

**MANCHESTER
CANCER
RESEARCH
CENTRE**

Annual Report

2019

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Executive Summary



Welcome

With 2019 now behind us, we can look back on what has been a tremendously successful year for the Manchester Cancer Research Centre as we have continued to expand our research horizons, laying the foundations for us to be a top 5 comprehensive cancer centre by 2025.

Research Strengths

Research has always been a strength in Manchester, and 2019 has been no exception. In addition to securing several key grants that forge the way for novel research, we have welcomed some of the best and brightest through our doors and enjoyed many successes throughout the year.

The highlight for the MCRC would have to be the outstanding conference we held in July. Organised by both the MCRC and Experimental Cancer Medicine Centre, the 'Phase I Conference: Where Science Becomes Medicine' showcased the very best in early phase clinical work in Manchester.

With over 200 delegates attending over the three days, this conference has certainly been successful in showcasing how the basic and discovery science can be translated into real world benefits. With many more events planned throughout the coming year, we hope to continue to see engagement from across our partnership.

Funding Novel Research

Three of the biggest developments of 2019 have been the result of funding injections to help pump prime new research programmes and initiatives in key strategic areas: radiotherapy research, early detection research and training the next generation of cancer leaders, with these three awards bringing in a combined £26m.

Cancer Research UK RadNet Manchester is a £16.5m Radiation Research Unit, in collaboration with The Christie NHS Foundation Trust, that will deliver a world-leading and novel radiotherapy research programme furthering our understanding of radiobiology, immune responses and genomics.

Manchester is also a founding member of the International Alliance for Cancer Early Detection (ACED) and will see our researchers tackle the biggest challenges facing early detection researchers, alongside five international organisations and institutions.

And finally, Manchester has been awarded a Clinical Academic Training grant to develop the next-generation of clinical researchers. We will be developing an integrated PhD programme to provide clinicians with research experience.

Over the next few years, we will continue to see exciting developments in these new initiatives and continue to see new research drive new developments to benefit patients throughout Manchester, the UK and beyond.

Recognised Success

I am also delighted to continue to see our research recognised in high impact publications, via awards and in the media.

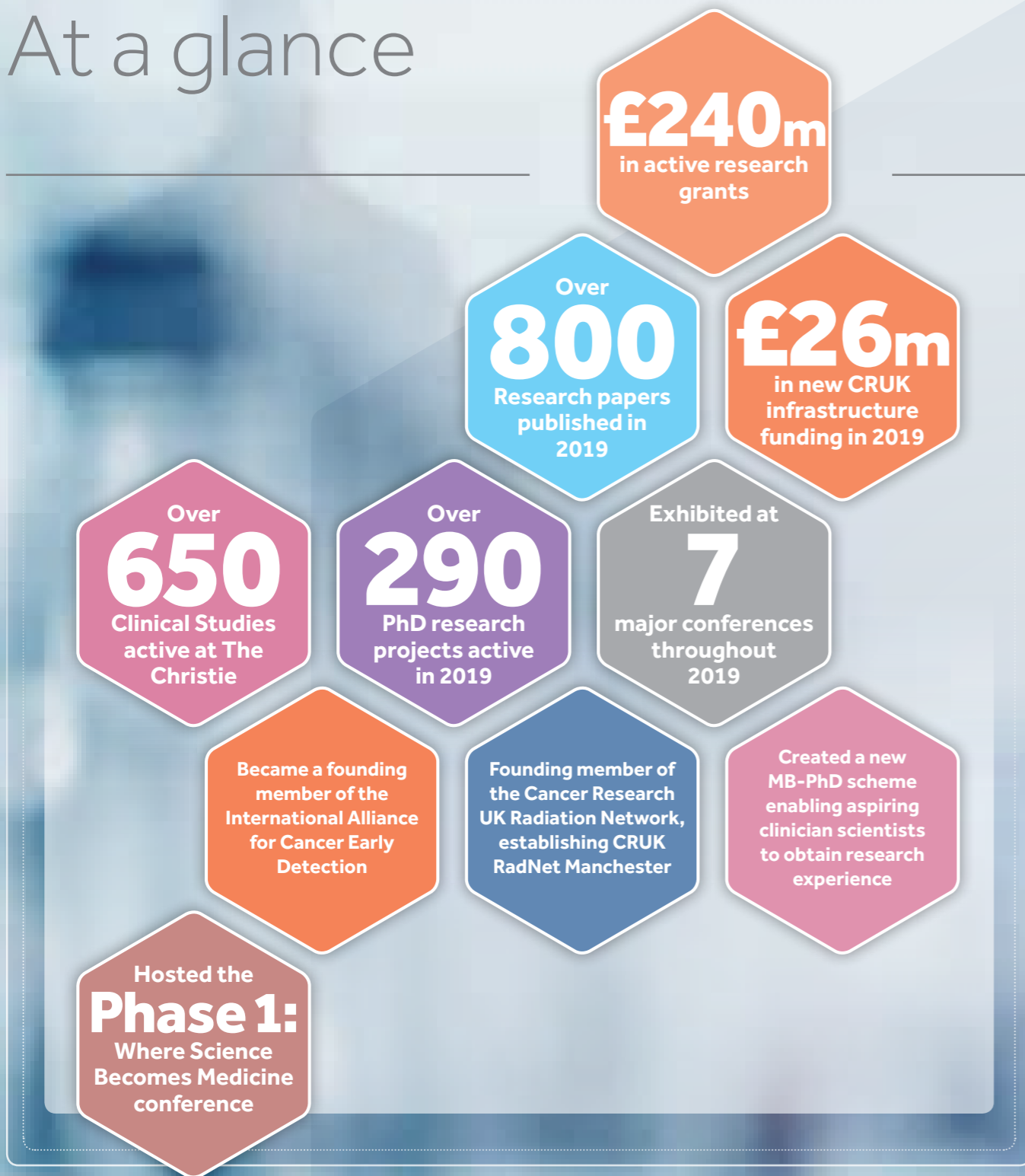
Manchester researchers have also published over 850 research papers this year, with a large number being in high impact publications – demonstrating how our research is both world-leading and practice-influencing. We have also seen stories of our research published in mainstream news articles like the BBC, but also covered in depth in opinion pieces from across the industry.

And finally, we have had great cause for celebrating success with our research teams and researchers winning several awards throughout the year, presenting their research on an international scale and showing their commitment to great science.

I hope you enjoy reading this summary of our 2019 landmarks and I look forward to seeing what exciting science and new discoveries we will make together in 2020.

Professor Robert Bristow,
Director, MCRC
Co-Director, Cancer Research UK
Manchester Centre

At a glance



Team Science and the MCRC

As a partnership between The University of Manchester, Cancer Research UK and The Christie NHS Foundation Trust, the Manchester Cancer Research Centre is home to researchers from various organisations, both academic and healthcare-focused all of whom are working towards the common goal: finding novel treatments for cancer.

The MCRC acts as a resource multiplier, ensuring the collective resources of each partner institution are appropriately distributed to help tackle the greatest challenges in cancer research. By acting as this one single entity, research performed in Manchester has the greatest impact in the Greater Manchester area, the UK and beyond.

It is through successfully delivering key projects that Manchester research has been recognised as 'world-leading' 'practice-influencing' and 'life-changing'. This rich heritage drives us forward to create new innovations in basic and discovery science and translate these successes into the clinic and ultimately benefit patients the world over.

This continuous innovation will help the MCRC achieve its vision of becoming a top 5 global comprehensive cancer centre by 2025.

Building the right team

Realising our vision involves breaking down the research silos that often lead to groups working in isolation. By instead working across institutional boundaries and connecting researchers with different backgrounds, skills and experiences, the MCRC enables teamwork, collaboration and great science to flourish.

We collaborate with NHS trusts and healthcare providers across Greater Manchester to ensure we enable patients to access novel treatments, ensure new screening programmes engage with the right communities, and meet the future priorities of our NHS.

One of the ways we achieve this collaboration is through our Town Hall events, inviting healthcare workers, researchers and patients together in one room to develop a novel, research strategy for a specific site or theme that can only be achieved in Manchester. In 2019, we held the latest in our Town Hall series, this time focused on hepato-pancreato-biliary (HPB) cancer, with the project now in the final stages of development.

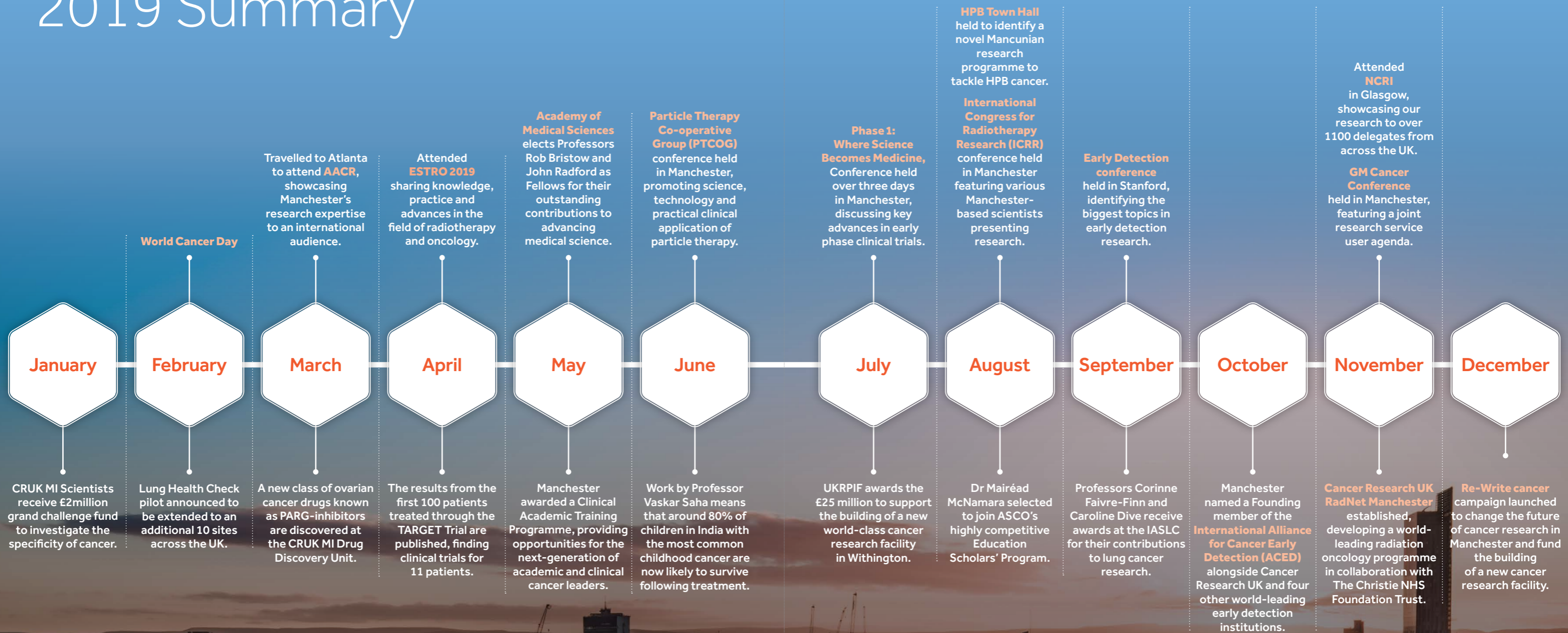


Across the world, Manchester-based researchers lead, influence and collaborate on innovative cancer research with various institutions across multiple different disease sites and research themes.



References available on page 40.

2019 Summary



Driving Translational Research within 'One Manchester':

The Cancer Domain within the Manchester Academic Health Science Centre

As partnerships between leading universities and the NHS, Academic Health Science Centres (AHSCs) help to coordinate research to tackle diseases, develop new treatments and transform patient care. The Cancer Domain of the Manchester AHSC yields the power of the MCRC to translate scientific advances within Manchester directly to the frontline of the NHS to benefit patients.

Collaboration between NHS and Universities

Recently renewed until 2025, the Manchester AHSC brings together The University of Manchester, Manchester University NHS Foundation Trust (MFT), The Christie, Salford Royal NHS Foundation Trust and the Greater Manchester Mental Health NHS Foundation Trust to deliver research and innovation. This partnership represents the union of academic and health and social care partners in city region.

The Manchester AHSC also combines all of the NIHR assets within the Manchester ecosystem, such as the BRC (Biomedical Research Centre) and

our cancer Clinical Research Facilities (CRFs; the Christie NHS Trust and Manchester Foundation Trusts), and is a central driver of digital data mining amongst cancer records in partnership with Health Innovation Manchester.

Research and innovation is delivered through six distinct domains that each represent our areas of strength aligned to the most urgent population needs. Within this domain structure lies the Cancer Domain, with basic and discovery research driven by the MCRC impacting service delivery across the city.

The strength of the Cancer Domain within the AHSC lies in the strong alignment with the NHS Long Term Plan and the close collaboration that exists between the MCRC and Greater Manchester Cancer through the delivery of the Greater Manchester Cancer Plan and the Government's Life Sciences Industrial Strategy in which we drive unique cell and gene therapy trials through our iMATCH program.

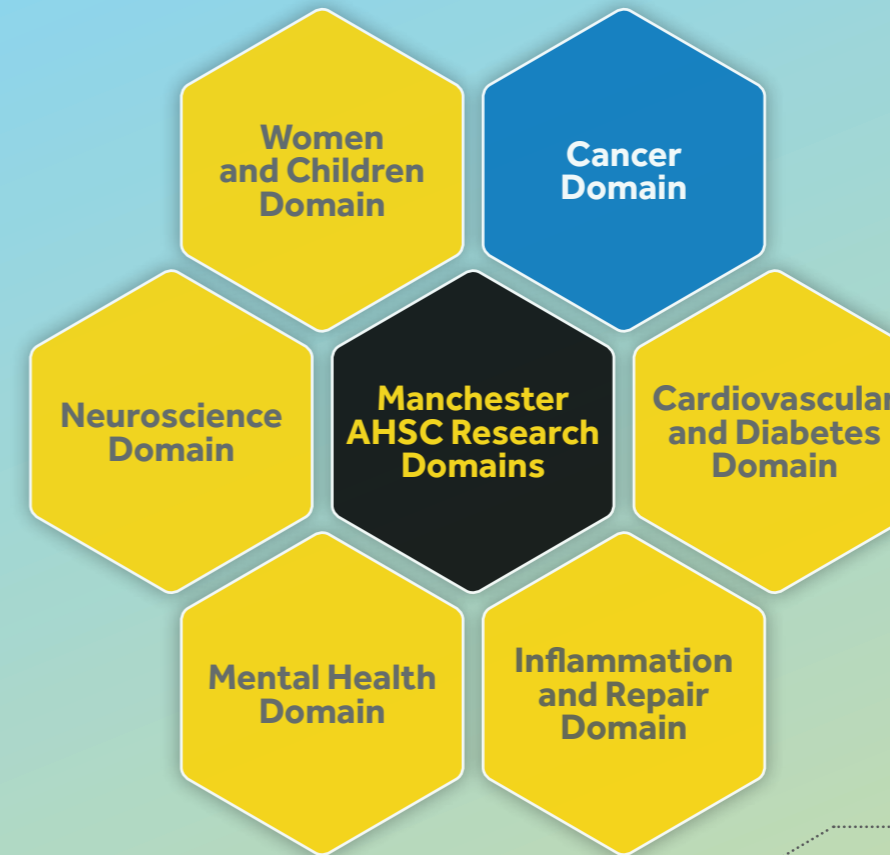
Alignment across Manchester

To demonstrate coordination across Manchester, the AHSC aligns to the grand challenges that have been set up

by the Faculty of Biology, Medicine and Health at The University of Manchester – to discover novel disease mechanisms; to focus on prevention and early detection; and to deliver advanced and next generation therapies.

Meeting each of these goals requires the continued integration of Manchester services, science and innovation. MCRC-driven programmes are key to this successful delivery, with early detection programmes such as the Manchester Lung Health Checks and other early detection trials leading locally and internationally within the International Alliance for Cancer Early Detection (ACED). In addition, the provision for state-of-the-art radiotherapy aligns with our recent CRUK RadNet Manchester Radiation Research Unit providing the UK's first NHS high-energy proton beam treatment centre.

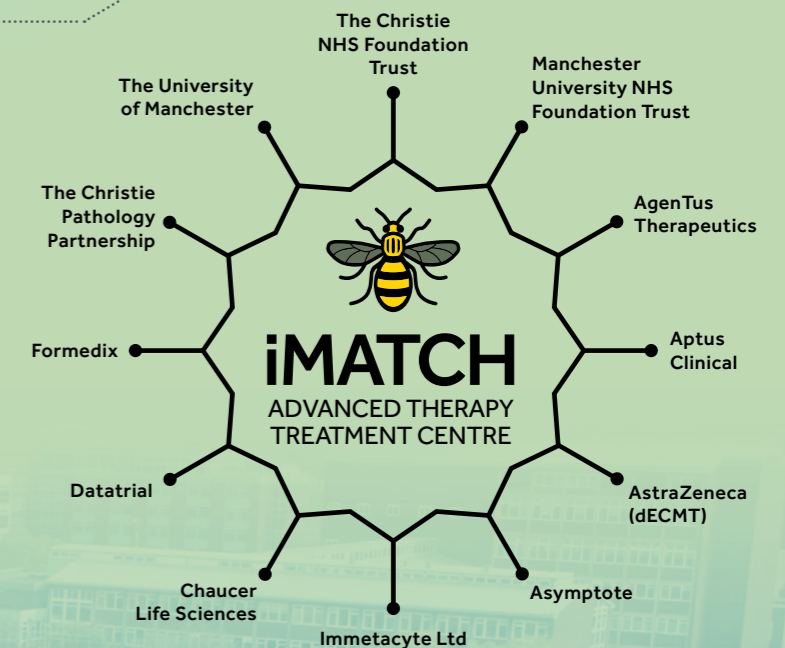
A further example of providing advanced therapies comes through our novel molecular targeted and immunotherapy clinical trials, including CAR-T cell therapy, driven in our NIHR CRFs whereby the best translational research becomes best patient care in the NHS.



iMATCH

iMATCH is a 12 partner, Manchester-based consortium, comprising of two clinical sites (The Christie and Manchester University NHS Foundation Trust), The University of Manchester and nine commercial, life science partners.

Awarded funding by Innovate UK to coordinate scale up of advanced therapies as part of the national Advanced Therapy treatment Centre (ATTC) network, the goal of iMATCH is to transform the conduct of clinical studies in Advanced Therapies to make them as routine to deliver as other clinical studies across the NHS.



The Christie



The Christie is a world leading specialist cancer treatment centre and is the largest single site cancer centre in Europe.

3.2m

Serves the population of 3.2 million people across Greater Manchester and Cheshire while more than a quarter of our patients are referred to us from across the UK.



97,000

Over 97,000 chemotherapy treatments delivered to patients during 2019.

One of nine UK Centres to offer advanced CAR-T therapies.

Mobile chemotherapy unit provides treatment options at locations across Manchester closer to patients' homes.



105,000

Extensive radiotherapy facilities providing over 105,000 treatments during 2019 in fields including: MR-Linac, Proton Beam Therapy, FLASH radiotherapy, SABR, Adaptive Radiotherapy.

The Christie was the first UK member audited and accredited as a Comprehensive Cancer Centre by the Organisation of European Cancer Institutes; meeting quality standards in care, education and research.

1st

The Christie was the first specialist hospital to be ranked **OUTSTANDING** by the Care Quality Commission twice in successive inspections describing the hospital as a 'leader in cancer care'



Top 100

The Christie has been named one of the 100 best specialist hospitals in the world by Newsweek magazine – one of the highest profile publications in the USA, sharing this accolade with a small group of the world's elite specialist hospitals.



The Christie has been named as the most Technologically advanced hospital outside of North America.

The Christie works with national and international industry organisations including: Roche, AstraZeneca, Bristol-Myers Squibb, Novartis, GlaxoSmithKline and Celgene.

We also work with clinical research organisations **Pharmaceutical Product Development (PPD), IQVIA and Paraxel.**



References available on page 40.



Personalised and Powerful: a New Approach to Radiotherapy Research

Recognising our combined heritage and prowess in radiation related research, Manchester has been named as a new centre of excellence for radiotherapy research. Over 100 years after Ernest Rutherford discovered the proton, his teachings are still having a major impact on our research capabilities.

Established as part of a UK-wide network, Manchester has been named as a Radiation Research Unit by Cancer Research UK and has been awarded £16.5 million over the next 5 years to develop a new state of the art radiotherapy oncology programme. This funding will contribute to establishing new research infrastructure and research groups, and pump prime novel projects.

Cancer Research UK RadNet Manchester is the largest of the seven centres of excellence established in CRUK's Radiation Research Network.

In collaboration with The Christie, scientists working within the Cancer Research UK RadNet Manchester will work towards establishing individualised physical and biological targeting using the facilities available within Manchester.

Individualised research programmes

One of the main aims of the Research Unit is to use advanced radiotherapy technologies to personalise radiotherapy treatments in combination with other new discoveries. An example is to work with colleagues at the Cancer Research UK Manchester Institute Cancer Biomarkers Centre to identify new biomarkers that can be used to predict how patients will benefit from having immunotherapy in combination with radiotherapy.

In addition, researchers are looking at how to personalise treatments and provide clinical studies for patients who are elderly or have other non-cancer diseases that typically complicate treatment. This research will aid in understanding how comorbidities and different medications impact the radiation response and side-effects for 'real-world' patients.

Researchers are also looking at the biology of tumours during radiotherapy treatments. By studying the tumour microenvironment and genomics, they can gain an understanding of the mechanisms of mutations and chromosomal instability in hypoxic cells during radiotherapy. This will lead to the ability to identify novel targets for combined trials with precision radiotherapy.

It is hoped that these attempts to personalise radiotherapy and combination treatments will further increase survival rates, reduce side-effects from treatments, and provide patients with novel radiotherapy treatments bespoke to their individual tumour.

£16.5m
over 5 years



CANCER
RESEARCH
UK

RADNET
MANCHESTER

in collaboration with



The Christie
NHS Foundation Trust

one
of
seven
centres of
excellence across
the UK

World-class facilities

Success of CRUK RadNet Manchester will be realised by researchers working collaboratively across a number of sites in Manchester. These include both treatment facilities like the Proton Beam Therapy Centre, 'hubs' which will train and develop the next generation of radiographers and bringing in new areas of expertise to address these key questions, including immunology and data science.

Researchers will have access to the world-class radiotherapy facilities housed in The Christie, which delivers over 100,000 radiation fractions annually to around 8,500 patients. In addition to the Proton Beam Therapy Centre, the first UK high energy proton beam facility and currently the only site to offer proton beam therapy on the NHS, researchers also have access to MR-Linac instruments, which combines an MRI scanner with a radiotherapy machine to deliver real-time information about tumour responses to radiotherapy.

Radiotherapy researchers are also looking to expand capabilities into new advanced radiotherapy technologies such as FLASH radiotherapy, where pulses of high-dose radiotherapy are delivered in a fraction of a second. Researchers are looking into the benefits of using FLASH radiotherapy as an alternative to longer exposure radiotherapy treatments.

Manchester is the only UK site to offer these radiotherapy techniques, and exemplifies the world-leading expertise and facilities available to radiotherapy researchers.



Catching Cancer Earlier: Transforming Cancer Survival

Building on Manchester's heritage in early detection research in gynaecological, breast and lung cancers, Manchester has become a founding member of the International Alliance for Cancer Early Detection, recognising the growing need for impactful early detection research.

An International Effort

As a partnership between Cancer Research UK, Canary Center at Stanford University, the University of Cambridge, OHSU Knight Cancer Institute, UCL, and The University of Manchester, ACED brings together six global heavyweights to tackle some of the biggest challenges in early detection.

Collaboration lies at the heart of this new early detection hub, with partner institutions encouraged to find new and exciting ways of working together - sharing knowledge and expertise. This synergistic approach ensures that the Alliance acts as a force multiplier, ensuring that the whole is better than the sum of its parts, breaking down institutional silos to develop new research initiatives.

In addition, the Alliance also seeks to train the next-generation of cancer researchers, and providing researchers with opportunities to expand their

careers through workshops and conferences, ensuring retention of talent and skills and the growth of career researchers focused on early detection research.

Novel research programmes

The £3.2 million ACED funding award to Manchester has been allocated to three distinct research projects and sees clinicians, scientists, patients and engineers all working together to provide clinical context to cancer, identify new biomarkers, collect new data informatics, and create models to replicate how cancer develops in early stages.

The first research project builds upon the prior success of the 'Scans in Vans' project that ran between 2016-2017 and screened over 2500 people for lung cancer. By developing new testing of CT screening and identifying biomarkers in bloods, new research programmes will be further expanded into various underserved populations in Greater Manchester with the aim of identifying lung cancer sooner.

Identifying breast cancer in young women with high risk of developing the disease is the goal for the second research programme that seeks to identify how to best predict who is most at risk, and how best to reach them.

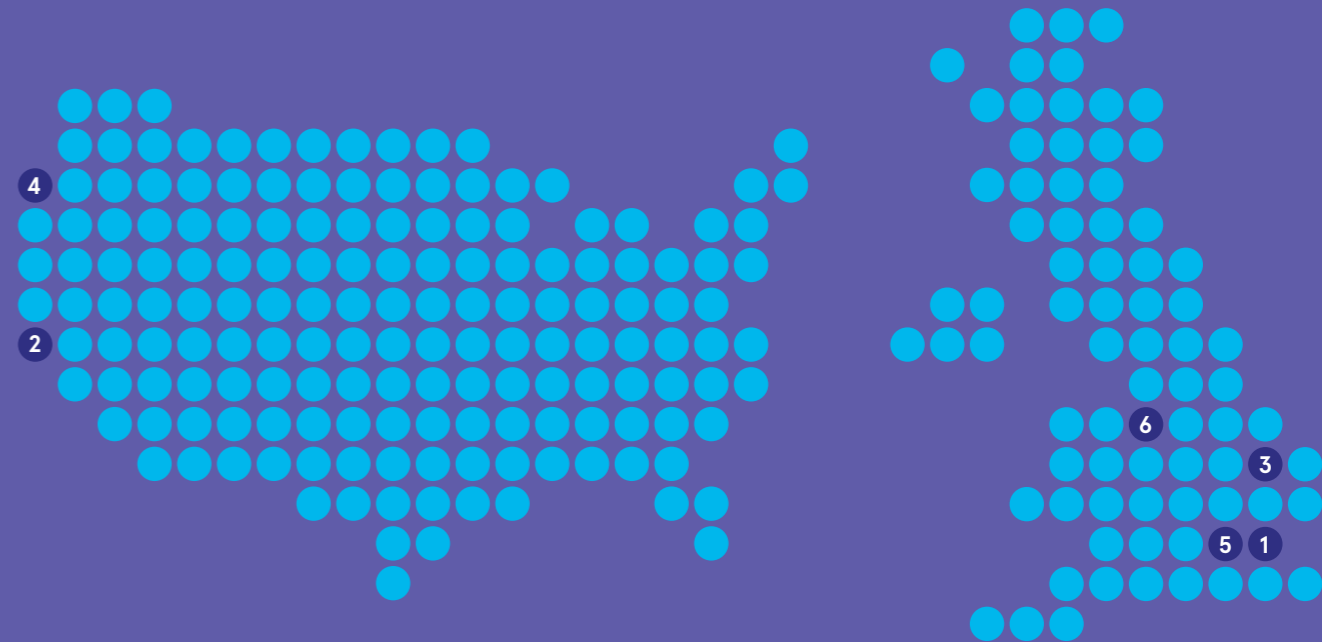
Finally, Manchester researchers are seeking to answer fundamental questions of how cancer develops, and how precancerous tissue develops into early and then late stage cancer. To achieve this, scientists are creating human-derived models that represent at-risk normal tissue in sites such as breast, that can be studied ex vivo to understand how cancer develops.

Researchers will also leverage the world-first NHS early detection testbed within the Greater Manchester Cancer Plan (GM Cancer). This strategic initiative will provide the 3.2 million people within Greater Manchester with unrivalled access to new screening treatments and research opportunities that are developed within the Alliance.

Catalysing all of these research programmes is ACED. Additional funding calls will be open throughout the year to provide researchers with further opportunities to undertake collaborative research with any of the Alliance's partners. It is through working together with patients, clinicians and scientists and embracing our diversity that we can solve some of the critical challenges in early detection research.

£3.2m
over 5 years

One of six international partners



- 1 Cancer Research UK
- 2 Canary Centre at Stanford
- 3 University of Cambridge
- 4 OHSU Knight Cancer Institute
- 5 UCL
- 6 The University of Manchester

ACED
INTERNATIONAL ALLIANCE FOR
CANCER EARLY DETECTION



Developing the Next Generation of Cancer Leaders

Education and training lie at the heart of the Manchester Cancer Research Centre and our vision for developing the next generation of cancer leaders.

In 2019, we were able to make a step change in our clinical training provision as a result of securing CRUK Clinical Academic Training Programme funding.

Alongside nine other centres across the UK, Manchester received £6.5 million in funding over the next five years to develop a clinical academic training (CAT) programme to support the next generation of cancer leaders.

Established by Cancer Research UK in May 2019, the programme aims to develop the clinical leaders of tomorrow by supporting a nationwide network of CRUK centres to offer early career clinician scientists greater flexibility and a wider range of training options while providing highest quality development opportunities.

Developing new training routes

A key development introduced within the CAT programme is the MB-PhD training route, enabling aspiring clinician scientists to undertake the vocational training of a medical degree in tandem with the research aspiration of a PhD.

Within Manchester, four MB-PhDs will be recruited every year. The first cohort of students will intercalate onto an integrated PhD in Cancer Sciences in 2020, which will provide a rigorous and highly competitive training programme for early career researchers to become the next generation of cancer research leaders within Manchester.

Education

The MB-PhD adds another training option to the existing portfolio of opportunities within Manchester for early career development. Across the Greater Manchester partnership, there are almost 300 PhD students actively engaged in laboratory and clinical PhDs through the Cancer Research UK Manchester Institute, Cancer Research UK Manchester Centre, or Division of Cancer Sciences.

These projects are investigating the latest breakthroughs and innovations in basic and discovery cancer research, driving new discoveries from the laboratory into the clinic to provide patients with the greatest benefit.

Over 290 active PhD students across The University of Manchester's Division of Cancer Sciences, Cancer Research UK Manchester Institute and Cancer Research UK Manchester Centre

Covering basic and discovery science and translating this into the clinic.

Our range of training options include:

Non-Clinical PhDs

Clinical Research Training Fellowships

MB-PhDs

Leeds-Manchester Clinical Research Training Fellowships

Masters in Oncology and other postgraduate training courses

Phase 1: Where Science Becomes Medicine

In July 2019, the MCRC and the Experimental Cancer Medicines Centre (ECMC) held an inaugural conference to celebrate Manchester's prolific history and heritage in early phase clinical research right in the heart of Manchester.

Held between the 14th and 16th of July, the **Phase 1: Where Science Becomes Medicine** conference brought together a diverse range of professionals for three days of presentations discussing early phase clinical research and included representatives from across the world.

Spread across ten sessions throughout the three days, the conference covered a range of topics related to the key theme of developing early-phase clinical trials, and included themes like radiotherapy, personalising treatments using biomarkers advanced therapies, immuno-oncology as well as debates and keynote speakers.

Keynote Speakers

The conference featured two excellent keynote lectures: Professor Lillian Siu from Princess Margaret Hospital, Canada, and Professor Skip Burris from the Sarah Cannon Research Institute in the USA.

Lillian Siu spoke to how Phase 1 clinical trials have changed over the decades she has been working in the field. She spoke about how the lines between Phase 1 trials and Phase 2 and 3 trials have evolved to the stage where trials are now being conducted on larger patient groups, taking longer, and used to identify other properties typically deferred to latter in the drug development process. This comes also at a time when the development process is being crunched, to bring more drugs to market quicker, and amounts to a major evolution in the purpose of Phase 1 trials.

In the second keynote, Skip Burris focused on the future of Phase 1 clinical trials and how the advent of biomarkers and personalised medicine can change the shape of cancer treatment for the better.

Showcasing novel research

Outside of the keynote lectures and presentations, the conference also offered early career researchers the opportunity to present their own research. Over 30 posters were presented covering a range of topics including digital technologies for oncology, immuno-oncology, radiotherapies and more.

Interspersed with the various academic lectures, debates, and presentations, the conference also featured a series of videos of patient experiences with clinical trials. These short videos provided powerful, first-hand accounts of what being on a clinical trial is like, and the impact that cancer has on patients and their family.

Feedback from delegates was overwhelmingly positive, with attendees pointing to the strong scientific content, engaging debates and excellent sessions covering various topics in early phase clinical research.

Proceedings of the conference are now available to view in the Journal of Immunotherapy and Precision Oncology, 2019, 2(4), 156-174.

JULY 2019
14-16

3 days



200+
delegates



34
speakers from
across the
world



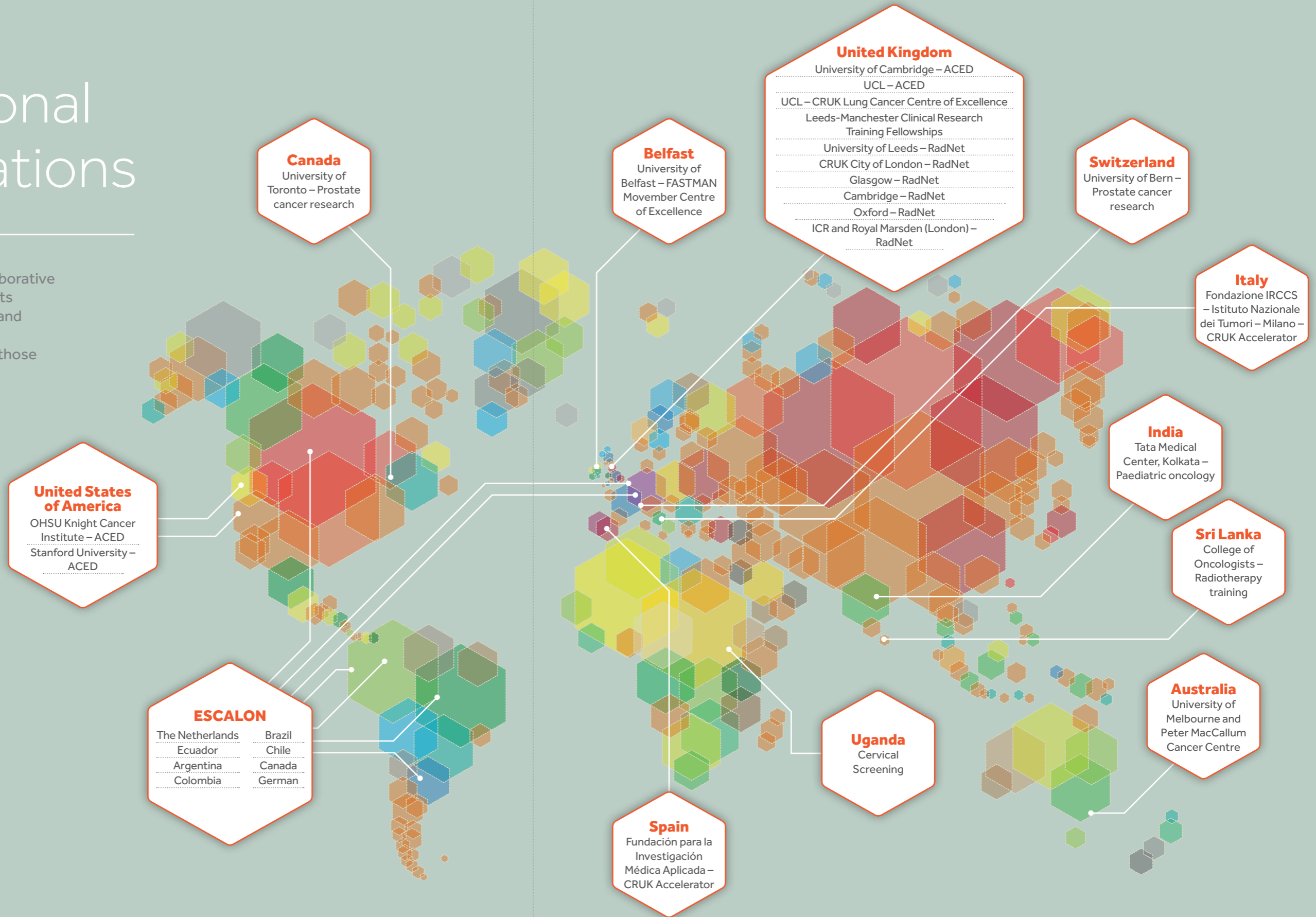
31
posters
presented



Parallel nursing
session

International Collaborations

Our research is high-impact, collaborative and international. The MCRC and its partners work with organisations and institutions across the world, and these are just a small selection of those partnerships and activities.



United States of America
 OHSU Knight Cancer Institute - ACED
 Stanford University - ACED

Canada
 University of Toronto - Prostate cancer research

Belfast
 University of Belfast - FASTMAN
 Movember Centre of Excellence

United Kingdom
 University of Cambridge - ACED
 UCL - ACED
 UCL - CRUK Lung Cancer Centre of Excellence
 Leeds-Manchester Clinical Research Training Fellowships
 University of Leeds - RadNet
 CRUK City of London - RadNet
 Glasgow - RadNet
 Cambridge - RadNet
 Oxford - RadNet
 ICR and Royal Marsden (London) - RadNet

Switzerland
 University of Bern - Prostate cancer research

Italy
 Fondazione IRCCS - Istituto Nazionale dei Tumori - Milano - CRUK Accelerator

India
 Tata Medical Center, Kolkata - Paediatric oncology

Sri Lanka
 College of Oncologists - Radiotherapy training

Australia
 University of Melbourne and Peter MacCallum Cancer Centre

Uganda
 Cervical Screening

Spain
 Fundación para la Investigación Médica Aplicada - CRUK Accelerator

ESCALON
 The Netherlands
 Ecuador
 Argentina
 Colombia
 Brazil
 Chile
 Canada
 German

The Digital Cancer Hospital: Real-World Evidence and Trials

In collaboration with The Christie, the Digital Health domain at The University of Manchester, and Health Innovation Manchester, the MCRC is driving academic programmes in real-world evidence research using machine learning to understand how patients respond to treatments and the side-effects they experience.

Understanding the real patient

Every patient is unique.

Therefore, to provide a truly personalised medicine and therapeutic protocol to patients, we first need to understand how a patient responds to current treatments in real time and how additional external factors might affect their treatment protocol.

Part of this research programme includes looking at the patient holistically. For instance, we need to consider what other diseases the patient might be suffering from – a patient's co-morbidities – as well as the other drugs that they are taking for noncancer purposes – polypharmacy – to understand whether or not these influence patient responses. In addition, the programme will enable patients

to log, in real-time, the side-effects as "patient-reported outcomes or PROMS" as experienced during any treatment protocol, be it a course of chemotherapy, immuno-therapy or radiotherapy.

A key focus of personalised therapies

This digital intersection of co-morbidity data alongside clinical trial outcomes and machine learning research is a key focus at The University of Manchester as well as a number of funding bodies.

In particular, two of the MCRC's most recent awards have included real world evidence and electronic patient reported outcomes or experiences: the Cancer Research UK Manchester 'Major' Centre, and the Cancer Research UK RadNet Manchester.

Further collaborations are planned to drive artificial intelligence approaches to the data with the Alan Turing Institute, the University's Division of Informatics, Imaging and Data Sciences, the Pankhurst Institute for Health Technology as well as industrial partners such as Roche.

A global lead in health Informatics

The ambition is for Manchester to become a global lead in cancer health informatics, understanding the impact of co-morbidity on cancer treatment outcome. This work also underpins the development of new clinical trials that will serve patients with several concurrent health problems, as well as the elderly, and offer them bespoke treatment protocols that take into account their other diseases and drugs that they are taking.

Given that the population as a whole is ageing and patients are becoming more complex, this should put the MCRC into an excellent place to be an international lead in this area and develop clinical trials that will reflect the majority of patients within the next decade.



MCRC: Selected Publications

In 2019, Manchester researchers published over 800 research papers. The following are a small selection of the high-impact studies that received media attention during 2019.

Nature Genetics

2019, **51 (2)**, 308-318

Robert G. Bristow et al.

A landmark pan-cancer study has analysed mutation signatures of low oxygen in more than 8,000 human tumours across 19 different cancer types.

British Journal of Cancer

2019, **120**, 141-153

Natalie Cook et al.

Liquid biopsies have the potential to guide treatment options in cancers of unknown primary by providing genetic information that can be used for prognosis.

EClinicalMedicine

2019, **7**, 39-46

D. Gareth Evans et al.

Results from the FH02 trial, finding that annual screening for younger women aged 35-39 who have a family history of breast cancer would be highly effective in detecting tumours earlier.

Cancer Cell

2019, **35 (3)**, 519-533

Stephen Taylor et al.

A new class of drugs called PARG inhibitors can kill ovarian cancer cells by targeting weaknesses within their ability to copy their DNA.

BMJ Open

2019, **9**, 1-7

Emma Crosbie et al.

Urine testing may be as effective as the smear test at picking up high-risk human papillomavirus (HPV), preventing cervical cancer.

Nature Medicine

2019, **25 (5)**, 738-743

Matthew Krebs et al.

Next-generation sequencing of circulating tumour DNA in blood can help match patients to early phase clinical trials, with 11 patients from the first cohort of 100 matched onto clinical trials.

The Lancet Public Health

2019, **4**, e551

Ellena Badrick, Emma Crosbie and Andrew Renehan et al.

A top ten list of unanswered questions drawn up by researchers, clinicians and patients identifies priorities in early detection.

Nature

2019, **574**, 273-277

Daniel Wiseman et al.

Faults in two genes directly work together to cause the deadliest form of blood cancer and that targeting both could be the key to successful treatments.

JAMA

2019, **322**, 2084-2094

Peter Hoskin et al.

A single dose of radiotherapy is as "effective" as five doses for end-of-life cancer patients suffering with painful spinal canal compression.

Nature Communications

2019, **10**, 5016

Rachel Eyre and Robert Clarke et al.

Drugs used to treat arthritis could be repurposed to help prevent breast cancer.

Nature Medicine

2019, **25**, 1615-1626

Robert G. Bristow et al.

By identifying the complete set of 1,178 biomarkers in men's genomes inherited from one's parents can help predict how an individual person's prostate cancer will grow.

Nature Medicine

2019, **25**, 1534-1539

Caroline Dive et al.

The identification of potential tumour cells in the blood during surgery is an indicator that lung cancer will return.

845
Papers published
in 2019

More than
60%
had international
collaboration

More than
10%
academic-industry
collaboration

More than
400
papers were in the
top 10%
of journals

Paterson Redevelopment Project

Building a World-Class Cancer Research Facility

Plans for a new facility on the site of the Paterson Institute gained significant momentum in 2019, following the approval of planning permission to build a nine-storey building and the investment of £25 million from UKRPIF, launching our vision to Re-Write Cancer.

Led by The Christie on behalf of the MCR, the Paterson Redevelopment Project seeks to build a new facility on the site of the Paterson building in Withington.

As well as housing the Cancer Research UK Manchester Institute (CRUK MI), the new development will enable research growth for basic, translational and clinical research to flourish. It will also house the CRUK MI Cancer Biomarkers Centre, which seeks to discover, clinically validate and quantify biomarkers for use in personalised medicine, and the CRUK MI Drug Discovery Unit, which works with the Manchester cancer research

community to develop novel cancer therapeutics as well as with industry partners to commercialise laboratory discoveries and translate discoveries into real world treatments.

From the Ashes

Building this world-leading cancer research facility represents an incredible opportunity to create one of the top cancer research facilities in the world-right in the heart of Manchester.

Following the severe Paterson building fire in April 2017, plans are now well underway to build a new £150 million comprehensive cancer research facility on the site of the old building. This new research facility will be twice the size of the previous one and filled with state-of-the-art equipment and house over 300 scientific researchers.

Strategic Funding

In July 2019, the Research England UK Research Partnership Investment Fund (UKRPIF) announced it was to invest £25 million into the project, marking a significant step forward in the development of the facility.

Further major funding announcements have also been made, most recently with the Wolfson Foundation – an independent charity that supports and promotes excellence in the fields of science, health, education and the arts, awarded a £5 million gift to the project.

Re-Writing the Future of Cancer

This new facility represents an incredible opportunity to re-write the future of cancer by developing new techniques and driving new innovations from the laboratory into the clinic.

To achieve this goal, scientists in the new facility will work collaboratively bringing together different ideas, skill sets, expertise, and ways of working together all under one roof. Scientists will be looking at various topics, from identifying treatments and trials for patients with multiple diseases in addition to cancer, to tackling health inequalities and the high incidence of cancer in the GM population.

With construction of the new facility underway, the project is well underway in the aim to open its doors to researchers in 2022.

“

We want to re-write the future of cancer. As it stands, our successful partnership makes us a global leader in many fields of cancer research, which is a fantastic achievement and one we are very proud of. This building will provide the necessary infrastructure we need to be one of the best comprehensive cancer centres in the world for basic, translational and clinical research, within the next 10 years.

Professor Nic Jones

Director of Strategic Initiatives,
The University of Manchester and
former Chief Scientist at CRUK

”



Artist's impression of the Paterson Redevelopment Project

Combining Cancer Research and Patient Care in Manchester

Following a landmark decision in 2015, Greater Manchester became the first region in the UK to have control of its integrated health and social care budgets to the sum of over £6bn.

Integrating research and education with clinical and social care

At the vanguard of integrated clinical and social care for cancer in this region is Greater Manchester Cancer, the cancer programme for the devolved health and social care system, serving the more than 3.2 million population of Greater Manchester and Eastern Cheshire.

It is GM Cancer's goal to integrate research coordinated from both the MCRC partnership and the Manchester Academic Health Science Centre (MAHSC) cancer domain to ensure the seamless integration of basic and translational research with clinical and social care.

Supporting this vision aiming to improve cancer outcomes in this region, GM Cancer has published an ambitious Greater Manchester Cancer Plan to tackle cancer in the region with the aim that by 2021, 1,300 fewer people will die of cancer.

Since publishing, this plan has evolved to incorporate the key strategic goals of the NHS, stressing the importance of prevention and early detection to reduce the number of late stage referrals, while also increasing the number of patients who survive cancer for more than five years.

Increasing early stage diagnosis

Central to the goal of increasing the percentage of stage 1 or 2 cancers to 75% by 2028, from the current rate of 50% are prevention and early detection strategies.

Initiatives already underway in Manchester have paved the way to achieve this ambitious goal. One such project, the Lung Health Check led by Dr Phil Crosbie which identified higher incidents of early stage lung cancer in members of the public screened in car parks or town centres across Manchester, proved to be such a success that it is now being rolled out to multiple locations across the UK.

Additional projects are in development as part of Manchester's membership of the International Alliance for Cancer Early Detection (ACED), which is developing further collaborative projects in early detection research with partners from the UK and America.

Personalised and improved care

Another key strategy in the region is offering patients access to more individualised and personal treatments specific to their tumour and their genetic profile.

In Manchester, several initiatives are being explored to provide patients with the access to new trials or better care. This could be through receiving treatment closer to home allowing them to get on with their daily lives, or through novel trials and studies like the TARGET trial, which matches patients onto specific clinical trials. Furthermore, using expertise developed at the CRUK MI Cancer Biomarkers Centre, studies such as CACTUS and DETECTION are looking at how circulating tumour DNA can inform therapies, with the latter Phase 3 study looking at the likelihood of melanoma relapse through ctDNA detection at surgery.

In addition, the closer integration with real-world evidence and patient reported outcomes enables researchers to understand the patient holistically, identifying how co-morbidities impact treatment, and what side-effects are experienced during treatment.



GM Cancer Conference

19-20 November 2019

92
speakers

600+
delegates
attended each day
showcasing
collaborative work

76
posters
presented

Awards

Professors **Rob Bristow** and **John Radford** have been elected as fellows of the Academy of Medical Sciences, recognising their significant contributions to medical science, cutting edge research discoveries and translating these developments into benefits for patients and the wider society.



Rob Bristow



John Radford

Professor **Caroline Dive** named the Faculty of Biology, Medicine and Health's Researcher of the Year at The University of Manchester's 2019 Distinguished Achievement Awards. Caroline was recognised for transforming the field of biomarker research, and her commitment for nurturing the next generation of clinical and non-clinical cancer researchers in Precision Medicine.



Caroline Dive with Professor Dame Nancy Rothwell (President and Vice-Chancellor, The University of Manchester) at the 2019 Distinguished Achievement Awards

The **Manchester Lung Cancer Screening Team** won the National Cancer Care Team of the Year award at the BMJ Awards 2019 for their work on the Lung Health Check programme.

Clinical fellow in the Molecular Oncology group, **Rebecca Lee** was awarded the CRUK MI Dexter Prize for Young Scientists for 2018 in recognition of her work involving ctDNA and predictive biomarkers.

Postdoctoral fellow **Lucas Trucco** from the CRUK MI Molecular Oncology group, was awarded the American Association for Cancer Research – Pezcoller Foundation Scholar-in-Training Award enabling him to present research at AACR 2019.

Daniel White from the CRUK MI Cancer Biomarkers Centre, was awarded the Ignition Award through The University of Manchester intellectual Property (UMIP) Innovation Optimiser

Research Associate within the Radiotherapy Related Research department, **Corinne Johnson-Hart** was awarded the Innovation prize by Cancer Research UK.

Clinical PhD student **Rebecca Fish** was awarded the Faculty Student of the Year Award celebrating her achievements in the field of anal cancer.

Maximilian Schenk, from the CRUK MI Cancer Biomarker Centre, was awarded the overall prize for best oral presentation; and **Christian Bromley**, based in the Cancer Inflammation and Immunity group at the CRUK MI, was awarded the prize for one of the top 3 poster presentations at the 13th annual IPSCC conference.

Professor **Corinne Faivre-Finn** has been awarded the James D. Cox Lectureship award by the International Association for the Study of Lung Cancer (IASLC) for her continued commitment to high quality radiotherapy research.

Professor **Caroline Dive** has been awarded the Heine H Hansen Lectureship award by the International Association for the Study of Lung Cancer (IASLC) in recognition of her work in the field of basic sciences.



Emma Crosbie (second from the left) receiving the CREST award



Experimental Cancer Medicine Team receiving the Research Team of the Year at the 2019 GM Clinical Research Awards

Director of Strategic Initiatives, Professor **Nic Jones**, has been appointed to the Cancer Research UK Charity's Governing Council to support the charity in ensuring it meets its key objectives.

Professor **Emma Crosbie** was awarded the Cancer Research Excellence in Surgical Trails (CREST) award, established to recognise surgical teams who have made the greatest contribution in recruitment across the National Institute for Health Research (NIHR) cancer trials portfolio at the National Cancer Research Institute (NCRI) 2019 conference.

The Manchester **Experimental Cancer Medicine Team (ECMT)** was awarded the Research Team of the Year award at the 2019 GM Clinical Research Awards, recognising continues commitment to delivering a diverse portfolio of early phase clinical trials.

News

Pioneering Manchester Cancer Screening Pilot to be Rolled out Nationwide

Manchester's Lung Health Check pilot, which quadrupled lung cancer early diagnosis rates, is being extended to 10 sites across the country in a drive to save lives as part of The NHS Long Term Plan. Around £70 million will fund 10 national projects that check those most at risk.



Manchester Cancer Screening Pilot



MR-Linac machine

MR-Linac treats first cancer patient at The Christie

Able to perform real-time MRI scans while delivering targeted X-ray radiation beams at tumours, the MR-Linac machine was used to treat the first patient at The Christie in May 2019.

This makes The Christie one of only two sites worldwide to offer both MR-Linac and proton beam therapy treatment options to patients.

Blood Samples can help match cancer patients to early phase clinical trials

Using next-generation sequencing of circulating tumour DNA, the TARGET Trial seeks to match patients with a broad range of advanced cancers to early phase clinical trials. For the first 100 patients of the trial, 41 were found to have actionable mutations, and 11 received a matched therapy.



Urine testing could prevent cervical cancer

New research by Professor Emma Crosbie and supported by the NIHR Manchester BRC, indicates that a urine test was as good as a smear test at identifying the human papillomavirus (HPV) which is linked to cervical cancer. It is hoped that this less invasive screening test, could increase the number of women who are screened for cervical cancer and increase survival rates.



India's childhood leukaemia survival rate leaps to 80%

Work led by Professor Vaskar Saha means that around 80% of children with the most common childhood cancer are now likely to survive following treatment at major centres across India. His approach has helped

cure children diagnosed with acute lymphoblastic leukaemia (ALL) by 15% during the five years he has led the ICICLE (Indian Childhood Collaborative Leukaemia Group) clinical project.

ESMO fellows visit Manchester for an immersive workshop in biomarkers

The MCRC hosted eleven clinical fellows from across Europe and Asia for a series of lectures and workshops around biomarkers. This four-day visit was designed to provide fellows with a comprehensive understanding of biomarkers and the development of early phase clinical trials.



ESMO fellows visiting MCRC



Artist's Impression of the Paterson Redevelopment Project

Paterson Redevelopment Project receives £25 million in Government funding

The plans to develop a new world-leading cancer research facility on the site of the old Paterson building have been awarded £25 million by Research England UK Research Partnership

Investment Fund (UKRPIF). The new facility will be built on the old Paterson building and will support 400 scientists, clinicians and support and operations staff.

Phase III Trial DETECTION funded by CRUK

Cancer Research UK has funded a Phase III trial called DETECTION (Circulating tumour DNA guided Therapy for stage IIB/C melanoma after surgical resection) which will test whether the survival of patients with stage IIB/c melanoma is improved through early treatment of ctDNA-detected relapse with immune therapy.



Christie Cancer Centre in Macclesfield given the green light

Cheshire East Council has approved plans for a state-of-the-art new cancer centre to be built in the grounds of Macclesfield District General Hospital. The ambitious new centre will bring together essential cancer services into one purpose-built unit delivering local specialist access to radiotherapy, chemotherapy, holistic support and information services, outpatient care, palliative care and a wider range of clinical trials than at present.

Artist's Impression of the Christie Cancer Centre at Macclesfield District General Hospital



The Society of Spanish Researchers visiting MCRC

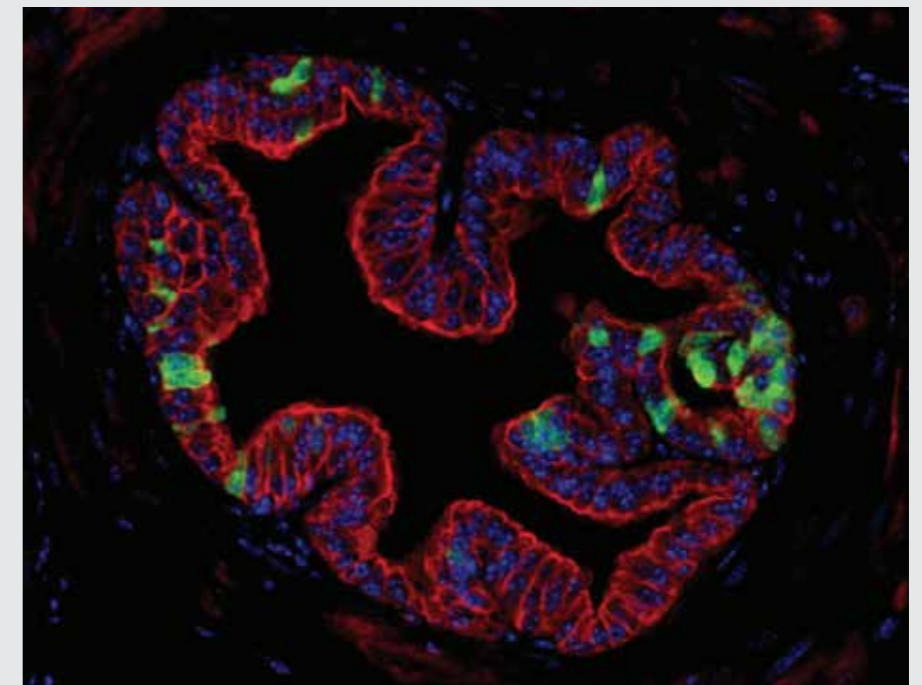
European network for young cancer researchers launched in Manchester

The Society of Spanish Researchers in the United Kingdom (SRUK/CERU) launched its European Network for Young Cancer Researchers by holding the first networking day in cancer research, bringing together world-

leading scientists in the field. With this, SRUK aims to build a European network of young researchers working in the cancer field as a platform to forge strong collaborations between research centres and promote scientific discussions.

£1.25m in additional funding to further improve prostate cancer research

Scientists from across Manchester have been awarded a part share of £1.25m funding from Prostate Cancer UK and the Movember Foundation to expand work being performed in prostate cancer research. The grant, which is shared between The University of Manchester and Queen's University Belfast as part of the Belfast-Manchester Centre of Excellence (also known as FASTMAN), will help to expand current research programmes, drive the development of new clinical trials and answer some of the fundamental questions about the disease.



Sitting Down with Claire Trinder



With a background in bioinformatics and having previously worked at the Paterson Institute, we sit down with the MCRC Director of Research Strategy and Operations, Dr Claire Trinder, to find out more about the skills and experiences she will bring to the role.

Can you tell us about your past experiences and time in Manchester?

It's probably easiest to start at the beginning! I'm originally an alumna of The University of Manchester, having completed my undergraduate studies in Biochemistry and Biotechnology, followed by a masters and PhD in Bioinformatics.

I found that computer-based lab investigations suited me much better than being at the bench. I much preferred the way you can see and understand why things work – or don't work – with bioinformatics, and it really suits my detail focused personality.

After my PhD, I actually moved to the Paterson Institute to join Crispin Miller who was setting up a new research group and needed a bioinformatician. It was here that I began working in cancer discovery and gene expression, and what would later become biomarker sciences. After a few years working at the institute, I then took another

postdoctoral position with Ged Brady at Epistem. It was after working here that I realised I wanted to move away from Manchester and into a more industrial role.

Tell us about your time working in industry?

An opportunity came up to join a larger bioinformatics team at Almac in Northern Ireland – which is a contract research organisation and provided a nice balance between academic and industrial research. As I rose up the ranks at Almac, I ended up selling Manchester as the location to set up a satellite office and ultimately ended up moving back to the city.

After establishing Almac's Didsbury office, I decided I wanted to develop my programme, project management, and broader operational delivery skills and I moved to work in service delivery for a global IT provider (Hewlett Packard). Here, I was able to develop my transferable secondary and leadership skills, moving from a regional team leader to a global team manager.

But, it was after being in this position for a few years that I realised that I missed science! So, I ended up taking a position at the Science and Technologies Facilities Council (STFC) in Warrington – which is a part of UKRI – to work in high performance computing as the

Head of Programmes. It was incredibly interesting to be at the forefront of high-performance computing, artificial intelligence and data science, while also gaining skills and experience in grant funding and commercialisation.

What attracted you to join the MCRC and return to cancer research?

My aim was to always return to medical science. So, when the opportunity to join the MCRC as the Director of Research Operations and Strategy came up, I thought 'this is perfect'. Returning to cancer research means I can bring my years of secondary skills and previous experiences back to my original field.

What truly attracted me to the MCRC is the Team Science mentality. I'm really passionate about collaborative working and synergy, as experience demonstrates that research is more powerful and impactful when teams work together. This is clearly the driving force behind the MCRC bringing together multi-disciplinary teams to deliver integrated and innovative basic, translational, and clinical research.

Synergy is at the heart of the cancer research ecosystem in Manchester. I'm excited to continue the legacy of Cancer Team Science Town Halls and create exciting novel research projects.



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And it's a time of great change with the development of the Paterson building. It's not just a rebuild, but a reimagining of the facility. There is so much happening on the Withington campus.

Outside of work, what else keeps you busy?

I have a two-year-old daughter who occupies my time outside of work. It is a challenge being in a senior position while also being a mother, and this has led me to be a stern believer in establishing a robust work-life balance.

Wellbeing of the team and researchers is really important to me as this allows us to do our best research and enjoy the work we are doing. In previous roles this materialised into things like coffee mornings, yoga sessions over lunch and regular team building activities. I'm really excited to see what I can bring to the Manchester team and how to advance cancer research in Manchester.

Claire joins the MCRC on the 6th of April 2020 and will lead the MCRC core Operations team as well as developing and implementing the MCRC research strategy.



References

All information presented in this annual report is accurate at the time of production (31st March 2020) and provides a snapshot of the research activities throughout 2019 and into early 2020. Additional references or additional reading for specific statistics cited throughout this document can be found in this section.

World-Leading Research Themes

(based on REF returns, scientific awards and bibliometrics)

Radiotherapy Research

Exemplars include research using MR-Linac, Proton Beam, SABR and FLASH as well as CRUK Manchester RadNet Radiation Research Unit of Excellence.

Early Detection

Exemplars include the Manchester Lung Health Check and associated translational programme; allied with UCL-Manchester Lung Cancer Centre of Excellence and International Alliance for Cancer Early Detection (ACED) with CRUK.

Early Phase Clinical Trials

One of the largest Early Phase clinical trials unit in Europe, pioneering studies involving targeted therapies, immunotherapy and cell/gene therapy (iMATCH), ctDNA-guided trials (TARGET); allied with Experimental Cancer Medicine Centre (CRUK ECMC).

Biomarkers and Liquid Biopsies

National biomarker centre (CRUK MI

Cancer Biomarker Centre) for trial-associated biomarkers in cancer precision medicine and early detection (e.g. immune biomarkers, ctDNA, CTC, proteomic markers).

Digital/Real World Evidence

Christie real world evidence programme, Roche and Innovate UK Industrial Life Sciences Strategic centre, ePROMS and ePREMS for all cancer patients, studies of comorbidity and patient diversity in outcome.

Tumour Microenvironment

Scientific exemplars include hypoxia signature development and links to genetic instability, signature use in clinical trials, commercialisation of tests in head and neck, bladder, prostate cancers; novel approaches to understanding of cell matrix, inflammation and stroma in pancreatic, breast and lung cancer.

Cell Signalling and Genetic Instability

Scientific exemplars include work linking B-Raf signalling and melanoma, ovarian, prostate, lung cancer drivers and genetic instability, leukaemia stem cell biology and signalling.

Practice-influencing Research Themes

Small Cell Lung Cancer

Caroline Dive, Corinne Faivre-Finn, Fiona Blackhall, Colin Lindsay et al., *Annals of Oncology*, 2019, **30**, 1114-1120.

Non-small cell lung cancer

Caroline Dive et al., *Nature Medicine*, 2019, **25**, 1534-1539.

Hepato-pancreato-biliary

Juan Valle, Angela Lamarca, Mairéad McNamara et al., *Journal of the National Cancer Institute*, 2020, **112**, 200-210.

Peritoneal Metastasis

Omer Aziz, Sarah O'Dwyer et al., *BMJ Open*, 2020, **10**, e039314.

Lymphoma

John Radford, Tim Illidge, Peter Hoskin et al., *Journal of Clinical Oncology*, 2019, **37**, 1732-1741.

Prostate Cancer

Peter Hoskin et al., *JAMA*, 2019, **322**, 2084-2094.

Bladder Cancer

Ananya Choudhury, Peter Hoskin et al., *Nature Reviews Urology*, 2019, **16**, 511-522.

Melanoma

Richard Marais, Sarah Valpione et al., *Nature Cancer*, 2020, **1**, 210-221.

Ovarian Cancer

Stephen Taylor et al., *Cancer Cell*, 2019, **35**, 519-533.

Breast cancer

Nigel Bundred, Sacha Howell, Anne Armstrong et al., *European Journal of Surgical Oncology*, 2017, **43**, 931-937.

Colorectal Cancer

Gordon Jayson et al., *Nature Communications*, 2018, **9** 4672.

Leukaemia

Vaskar Saha et al., *Lancet Haematology*, 2019, **6**, e201-e216.

The Christie NHS Foundation Trust

All statistics on number of patients treated and number of clinical studies correct as of January 2020.

- The Christie NHS Foundation Trust was recognised in 2018 by the Organisation of European Cancer Institutes as a comprehensive cancer centre www.oeci.eu/Institute.aspx?ld_Member=49.
- The Christie has been recognised by the magazine Newsweek as a top specialist hospital: www.newsweek.com/best-hospitals-2019/top-specialized and by Top Masters in Healthcare as the most technologically advanced hospital outside of north America www.christie.nhs.uk/about-us/news-at-the-christie/latest-news-stories/we-are-a-technologically-advanced-cancer-centre.

Publication Statistics

Publications mentioned on page 24-25 correspond to those that have received interest from press offices at any of the Manchester affiliated organisations or any major cancer research funder.

Statistics were obtained through SciVal through evaluating publications from over 90 Division of Cancer Sciences, The University of Manchester and The Christie NHS Foundation Trust principle investigators correlated against Manchester affiliations, publication year 2019 and the keyword 'Cancer'. Analyses of the top research publications in both research fields and involving industrial and academic collaborations were evaluated using parameters established on SciVal (search completed 11th February 2020).



The MCRC Partnership

The MCRC is a partnership between The University of Manchester, Cancer Research UK and The Christie NHS Foundation Trust. Since its creation in 2006, the MCRC has widened its reach to drive forward cancer research in other NHS trusts and organisations in Manchester.



The University of Manchester

The University of Manchester is one of the largest universities in the UK, with hundreds of specialist research groups undertaking pioneering multi-disciplinary teaching and research of worldwide significance. It has an exceptional record of generating and sharing new ideas and innovations, and a rich academic heritage, and can lay claim to 25 Nobel laureates amongst its current and former staff and students. The University's research beacons are examples of pioneering discoveries, interdisciplinary collaboration and cross-sector partnerships that are tackling some of the biggest questions facing the planet, and cancer is one of the five beacons.



Cancer Research UK

Cancer Research UK is the world's leading cancer charity dedicated to saving lives through research. Their groundbreaking work into the prevention, diagnosis and treatment of cancer has helped save millions of lives and is entirely funded by the public. Cancer Research UK has been at the heart of the progress that has already seen survival rates in the UK double in the last forty years. Cancer Research UK supports research into all aspects of cancer through the work of over 4,000 scientists, doctors and nurses. Together with its partners and supporters, Cancer Research UK's vision is to beat cancer sooner.



The Christie NHS Foundation Trust

The Christie specialises in cancer treatment, research and education, and is the largest cancer centre in Europe. As well as treating 19,000 new patients every year from across the UK, its experts have been pioneering cancer research breakthroughs for more than 100 years. The Christie serves a population of 3.2 million people across Greater Manchester and Cheshire, while 26% of its patients are referred from across the UK. Based in Manchester with radiotherapy centres in Oldham and Salford, The Christie is known for many world-firsts, which have impacted cancer treatment on a global scale. The Christie also has its own School of Oncology – the first of its kind – enhancing the education and knowledge of healthcare professionals across the country.

Engagement



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