON, K.T. and DICKSON, G.R. (2010) The synthesis and characterization of nanophase hydroxyapatite using a novel dispersant-aided precipitation method, *Journal of Biomedical Materials Research*, 95A, 4, p1142-1149.

CUNNINGHAM, R.M., LARKIN, P. and McCLOSKEY, K.D. (2011) Ultrastructural properties of interstitial cells of cajal in the Guinea pig bladder, *J Urol*, 185(3), p1123-31.

DEHMER, M., EMMERT-STREIB, F., GRABER, A. and SALVADOR, A. (2011) Applied Statistics for Network Biology: Methods in Systems Biology, Wiley-Blackwell.

DEHMER, M., MOWSHOWITZ, A. and EMMERT-STREIB, F. (2011) Connections between classical and parametric network entropies, *PLoS ONE*, 6(1):e15733.

DELLETT, M., O'HAGAN, K.A., COLYER, H.A.A. and MILLS, K.I. (2010) Identification of gene networks associated with acute myeloid leukemia by comparative molecular methylation and expression profiling, *Biomarkers in Cancer*, 2, p43-55.

DOHERTY, K.J., McKAY, C., CHAN, K.K. and EL-TANANI, M. (2011) RAN GTPase as a target for cancer therapy: Ran binding proteins, *Current Molecular Medicine* (In press).

DONALDSON, L.R., WALLACE, S., HAIGH, D., PATTON, E.E. and HULME, A.N. (2011) Rapid synthesis and zebrafish evaluation of a phenanthridine-based small molecule library, *Organic and Biomolecular Chemistry*, 9, p2233-2239.

EL-TANANI, M. (2010) Molecular Mechanisms of Neoplastic Transformation, Belfast, Transworld Research Network, ISBN: 978-81-7895-445-5.

EL-TANANI, M.K., JIN, D., CAMPBELL, F.C. and JOHNSTON, P.G. (2010) Interferon-induced transmembrane 3 binds osteopontin in vitro: expressed in vivo IFITM3 reduced OPN expression, *Oncogene*, 29, p752-762.

EL-TANANI, M., YUEN, H.F., SHI, Z., PLATT-HIGGINS, A., BUCKLEY, N.E., MULLAN, P.B., HARKIN, D.P., JOHNSTON, P.G. and RUDLAND, P.S. (2010) Osteopontin can act as an effector for a germline mutation of BRCA1 in malignant transformation of breast cancer-related cells, *Cancer Sci*, 101(6), p1354-60.

EMMERT-STREIB, F. (2010) Exploratory analysis of spatiotemporal patterns of cellular automata by clustering compressibility, *Phys Rev E Stat Nonlin Soft Matter Phys*, 81(2 Pt 2):026103. Epub 2010 Feb 8.

EMMERT-STREIB, F. (2010) Statistic complexity: combining kolmogorov complexity with an ensemble approach, *PLoS ONE*, 5(8):e12256.

EMMERT-STREIB, F. and ALTAY, G. (2010) Local network-based measures to assess the inferability of different regulatory networks, *IET Syst Biol*, 4(4), p277-88.

EMMERT-STREIB, F. and DEHMER, M. (2010) Influence of the time scale on the construction of financial networks, *PLoS ONE*, 5(9). pii:e12884.

EMMERT-STREIB, F. and DEHMER, M. (2011) Networks for systems biology: conceptual connection of data and function, *IET Syst Biol*, 5(3), p185.

EMMERT-STREIB, F. and GLAZKO, G.V. (2011) Network biology: a direct approach to study biological function, *Wiley Interdiscip Rev Syst Biol Med*, 3(4), p379-91, doi: 10.1002/wsbm.134. Epub 2010 Dec 31.

EMMERT-STREIB, F. and GLAZKO, G.V. (2011) Pathway analysis of expression data: deciphering functional building blocks of complex diseases, *PLoS Comput Biol*, 7(5):e1002053. Epub 2011 May 26.

FORMENTI, F., BEER, P.A., CROFT, Q.P., DORRINGTON, K.L., GALE, D.P., LAPPIN, T.R., LUCAS, G.S., MAHER, E.R., MAXWELL, P.H., McMULLIN, M.F., O'CONNER, D.F., PERCY, M.J., PUGH, C.W., RADCLIFFE, P.J., SMITH, T.G., TALBOT, N.P. and ROBBINS, P.A. (2011) Cardiovascular function in two human disorders of the hypoxia-inducible factor (HIF) pathway: von Hippel-Lindau disease and HIF-2{alpha} gain-of-function mutation, *FASEB J*, (epub).

FORMENTI, F., CONSTANTIN-TEODOSIU, D., EMMANUEL, Y., CHEESEMAN, J., DORRINGTON, K.L., EDWARDS, L.M., HUMPREYS, S.M., LAPPIN, T.R., McMULLIN, M.F., McNAMARA, C.J., MILLS, W., MURPHY, J.A., O'CONNER, D.F., PERCY, M.J., RATCLIFFE, P.J., SMITH, T.G., TREACY, M., FRAYN, K.N., GREENHAFF, P.L., KARPE, F., CLARKE, K. and ROBBINS, P.A. (2010) Regulation of human metabolism by hypoxia-inducible factor, *Proceeding of the National Academy of Science (USA)*, 107(28), p12722-7.

GALE, R.P., BAROSI, G., BARBUI, T., CERVANTES, F., DOHNER, K., DUPRIEZ, B., GUPTA, V., HARRISON, C., HOFFMAN, R., KILADJIAN, J-J., MESA, R., McMULLIN, M.F., PASSAMONTI, F., RIBRAG, V., ROBOZ, G., SAGLIO, G., VANNUCCHI, A. and VERSTIVEK, S. (2011) What are RBC-transfusion-dependence and –independence? *Leukemia Research*, 35, p8-11.

GUSTAFSSON, A.J., MURARO, L., DAHLBERG, C., MIGAUD, M.E., CHEVALLIER, O.P., KHANH, H.N., KRISHNAN, K., LI, X. and ISLAM, B. (2011) ADP ribose is an endogenous ligand for the purinergic P2Y1 receptor, *Molecular and Cellular Endocrinology*, 333, p8-19.

HAFERLACH, T., KOHLMANN, A., WIECZOREK, L., BASSO, G., KRONNIE, G.T., BÉNÉ, M.C., DE VOS, J., HERNÁNDEZ, J.M., HOFMANN, W.K., MILLS, K.I., GILKES, A., CHIARETTI, S., SHURTLEFF, S.A., KIPPS, T.J., RASSENTI, L.Z., YEOH, A.E., PAPENHAUSEN, P.R., LIU, W.M., WILLIAMS, P.M. and FOÀ, R. (2010) The Clinical Utility of Microarray-Based Gene Expression Profiling in the Diagnosis and Subclassification of Leukemia: Report on 3248 Cases from the International MILE Study Group, *J.Clin.Oncology*, 28, p2529-2537.

HAIDER, S.M., AUTIERO, I. and NEIDLE, S. (2011) Surface area accessibility and the preferred topology of telomeric DNA quadruplex-ligand complexes, *Biochimie*, 93, p1275-79.

HAIDER, S.M., JOSEPH, C.G., NEIDLE, S., FIERKE, C.A. and FUCHTER, M.J. (2011) On the function of the internal cavity of histone deacetylase protein 8: R37 is a crucial residue for catalysis, *Bioorganic & Medicinal Chemistry Letters*, 21(7), p2129-32.

HAIDER, S.M., NEIDLE, S. and PARKINSON, G.N. (2011) A structural analysis of G-quadruplex/ligand interactions, *Biochimie*, 93, p1239-51.

HARDACRE, C., HUANG, H., JAMES, S.L., MIGAUD, M.E., NORMAN, S. and PITNER, W.R. (2011) Overcoming hydrolytic sensitivity and low solubility of phosphitylation reagents by combining ionic liquids with mechanochemistry, *Chemical Communications* (Cambridge, England), 47, p5846-5848.

HARRISON, C.N., BAREFORD, D., BUTT, N., CAMPBELL, P., CONNEALLY, E., DRUMMOND, M., ERBER, W., EVERINGTON, T., GREEN, A.R., HALL, G.W., HUNT, B.J., LUDLAM, C.A., MURRIN, R., NELSON-PIERCY, C., RADIA, D.H., REILLY, J.T., VAN DER WALT, J., WILKINS, B. and McMULLIN, M.F. (2010) Guideline for investigation and management of adults and children presenting with a thrombocytosis, *British Journal for Haematology,* 149, p352-375.

HE, M., ZHAO, M., SHEN, B., PRISE, K.M. and SHAO, C.L. (2011) Radiation-induced intercellular signalling mediated by cytochrome-c via a p53-dependent pathway in hepatoma cells, *Oncogene*, PMID:21132005 (In press).

HIGGINS, C.A., BELL, T., DELBEDERI, Z., FEUTREN-BURTON, S., MCCLEAN, B., O'DOWD, C., WATTERS, W., ARMSTRONG, P., WAUGH, D. and VAN DEN BERG, H. (2010) Growth Inhibitory Activity of Extracted Material and Isolated Compounds from the fruits of Kigelia pinnata, *Planta Med,* doi: 10.1055/s-0030-1250046.

ITO, K., CHUANG, L.S., ITO, T., CHANG, T.L., FUKAMACHI, H., SALTO-TELLEZ, M. and ITO, Y. (2011) Loss of Runx3 is a key event in inducing precancerous state of the stomach. *Gastroenterology*, 140(5), p1536-46.e8. Epub 2011 Jan 27.

JAIN, S., COULTER, J.A., HOUNSELL, A., BUTTERWORTH, K.T., CURRELL, F.J., McMAHON, J., HYLAND, W., MUIR, M.F., DICKSON, G.R., PRISE, K., O'SULLIVAN, J. and HIRST, D.G. (2011) Cell specific radiosensitization by gold nanoparticles at megavoltage radiation energies, *International Journal of Radiation Oncology, Biology and Physics*, 79(2), p531-9.

JAIN, S., HARRISON, C., McMULLIN, M.F. and HOUSTON, R.F. (2010) Tumour lysis syndrome after splenic irradiation in a patient with JAK2 V617F post-polycythaemia vera myelofibrosis, *Clinical Oncology*, 22(10), p893.

JEGANATHAN, R., MCGUIGAN, J., CAMPBELL, F.C. and LYNCH, T. (2011) Does pre-operative estimation of oesophageal tumour metabolic length using 18F-fluorodeoxyglucose PET/CT images compare with surgical pathology length? *Eur J Nucl Med Mol Imaging*, 38, p656-662.

JOHNSTON, P.G. and PINEDO, H.M. (2011) The high tide of cancer research in Europe, *Oncologist*, 16(5), p539-42.

JOHNSTON, L., WOOLSEY, S., CUNNINGHAM, R.M., O'KANE, H., DUGGAN, B., KEANE, P. and McCLOSKEY, K.D. (2010) Morphological expression of KIT positive interstitial cells of Cajal in human bladder, *J Urol*, 184(1) p370-7.

JONES, A.V., CAMPBELL, P.J., BEER, P.A., SCHNITTGER, S., VANNUCCHI, A.M., ZOI, K., PERCY, M.J., McMULLIN, M.F., SCOTT, L.M., TAPPER, W., SILVER, R.T., OSCIER, D., HARRISON, C.N., GRALLERT, H., KISIALIOU, A., STRIKE, P., CHASE, A.J., GREEN, A.R. and CROSS, N.C. (2010) The JAK2 46/1 haplotype predisposes to MPL mutated myeloproliferative neoplasms, *Blood*, 115(22), p4517-4523.

KADHIM, M.A., LEE, R., MOORE, S.R., MACDONALD, D.A., CHAPMAN, K.L., PATEL, G. and PRISE, K.M. (2010) Genomic instability after targeted irradiation of human lymphocytes: Evidence for inter-individual differences under bystander conditions, *Mutation Research*, 688, p91-94.

KAVANAGH, J.N., CURRELL, F.J., TIMSON, D.J., HOLZSCHEITER, M.H., BASSLER, N., HERRMAN, N.R., PRISE, K.M. and SCHETTINO, G. (2010) Experimental set up and first measurement of DNA damage induced along and around an antiproton beam, *European Journal of Physics D*, 60(1), p209-214.

KOO, V., EL MEKABATY, A., HAMILTON, P., MAXWELL, P., SHARAF, O., DIAMOND, J., WATSON, J. and WILLIAMSON, K. (2010) Novel in vitro assays for the characterization of EMT in tumourigenesis, *Cell Oncology*, 32(1-2), p67-76.

KOO, V., LEE, A., SHARAF ELDIN, O., WATSON, C., HAMILTON, P. and WILLIAMSON, K. (2010) pcDNA3.1tdTomato is superior to pDsRed2-N1 for optical fluorescence imaging in the F344/AY-27 rat model of bladder cancer, *Molecular Imaging and Biology*, 12(5), p509-519.

KYULA, J.N., VAN SCHAEYBROECK, S., DOHERTY, J., FENNING, C.S., LONGLEY, D.B. and JOHNSTON, P.G. (2010) Chemotherapy-induced activation of ADAM-17: a novel mechanism of drug resistance in colorectal cancer, *Clinical Cancer Research*, 16, p3378-89.

LAPPIN, T. (2010) Dual control: the HIF-2 regulator, *Blood*, 116(16), p2870-2871.

LEBERT-GHALI, C.E., FOURNIER, M., DICKSON, G.J., THOMPSON, A., SAUVAGEAU, G. and BIJL, J.J. (2010) HoxA cluster is haploinsufficient for activity of hematopoietic stem and progenitor cells, *Experimental Hematology,* 38(11), p1074-1086.

LEE, C.H., SPENCE, R.A.J., UPADHYAYA, M. and MORRISON, P.J. (2011) Familial Multiple Lipomatosis with clear autosomal dominant inheritance and onset in early adolescence, *BMJ Case Reports*, 10.1136/bcr.10.2010.3395.

LINDSAY, J., McDADE, S.S., PICKARD, A., McCLOSKEY, K.D. and McCANCE, D.J. (2011) Role of DeltaNp63gamma in epithelial to mesenchymal transition, *Journal of Biological Chemistry*, 286(5), p3915-24.

LOGAN, A.E., WILSON, T.R., FENNING, C., CUMMINS, R., KAY, E., JOHNSTON, P.G. and LONGLEY, D.B. (2010) In vitro and in vivo characterisation of a novel c-FLIP-targeted antisense phosphorothioate oligonucleotide, *Apoptosis*, 15, p1435-43.

LU, G.D., LEUNG, C.H., YAN, B., TAN, C.M., LOW, S.Y., AUNG, M.O., SALTO-TELLEZ, M., LIM, S.G. and HOOI, S.C. (2010) C/EBPalpha is up-regulated in a subset of hepatocellular carcinomas and plays a role in cell growth and proliferation. *Gastroenterology*. 139(2), p632-43, 643.e1-4. Epub 2010 Mar 27.

MacDONALD, S.J.F., MIDTKANDAL, R.R. and MIGAUD, M.E. (2010) A stereocontrolled method for the synthesis of D- and L-2-deoxy-C-nucleosides using an intramolecular Sakurai-type cyclisation reaction, *Chemical Communications*, 46, p4538-4540.

McART, D.G. and ZHANG, S. (2011) Identification of Candidate Small-Molecule Therapeutics to Cancer by Gene-Signature Perturbation in Connectivity Mapping, *PLoS ONE*, 6(1), e16382, doi: 10.1371/journal.pone.0016382.

McCAIG, C., POTTER, L., ABRAMCZYK, O. and MURRAY, J.T. (2011) Phosphorylation of NDRG1 is temporally and spatially controlled during the cell cycle, *Biochemical and Biophysical Research Communications* (In press).

McCLOSKEY, K.D. (2011) Interstitial cells of Cajal in the urinary tract, *Handb Exp Pharmacol*, 202, p233-54.

McCLOSKEY, S. and McMULLIN, M.F. (2010) Snippets in Haematology, *Journal of Clinical Pathology*, 63(1), p93-96.

McCLOSKEY, S. and McMULLIN, M.F. (2010) Snippets in Haematology, *Journal of Clinical Pathology*, 63(5), p465-468.

McCOY, F., HURWITZ, J., McTAVISH, N., PAUL, I., BARNES, C., O'HAGAN, B., ODRZYWOL, K., MURRAY, J., LONGLEY, D., McKERR, G. and FENNELL, D.A. (2010) Obatoclax induces Atg7-dependent autophagy independent of beclin-1 and BAX/BAK, *Cell Death Disease*, 1:e108.

McDADE, S.S., PATEL, D. and McCANCE, D.J. (2011) p63 maintains keratinocyte proliferative capacity through regulation of Skp2-p130 levels, *J Cell Sci*, 124(10), p3718-3726.

McGARRY, C.K., CHINNECK, C.D., O'TOOLE, M.M., O'SULLIVAN, J., PRISE, K.M. and HOUNSELL, A.R. (2011) Assessing software upgrades, plan properties and patient geometry using Intensity Modulated Radiation Therapy (IMRT) complexity metrics, *Medical Physics* (In press).

McGARRY, C.K., BUTTERWORTH, K.T., TRAINOR, C., O'SULLIVAN, J., PRISE, K.M. and HOUNSELL, A.R. (2011) Temporal characterisation and in-vitro comparison of cell survival following delivery of 3D-Conformal, Intensity Modulated Radiation Therapy (IMRT) and Volume Modulated Arc Therapy (VMAT), *Physics in Medicine and Biology* (In press).

McKENNA, D.J., McDADE, S., PATEL, D. and McCANCE, D.J. (2010) MicroRNA 203 expression in keratinocytes is dependent on regulation of p53 levels by E6, *J Virol*, 84, p10644-52.

McLORNAN, D.P., BARRETT, H.L., CUMMINS, R., McDERMOTT, U., McDOWELL, C., CONLON, S.J., COYLE, V.M., VAN SCHAEYBROECK, S., WILSON, R., KAY, E.W., LONGLEY, D.B. and JOHNSTON, P.G. (2010) Prognostic significance of TRAIL signalling molecules in stage II and III colorectal cancer, *Clinical Cancer Research*, 16, p3442-51.

McMAHON, M., AYLLON, V., PANOV, K.I. and O'CONNOR, R. (2010) Ribosomal 18S RNA processing by the IGF-I-responsive WDR3 protein is integrated with p53 function in cancer cell proliferation, *The Journal of Biological Chemistry*, 285(24), p18309-18318.

McMAHON, S.J., HYLAND, W.B., MUIR, M.F., COULTER, J.A., JAIN, S., BUTTERWORTH, K.T., SCHETTINO, G., DICKSON, G.R., HOUNSELL, A.R., O'SULLIVAN, J.M., PRISE, K.M., HIRST, D.G. and CURRELL, F.J. (2011) Biological consequences of nanoscale energy deposition near irradiated heavy atom nanoparticles, *Scientific Reports (Nature Publishing)* (In press).

McMULLIN, M.F. (2010) Congenital erythrocytosis, *Haematologica* (ed.esp) 95, p429-431.

McMULLIN, M.F. (2010) Diagnosis and treatment of erythrocytosis, *European Haematology*, 4, p55-58.

McMULLIN, M.F. (2010) HIF pathway mutations and erythrocytosis, *Expert Reviews Hematology*, 3(1), p93-101.

MEHELLOU, Y., VALENTE, R., MOTTRAM, H., WALSBY, E.J., MILLS, K.I., BALZARINI, J. and McGUIGAN, C. (2010) Phosphoramidates of 2'-[beta]-d-arabinouridine (AraU) as phosphate prodrugs; design, synthesis, in vitro activity and metabolism, *Bioorganic & Medicinal Chemistry*, 18(7), p2439-2446.

MOLE, D.J., O'NEILL, C., HAMILTON, P., OLABI, B., ROBINSON, V., WILLIAMS, L., DIAMOND, T., EL-TANANI, M. and CAMPBELL, F.C. (2011) Expression of osteopontin coregulators in primary colorectal cancer and associated liver metastases, *British Journal of Cancer*, 104(6), p1007-12.

MORRISON, P.J. (2010) The iris – a window into the genetics of common and rare eye diseases, *Ulster Med J*, 79, p3-5.

MORRISON, P.J. et AL; (2011) on behalf of Consortium of Investigators of Modifiers of BRCA1/2, Common Genetic Variation at 9p22.2 is associated with ovarian cancer risk for BRCA1 and BRCA2 carriers, *J Natl Cancer Inst*, 103(1), p1–12.

MORRISON, P.J., DONNELLY, D.E., ATKINSON, A.B. and MAXWELL, A.P. (2010) Advances in the Genetics of Familial Renal Cancer, *The Oncologist*, 15(6), p532-8.

NESBIT, M.A., HANNAN, F.M., GRAHAM, U., WHYTE, M., MORRISON, P.J., HUNTER, S.J. and THAKKER, R.V. (2010) Identification of a Kindred from Northern Ireland with Familial Hypocalciuric Hypercalcaemia Type 3 (FHH3), which maps to Chromosome 19q13.3, *J Clin Endocrinol Metab*, 95(4), p1947-54.

OLADIPO, O., CONLON, S., O'GRADY, A., PURCELL, C., WILSON, C., MAXWELL, P.J., JOHNSTON, P.J., STEVENSON, M., KAY, E.W., WILSON, R.H. and WAUGH, D.J. (2011) The expression and prognostic impact of CXC-chemokines in stage II and III colorectal cancer epithelial and stromal tissue, *British Journal of Cancer*, 104(3), p480-487.

OLMOS, D., BARKER, D., SHARMA, R., BRUNETTO, A.T., YAP, T.A., TAEGTMEYER, A., ALLRED, A.J., SMITH, D.A., MURRAY, S.A., LAMPKIN, T.A., DAR, M.M., WILSON, R.H., DE BONO, J.S. and BLAGDEN, S.P. (2011) Phase I study of GSK461364, a specific and competitive Polo-like Kinase 1 (PLK1) inhibitor in patients with advanced solid malignancies, *Clinical Cancer Research*, 17(10), p3420-3430.

ONG, C.W., KIM, L.G., KONG, H.H., LOW, L.Y., WANG, T.T., SUPRIYA, S., KATHIRESAN, M., SOONG, R. and SALTO-TELLEZ, M. (2010) Computer-assisted pathological immunohistochemistry scoring is more time-effective than conventional scoring, but provides no analytical advantage. *Histopathology*, 56(4), p523-9.

PACEY, S.C., WILSON, R.H., WALTON, M., EATOCK, M.M., HARDCASTLE, A., ZETTERLUND, H., ARKENAU, H-T., BEECHAM, R., AHERNE, W., DE BONO, J.S., RAYNAUD, F., WORKMAN, P. and JUDSON, I. (2011) A phase I study of the Heat Shock Protein 90 inhibitor alvespimycin (17-DMAG) given intravenously to patients with advanced, solid tumours, *Clinical Cancer Research*, 17(6), p1561-70.

PARIKH, H. et AL. (2011) Fine mapping the KLK3 locus on chromosome 19q13.33 associated with prostate cancer susceptibility and PSA levels, *Human Genetics*, 129(6), p675-685.

PASSAMONTI, F., ELENA, C., SCHNITTGER, S., SKODA, R.C., GREEN, A.R., GIRODON, F., KILADJIAN, J-J., MCMULLIN, M.F., RUGGERI, M., BESSES, C., VANNUCCHI, A.M., LIPPERT, E., GISSLINGER, H., RUMI, E., LEHMANN, T., ORTMANN, C.A., PIETRA, D., PASCUTTO, C., HAFERLACH, T. and CAZZOLA, M. (2011) Molecular and clinical features of the myeloproliferative neoplasm associated with JAK2 exon 12 mutations, *Blood*, 117(10), p2813-6.

PATEL, D. and McCANCE, D.J. (2010) Compromised Spindle Assembly Checkpoint due to Altered Expression of Ubch10 and Cdc20 in Human Papillomavirus Type 16 E6 and E7-Expressing Keratinocytes, *J Virology*, 84, p10956-10964.

PAUL, I., SAVAGE, K.L., BLAYNEY, J.K., LAMERS, E., GATELY, K., KERR, K., SHEAFF, M., ARTHUR, K., RICHARD, D.J., HAMILTON, P.W., JAMES, J.A., O'BYRNE, K.J., HARKIN, P., QUINN, J.E. and FENNELL, D.A. (2011) PARP inhibition induces BAX/BAK-independent synthetic lethality of BRCA1-deficient non-small cell lung cancer, *Journal of Pathology*, 224, dio:10.1002/path.2925.

PETRACCONE, L., FOTTICCHIA, I., CUMMARO, A., PAGANO, B., GINNARI-SATRIANI, L., HAIDER, S.M., RANDAZZO, A., NOVELLINO, E., NEIDLE, S. and GIANCOLA, C. (2011) The triazatruxene derivative azatrux binds to the parallel form of the human telomeric G-quadruplex under molecular crowding conditions: Biophysical and molecular modeling studies, *Biochimie*, 93, p1318-1327.

PICKARD, A., WONG, P.P. and McCANCE, D.J. (2010) Acetylation of Rb by P/CAF is required for nuclear localization and keratinocyte differentiation, *J Cell Sci*, 123, p3718-3726.

PLUMMER, R., WILSON, R.H., CALVERT, H., BODDY, A.V., GRIFFIN, M., SLUDDEN, J., TILBY, M.J., EATOCK, M., PEARSON, D.G., OTTLEY, C.J., MATSUMURA, Y., KATAOKA, K. and NISHIYA, T. (2011) A Phase I Clinical Study of Cisplatin-Incorporated Polymeric Micelles (NC-6004) in Patients with Solid Tumors, *British Journal of Cancer*, 104(4), p593- 598.

PRISE, K.M. (2010) Radiation-induced bystander responses: Potential role in cancer therapies, In *"Molecular Mechanisms of Neoplastic Transformation"* (El-Tanani, M.K., Ed) ISBN 978-81-7895-445-5.

PRISE, K.M. and SCHETTINO, G. (2011) Microbeams in radiation biology: Review and critical comparison, *Radiation Protection Dosimetry* (In press).

REA, G., McCULLOUGH, S., McNERLAN, S., CRAIG, B. and MORRISON, P.J. (2010) Delineation of a recognisable phenotype of interstitial deletion 3(q23q25.1) in a case with previously unreported truncus arteriosus, *Eur J Med Genet*, 53, p162-7.

REDMOND, K.L., CRAWFORD, N.T., FARMER, H., D'COSTA, Z.C., O'BRIEN, G.J., BUCKLEY, N.E., KENNEDY, R.D., JOHNSTON, P.G., HARKIN, D.P. and MULLAN, P.B. (2010) T-box 2 represses NDRG1 through an EGR1-dependent mechanism to drive the proliferation of breast cancer cells, *Oncogene*, 2010 Mar 29 [Epub ahead of print].

RICHARD, D.J., SAVAGE, K., BOLDERSON, E., CUBEDDU, L., SO, S., GHITA, M., CHEN, D., WHITE, M.F., PRISE, K.M., SCHETTINO, G. and KHANNA, K.K. (2011) hSSB1 rapidly binds at the sites of DNA double strand breaks and is required for the efficient recruitment of the MRN complex, *Nucleic Acid Research* (In press).

RICKETTS, C.J., FORMAN, J.R., RATTENBURY, E., BRADSHAW, N., LALLOO, F., IZATT, L., COLE, T.R., ARMSTRONG, R., AJITH KUMAR, V.K., MORRISON, P.J., ATKINSON, A.B., DOUGLAS, F., BALL, S.G., COOK, J., SRIRANGALINGAM, U., KILLICK, P., KIRBY, G., AYLWIN, S., WOODWARD, E.R., EVANS, D.G., HODGSON, S.V., MURDAY, V., CHEW, S.L., CONNELL, J.M., BLUNDELL, T.L., MacDONALD, F. and MAHER, E.R. (2010) Tumour Risks and Genotype-Phenotype-Proteotype Analysis in 358 Patients with Germline Mutations in SDHB and SDHD, *Hum Mutat*, 31(1), p41-51.

SAHOO, S. and ALBRECHT, A.A. (2010) Ranking of microRNA target prediction scores by Pareto front analysis, *Computational Biology and Chemistry,* 34, p284-92.

SALOMAA, S.I., WRIGHT, E.G., HILDEBRANDT, G., KADHIM, M.A., LITTLE, M.P., PRISE, K.M. and BELYAKOV, O.V. (2010) Editorial Non-DNA targeted Effects, *Mutation Research*, 201, p1-2.

SCHETTINO, G., GHITA, M. and PRISE, K.M. (2010) Spatio-temporal analysis of DNA damage repair using the X-ray microbeam, *European Physical Journal D*, 60, p157-161.

SCHETTINO, G. and PRISE, K.M. (2010) Application of microbeams to the study of the biological effects of low dose irradiation, In *Charged Particle and Photon Interactions with Matter-Recent Advances, Applications, and Interfaces* (eds., Y. Hatano, Y. Katsumura, and A. Mozumder) Taylor & Francis, Boca Raton.

SCHETTINO, G., GHITA, M., RICHARD, D.J. and PRISE, K.M. (2011) Spatio-temporal investigations of DNA damage repair using microbeams, *Radiation Protection Dosimetry* (In press).

SHAO, C., ZHANG, J. and PRISE, K.M. (2010) Differential modulation of a radiation-induced bystander effect in glioblastoma cells by pifithrin-alpha and wortmannin, *Nuclear Instruments and Methods in Physics Research B*, 268, p627-631.

SHI, Z., HODGES, V.M., DUNLOP, E.A., PERCY, M.J., MAXWELL, A.P., EL-TANANI, M. and LAPPIN, T.R. (2010) Erythropoietin-induced activation of the JAK2/STAT5, PI3K/Akt, and Ras/ERK pathways promotes malignant cell behaviour in a modified breast cancer cell line, *Mol Cancer Res*, (8)4, p615-26.

STEAD, M., CAMERON, D., LESTER, N., PARMAR, M., HAWARD, R., KAPLAN, R., MAUGHAN, T., WILSON, R., CAMPBELL, H., HAMILTON, R., STEWART, D., O'TOOLE, L., KERR, D., POTTS, V., MOSER, R., DARBYSHIRE, J. and SELBY, P. (2011) Strengthening Clinical Cancer Research in the United Kingdom, *British Journal of Cancer*, 104(10), p1529-1534.

STEVENSON, L., ALLEN, W.L., PROUTSKI, I., STEWART, G., JOHNSTON, L., McCLOSKEY, K., WILSON, P.M., LONGLEY, D.B. and JOHNSTON, P.G. (2011) Calbindin 2 (CALB2) Regulates 5-Fluorouracil Sensitivity in Colorectal Cancer by Modulating the Intrinsic Apoptotic Pathway, *PLoS ONE*, 6:e20276.

STEVENSON, R., FATEHULLAH, A., JAGAN, I., DEEVI, R.K., BINGHAM, V., IRVINE, A.E., MORRISON, P.J., DIMMICK, I., STEWART, R. and CAMPBELL, F.C. (2011) Enhanced lymphocyte interferon (IFN)-gamma responses in a PTEN mutation-negative Cowden disease kindred, *Clin Exp to Immuno*l, 164, p202-210.

THEILGAARD-MÖNCH, K., BOULTWOOD, J., FERRARI, S., GIANNOPOULOS, K., HERNANDEZ-RIVAS, J., KOHLMANN, A., MORGAN, M., PORSE, B., TAGLIAFICO, E., ZWAAN, C.M., WAINSCOAT, J., VAN DEN HEUVEL-EIBRINK, M.M., MILLS, K.I. and BULLINGER, L. (2011) Gene expression profiling in MDS and AML, *Leukemia*, 25, p909-920.

VAN SCHAEYBROECK, S., KYULA, J.N., FENTON, A., FENNING, C.S., SASAZUKI, T., SHIRASAWA, S., LONGLEY, D.B. and JOHNSTON, P.G. (2011) Oncogenic Kras promotes chemotherapy-induced growth factor shedding via ADAM17, *Cancer Research*, 71, p1071-80.

VAN SCHAEYBROECK, S., ALLEN, W.L., TURKINGTON, R.C. and JOHNSTON, P.G. (2011) Implementing prognostic and predictive biomarkers in CRC clinical trials, *Nat Rev Clinical Oncology*, 8(4), p222-32.

WANG, Y., McCLEARY, D., WANG, C.W., KELLY, P., JAMES, J., FENNELL, D.A. and HAMILTON, P. (2010) Ultra-fast processing of gigapixel Tissue MicroArray images using high performance computing, *Analytical Cellular Pathology / Cellular Oncology*, (33)5, 271.

WHEADON, H., RAMSEY, J.M., DOBBIN, E., DICKSON, G.J., CORRIGAN, P.M., FREEBURN, R.W. and THOMPSON, A. (2011) Differential Hox Expression in Murine Embryonic Stem Cell Models of Normal and Malignant Hematopoiesis, *Stem Cells Dev*, [Epub ahead of print].

XU, H., POSNER, G.H., STEVENSON, M. and CAMPBELL, F.C. (2010) Apc(MIN) modulation of vitamin D secosteroid growth control, *Carcinogenesis*, 31, p1434-1441.

YANG, J., PARSONS, J., NICOLAY, N.H., CAPORALI, S., HARRINGTON, C.F., SINGH, R., FINCH, D., D'ATRI, S., FARMER, P.B., JOHNSTON, P.G., McKENNA, W.G., DIANOV, G. and SHARMA, R.A. (2010) Cells deficient in the base excision repair protein, DNA polymerase beta, are hypersensitive to oxaliplatin chemotherapy, *Oncogene*, 29(3), p463-8.

YANG, Z., SHI, Y., WEI, X., HE, J., YANG, S., DICKSON, G.R., TANG, J., XIANG, J. and SONG, C. (2010) Fabrication and repair of cartilage defects with a novel acellular cartilage matrix scaffold, *Tissue Engineering Part C Methods*, Vol 16(5), p865-876.

YUEN, H.F., CHIU, Y.T., CHAN, K.K., CHAN, Y.P., CHUA, C.W., McCRUDDEN, C.M., TANG, K.H., EL-TANANI, M., WONG, Y.C., WANG, X. and CHAN, K.W. (2010) Prostate cancer cells modulate osteoblast mineralisation and osteoclast differentiation through Id-1, *Br J Cancer*, 102(2), p332-41.

YUEN, H.F., CHAN, Y.K., GRILLS, C., McCRUDDEN, C.M., GUNASEKHARAN, V., SHI, Z., WONG, A., LAPPIN, T., CHAN, K.W., FENNELL, D., KHOO, U.S., JOHNSTON, P.G. and EL-TANANI, M. (2011) Polyomavirus enhancer activator 3 protein promotes breast cancer metastatic progression through Snail-induced epithelial – mesenchymal transition, *Journal of Pathology*, 224(1), p78-89.

YUEN, H.F., McCRUDDEN, C.M., CHAN, K.K., CHAN, Y.P., WONG, M.L.Y., CHAN, K.Y.K., KHOO, U.S., LAW, S., SRIVASTAVA, G., LAPPIN, T.R., CHAN, K.W. and EL-TANANI, M. (2011) The role of Pea3-group transcription factors in esophageal squamous cell carcinoma, *Amer J Path* (In press).

ZHANG, S. (2011) Towards Accurate Estimation of the Proportion of True Null Hypotheses in Multiple Testing, *PLoS ONE*, 6(4), e18874. doi:10.1371/journal.pone.0018874.

ACKNOWLEDGEMENTS

We are grateful to everyone who provided information for this Annual Report, everyone who supplied images or gave us permission for their images to be used, and the many members of the CCRCB staff who helped to produce this report.

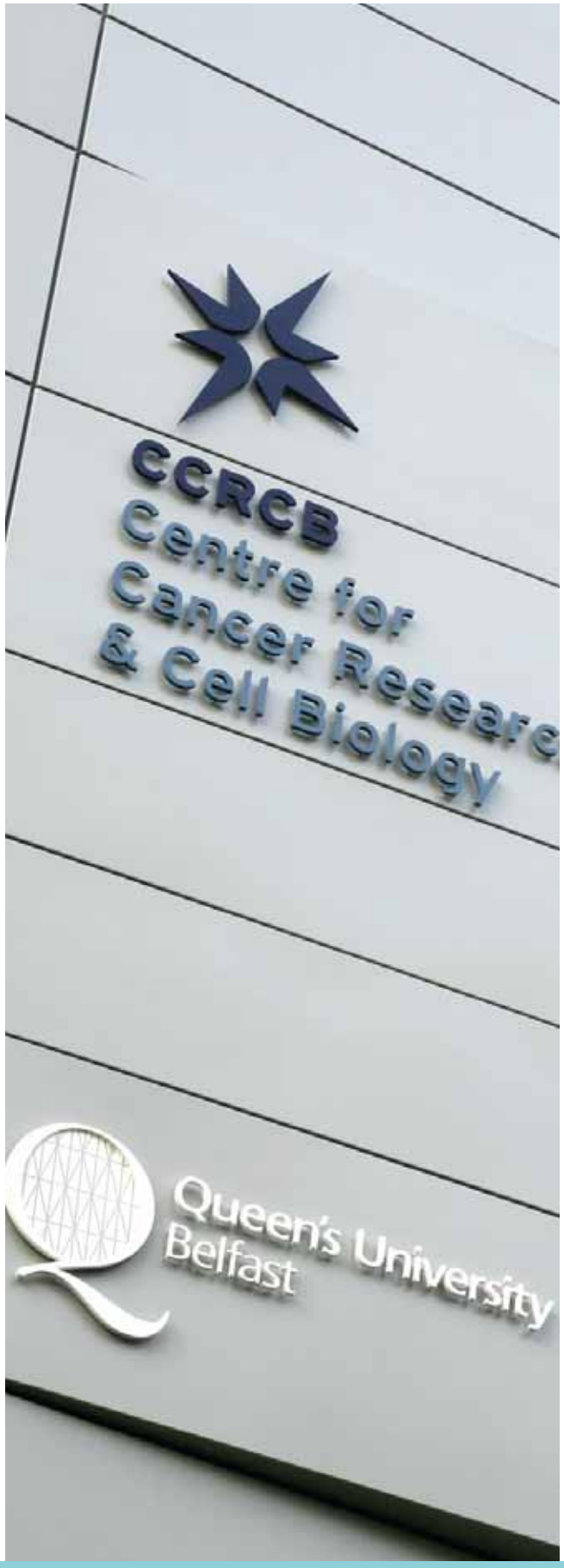
Design:
www.darraghneely.com

Printed by:
Corporate Document Services (CDS)

Comments on the CCRCB Annual Report are welcomed and should be sent to:

Beryl Graham
Centre for Cancer Research and Cell Biology
School of Medicine, Dentistry and Biomedical Sciences
Queen's University Belfast
97 Lisburn Road
Belfast, BT9 7BL

E: ccrcb@qub.ac.uk



Centre for Cancer Research and Cell Biology
School of Medicine, Dentistry and Biomedical Sciences
Queen's University Belfast
97 Lisburn Road
Belfast, BT9 7BL

T: +44 (028) 9097 2760
F: +44 (028) 9097 2776

www.qub.ac.uk/ccrcb