



NORTH WEST
CANCER RESEARCH

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A DECADE OF RESEARCH

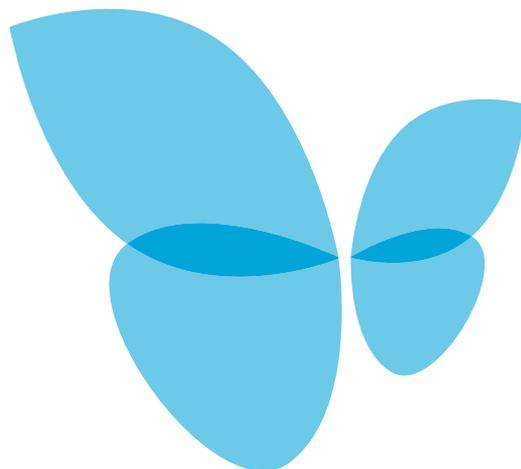
IMPACT REPORT

Research today
offers new hope
for tomorrow - the
impact of NWCR
research.





NORTH WEST CANCER RESEARCH



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Together we will
stop cancer sooner



Alastair Richards
CEO

CHIEF EXECUTIVE SUMMARY

I am delighted to present the first research impact review carried out by North West Cancer Research. The Charity has been funding life-saving research into cancer in our region for 70 years and we are proud to have invested £39m since 2000.

We have taken this opportunity to look back and consider what our funding has meant in the vital struggle against cancer and for the researchers in our area. I am sure that you will be delighted by the results.

Within this brief report you will find information on the types of cancer into which we have funded research as well as the different ways in which our work has impacted on the wider research community and a number of research stories that will give you a glimpse into some of the work being funded by NWCR. I am also pleased to share information on our future strategy and direction.

As we look to the future, our mission remains the same, to fight the toughest cancers which have the greatest impact on people in our region.

NWCR supports research that makes a difference to the lives of people in the North West and North Wales.

WHAT HAVE WE ACHIEVED

£39m

Since 2000 we have invested £39 million in life-saving research.

3 Universities

We support three leading Universities focussing on cancer research in the North West: Bangor – Lancaster - Liverpool.

100 Grants

We have awarded 100 research grants to 45 Lead Researchers between 2005 -2015

190+ Publications

Our research has led to 193 publications in peer-reviewed journals.

19 Countries, 4 Continents

NWCR funded researchers collaborate across the globe in over 19 different countries – spreading their knowledge world-wide.

£15m

35% of NWCR funded projects have opened the doors to new funding opportunities from other funders accounting for over £15 million of new funding dedicated to cancer research in the North West.

50+ Careers

51 instances where NWCR researchers' careers have benefitted from funding received.

16 Collaborations

NWCR funding has led to 16 interactions with pharmaceutical companies – working together with industry is a crucial step in translating research into treatments which in the future will make a difference to people with cancer.

5 Patents

Pending patents and licences which could pave the way to new discoveries which may improve the outcomes of patients.

10 YEARS OF RESEARCH (2005-2015)

Introduction

This study was commissioned to look at a snapshot of research funded between 2005 and 2015. During this time, 100 research grants were awarded by NWCR. We report on the findings from questionnaires that were sent to NWCR funded researchers located at three leading Universities in the North West of England and North Wales – Bangor, Lancaster and Liverpool.

Of the 100 grants awarded, 83 recipients have contributed to this study.

We have chosen the period of 2005 – 2015 for this report because many of the projects which started after 2015 are still in progress.

Acknowledgements

With thanks to the author of the report Dr Wendy Edwards, Hawthorn Edwards Research Consultancy and to all the NWCR researchers who have contributed their findings and time.

Research – Why we fund researchers

Sometimes a researcher's journey may lead them to a new discovery or may take them down a new path which perhaps they had not seen before. It may be that they don't find a cure but do discover a potential new avenue of treatment or a way of improving the care or quality of someone's life living daily with cancer.

It can take up to 25 years for a research project to truly make a difference or impact on people with cancer, but many new pathways are explored along the way which improve our understanding of cancer and which could ultimately lead to a cure.

Without the initial investment in studying new concepts and ground-breaking, innovative research, our generation and more importantly the next generation of cancer sufferers will not benefit from earlier diagnosis, new knowledge and improved treatments for cancer. North West Cancer Research plays a pivotal role in ensuring high quality research receives the funding it deserves.

Research funded today leads to the new discoveries of tomorrow

The findings of this impact study will enable NWCR to define their future aspirations in the quest to help us stop cancer sooner.



10 AREAS OF RESEARCH IMPACT

It is crucial to supporters and researchers that the research funded by NWCR makes an impact.

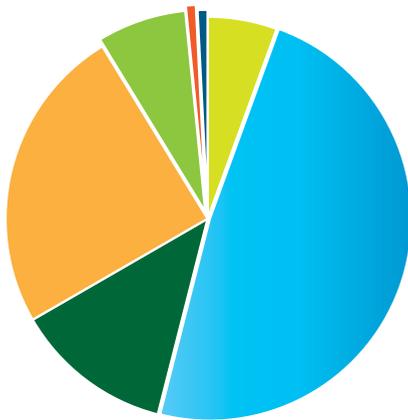
The impact of research can take decades or even generations to come to fruition.

NWCR has funded research for over 70 years in the North West. The impact of this funding and the journey researchers have taken cannot be underestimated.

In this study, we looked at how 83 research grants had influenced impact in 10 different impact areas:

1. New prevention ideas for cancer
2. The generation of new knowledge about the cause and a basic understanding of cancer
3. Improvements to knowledge and techniques for the diagnosis of cancer
4. Potential new treatments for cancer
5. Local and national health policy
6. Improvements to the quality of life (daily living experience) for people with cancer
7. Improvements to local and national services including clinical cancer pathways
8. Developing collaborations
9. Leveraging further funding
10. Supporting the careers of researchers

Areas of patient impact



PREVENTION

7

CAUSE & UNDERSTANDING

61

DIAGNOSIS

16

POTENTIAL TREATMENTS

31

IMPROVED QUALITY OF LIFE

9

IMPROVEMENTS IN CLINICAL CARE

1

INFLUENCE ON POLICY

1

Research projects may have more than one area of impact.



10 IMPACTS FROM NWCR FUNDING
including 10 research stories

1. Changing the footprint of cancer research in the UK

Three leading Universities focussing on cancer research in the North West

-  Liverpool
-  Lancaster
-  Bangor

LANCASTER
UNIVERSITY

UNIVERSITY
OF LIVERPOOL

BANGOR
UNIVERSITY

1 CHANGING THE FOOTPRINT OF CANCER RESEARCH IN THE UK

NWCR at University of Liverpool

NWCR has been funding research at the University of Liverpool for over 70 years.

In 2013, the University of Liverpool's Cancer Research Centre faced a challenge when funding from Cancer Research UK was not renewed. There was great concern that many researchers would be obliged to move away from Liverpool and find new research jobs at other universities. Fortunately, an application for funding to North West Cancer Research, led by the current Director of the Centre Professor Sarah Coupland, was successful and with additional funding from the University itself, the existence of the Cancer Research Centre at Liverpool was maintained. The centre was renamed 'North West Cancer Research Centre-University of Liverpool' or NWCR@UoL for short (www.liverpool.ac.uk/nwcr/)!

NWCR@UoL was launched in April 2014 with £720,000 funding from NWCR and £100,000 from the University of Liverpool for an initial period of three years. The Centre has since

received renewed funding from NWCR in 2018 until September 2021 at a cost of £1 million. NWCR@UoL is committed to improving cancer prevention, diagnosis and treatment through world-class research and access to the latest therapies. The Centre acts as a glue for cancer researchers at the University of Liverpool and has created a network of research across the North West and North Wales with its partners at Lancaster and Bangor Universities. Since inception, the Centre has established a Youth Academy of PhD students funding nine students to date, supporting 20 research projects and giving out ~20 travel and conference registration awards. The NWCR@UoL has also been active in the local community with over 25 outreach activities taking place over the last four years. These include visits to schools, lab tours, public lectures and presenting at local NWCR group meetings. It has created a 'Public and Patient Involvement/Engagement group' as well as the 'Liverpool Cancer Inequalities Research Network' (LCIRN), which aims to better understand the reasons behind poor outcome in cancer in some areas of Merseyside.

Professor Sarah Coupland says

“The future of cancer research in the North West is secure in the hands of NWCR and UoL. As the research community and network grows, the aim is that the Centre and its partners will deliver ground breaking research, which will improve the detection and treatment of cancer, as well as the outcomes for cancer patients who live in this region”.

1 CHANGING THE FOOTPRINT OF CANCER RESEARCH IN THE UK

NWCR at Lancaster University

NWCR has been funding research in Lancaster for over 20 years. The presence and support of NWCR is fundamental to the development of specialised cancer research teams.

NWCR funding has also led to positive collaboration between Liverpool, Bangor and Lancaster. This collaborative approach cannot be underestimated. New research collaborations have formed such as those of Dr Richard Mort and

Dr Sarah Allinson directly as a consequence of NWCR funding. Dr Allinson says

“NWCR provides a framework for collaborating and networking with other cancer researchers across the North West”.

Dr Allinson has always been keen to maintain strong links to the local community and often hosts open-days at the labs to show the local supporters how the money they raised is being used.

This enables the researchers to really see the public benefit and impact of their work.

“We are in a relationship with our supporters and this relationship is important to us – meeting people locally who have been affected by cancer ensures we do not lose sight of why we are doing this research”.



1 CHANGING THE FOOTPRINT OF CANCER RESEARCH IN THE UK

NWCR at Bangor University

Cardiff had traditionally been the focal point of cancer research in Wales but a partnership between NWCR, Welsh Assembly Government and Bangor University was to change this and would lead to the establishment of a world-class centre in North Wales. Today, The North West Cancer Research Institute is the lead research centre in Bangor University School of Medical Sciences.

Dr Ramsay McFarlane was instrumental in the formation of the Institute where he remains and has continued to develop his own research interests in how cancer cells utilise germline cell (precursor of reproductive cells) and stem cell genes to control cell proliferation.

Dr MacFarlane now has a team of researchers who are working to develop new diagnostic and patient stratification technologies as well as identifying and exploiting new anti-cancer drug targets.

The development of the NWCR Institute at Bangor resulted in the recruitment of a number of new independent internationally renowned research team leaders, one of which was Dr Edgar Hartsuiker, who was recruited to set up a new research group looking at the yeast genome as a model for DNA repair. Dr Hartsuiker's work was funded by a five year fellowship from NWCR. This funding established Edgar's career at Bangor as a leading expert.



“Without NWCR funding I would not be doing cancer research in Bangor, in fact I may never have been able to study the pathways involved in cell regulation”.

2 FUNDING AWARDS

Project Grants

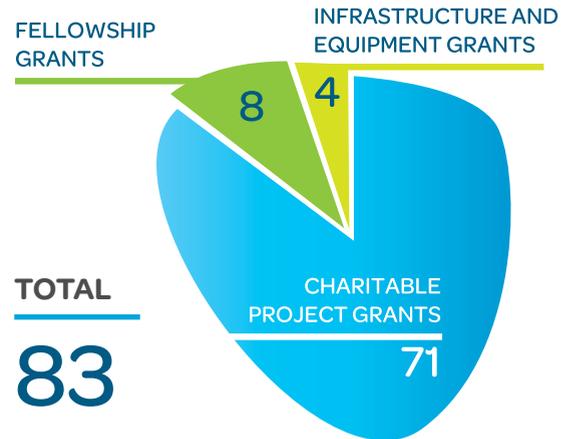
This type of grant funds a research project for up to three years at an average cost of £220,000.

Funding in this form has allowed Professor Roger Barraclough and Dr Mark Boyd, along with many others, to carry out pioneering research.

Project Grant Case Studies

Professor Roger Barraclough asked the question ‘why do some breast cancers spread and others don’t?’ He found that a gene called AGR2 encoded a protein that seemed to allow cancer cells to travel in and out of tissues. Project grant funding from NWCR enabled him to look more closely at the structure and function of this protein to try and find a way to block its action. If a treatment can be found that blocks this protein, then the cancer can be contained in the breast tissue and outcomes for patients will improve.

Dr Mark Boyd received project grant funding from NWCR to look at the p53-MDM2 pathway which plays a crucial role in controlling cancer.



p53 is a special protein encoded by the TP53 gene which acts a bit like a policeman making sure that cancer is kept at bay by ensuring that new cells only grow when they are needed. In order to fully understand how p53 does this, Dr Boyd and his team developed a transgenic mouse model, the first of its kind in the world. This ground-breaking research that started in Liverpool has since led to collaborations with the world renowned Beatson Institute for Cancer Research in Glasgow and it is hoped this research will lead to the identification of new treatments for people based on a better understanding of how the p53 policemen works and how it effects cancer cells.

2 _____ FUNDING AWARDED BY NWCR TO THREE LEADING UNIVERSITIES IN THE NORTH WEST

Fellowship Case Study

Dr Nikki Copeland received a 5-year fellowship from NWCR worth £317,336 in 2011. It enabled him to set up his own research laboratory at Lancaster University and build a body of evidence for the role of cyclin A-CDK2 in regulating cell division. Each cell division requires the precise copying of the genome, as to regulate this process leads to mutation and chromosome abnormalities that are associated with cancer.

The key research aims are to better understand the replication licensing and initiation process of DNA replication. Use of cell-based and cell-free DNA replication techniques provide powerful tools to monitor key regulatory steps in this process. The long-term goal is to identify differences between regulation of DNA replication in cancerous cells and normal tissues, to identify new therapeutic targets.

“The support provided by NWCR, has been fundamentally important for the establishment of my research group. NWCR kick started my independent research career and also enabled me to supervise the new research stars of the future.

“This is capacity building at its best – funding for today leading to new discoveries tomorrow.”



8 Fellowship Grants

This type of grant funds a researcher to undertake a PhD or Post-doctoral research for a period of 3-5 years at an average cost of £60,000 per year (includes all research project costs and salaries).

Infrastructure and Equipment Grants

The NWCR Centre at University of Liverpool (NWCRC@UoL) is an excellent example of how an infrastructure grant can have a massive impact.

Having received funding of close to £2 million pounds in the last five years, the NWCR Centre has developed a close research community across the region, joined together with one ultimate mission - to tackle cancer sooner. The Centre collaborates closely with the NWCR Institutes at Bangor and Lancaster and

shares resources, knowledge and innovation.

Through the generous funding, NWCRC@UoL has supported collaborative pilot research projects, seed-funded new ideas, developed educational outreach programmes and supported researchers at the early stages of their careers. It has also provided funding to set up the Liverpool Cancer Inequalities Research Network (LCIRN). The network brought together experts in science, cancer prevention, social care and public health working in partnership.

In a recent study undertaken as part of LCIRN's work, the researchers showed how social status influenced both incidence and mortality in people with Head and Neck Cancer. They found that the most disadvantaged groups are more likely to develop Head and Neck Cancer and are also more likely to die from it. "More needs to be done to fully understand the reasons behind this finding and to inform changes to health policy and practice in the North West" says Dr Sue Povall, LCIRN co-ordinator.

193

PUBLICATIONS
FROM RESEARCH

3 CONTRIBUTING TO THE WIDER RESEARCH COMMUNITY

Number of publications in leading scientific journals

Getting your research published is the goal for all researchers and establishes the calibre of their work. NWCR researchers have produced an outstanding

193 publications from research funded between 2005-2015. Now other experts in the world can read their findings and through networks and collaborations advancements in the treatment and prevention of cancer will be made.



4 CITATIONS FROM NWCR FUNDED RESEARCH

A citation is when a researcher quotes the published work of another expert. The more citations a researcher receives on a

publication the more their findings will be recognised and used to further the advancement in research around the world.

Nearly 4,000 citations have been made of research funded by NWCR during the period 2005-2015.

5 ____ NWCR RESEARCHERS PRESENTING AROUND THE WORLD

**45 NWCR
researchers were
invited to present
at 176 conferences
or meetings around
the world.**

From a local symposium such as the NWCR annual symposium held in April each year to the national and numerous international cancer conferences around the world.

NWCR funded researchers are renowned across the world. Researchers submit abstracts or summaries of

their research to conference programme committees who decide who to invite to present their research. These committees may receive thousands of abstracts but only have space for small numbers so only the highest quality and most ground-breaking research is chosen.



6 IMPROVED TREATMENTS AND LADDERS OF DISCOVERY

We hope that each piece of research will lead to new treatments and diagnostic tools which help doctors identify cancer earlier and reduce the impact it has on people's lives. Imagine a game of snakes and ladders – so often you go up a ladder only to fall back down a snake on your next turn. Research takes time and often leads along many paths which may turn out to be snakes rather than ladders.

The ladders are the new discoveries. The excitement of reaching the top of the board and finishing the game is how researchers feel when they discover a new gene or biomarker which might lead them to a new treatment. Each new potential treatment has to go through clinical trials to ensure it works and is safe

for use on humans. Drug discovery can take millions of pounds and between 15-25 years. Before a drug is even tested it has to be patented and then licensed for testing on humans.

NWCR funding in the last ten-years has contributed to five pending patents and licences on new biomarkers which could lead to new advances in treatments or diagnosis in the future – watch this space.

One example is a biomarker which might help identify people who will respond better to one chemotherapeutic drug over another. This could change the lives of people suffering from cancer. At present, every individual is given a cocktail of very strong drugs (some with unpleasant side effects) in the hope that one drug will work. Imagine

reducing the severity of side effects a person experiences by giving drug A to an individual whose blood test showed they would respond best to drug A and therefore eliminating the need to also give drug B.

As NWCR continues to fund these new discoveries it is hoped that patients will begin to benefit from individualised treatment of their cancers along with reduced side-effects.

5

PENDING PATENTS
AND LICENCES



7 DEVELOPING THE RESEARCHERS OF THE FUTURE

51 researchers' careers were noted to have been enhanced and progressed as a direct result of funding received from NWCR.

This was across all levels of seniority from Research Scientists to Lecturers and Head of Departments.

Dr Rita Cha (Bangor)

Rita was working at the National Institute for Medical Research in London when an opportunity arose for a five year NWCR Research Fellowship at Bangor University to look at DNA repair in yeast. This was already an area of expertise for Rita but her funding in London was drying up and she had even considered switching to a different area of research. Rita applied to Bangor and was successful in securing the Research Fellowship which was worth over £350,000. In 2013 she moved 275 miles from England to North Wales and has not looked back. "Without this fellowship



I would not have been able to continue with my research looking at how you can repair damages in DNA using yeast. Yeast cells repair DNA damage just like cells in our bodies do, which means that yeast allows us to find answers to important questions in a cost effective and rapid manner"

Rita's career has gone from strength to strength during her 5 years in Bangor. She has just published an article

in a high impact journal Developmental Cell on how damages to proteins affect how cells repair DNA damage and has been promoted to Senior Lecturer guiding the next generation of cancer researchers. She has supervised and supported one PhD student and supervised undergraduate student projects looking at different aspects of DNA repair.

Dr Cha recently secured a full contract to continue her research from the University of Bangor which she says "will provide me with the stability to continue to search for the causes and ways to prevent cancers"

51

ENHANCED
CAREERS

7 DEVELOPING THE RESEARCHERS OF THE FUTURE

Professor Ian Prior (Liverpool)



“NWCR have always been there at key times in my career and provided the resources for me to build a team of successful cancer researchers that have made a real impact in understanding the cancer biology of RAS”.

Professor Sarah Allinson (Lancaster)

When Dr Sarah Allinson first arrived in Lancaster, she was funded by a two year NWCR Research Fellowship which kick started her ability to find further funding and build a team around her specialising in understanding how skin cells respond to damage caused by ultraviolet radiation.

Ian Prior, Deputy Director of the NWCR Centre, undertook his PhD at the University of Liverpool but his interest in particular protein called RAS, which is linked to cancer, began in Queensland, Australia where he held a postdoctoral position for 3 years. In 2003 Ian returned to Liverpool having been awarded a prestigious Royal Society University Research Fellowship to continue his work on RAS biology at the University of Liverpool. Ian applied for a project grant which would be the first of many.

NWCR played a pivotal role in enabling Ian to set up a new lab by funding a postdoctoral researcher and his early lab running costs. NWCR have continued to fund Ian's work since 2003 and NWCR-funded members of his RAS research team at Liverpool have successfully transitioned to their own long-term careers in cancer research. Ian highlights how his own career progression to Professor, Deputy Director of NWCR Centre and an international leader in his field could not have been achieved without NWCR.

Having previously worked at the Harwell Radiation and Genome Stability Unit in Oxfordshire, Dr Allinson moved to Lancaster in the hope of setting up her own research group. A crucial collaboration developed with Trevor McMillan, also based in Lancaster, and Dr Allinson began her journey with further NWCR funding along with Alliance Boots funding to establish herself as a leading expert in the field of UV damage. She became a key advisor for the 'Scrap Sunbeds' campaign in 2014 and is regularly quoted in national

and regional media on the topic of skin cancer. More recently, Dr Allinson has been supporting the NWCR's successful 2018 '#suncreamselfie' campaign which aims to educate and highlight the importance of protecting your skin in the sun.



8 CATALYST OR SEED FUNDING

NWCR funding has opened doors to over £15 million pounds of further funding from other external funding organisations, including government agencies such as Medical Research Council, Biotechnology and Biological Sciences Research Council, National Institute of Health Research, Welsh Assembly and the European Union. Initial NWCR funding has also led to further funding being obtained from other charities or charitable trusts such as The Wellcome Trust, Bloodwise, Cancer Research UK, Crohn's and Colitis UK, Mersey Kidney First, Pancreatic Cancer Research and Breast Cancer Now.

Overseas funding has also been received from Brazil without Borders which enables young researchers from Brazil to work in world-class research laboratories around the world to exchange ideas and learn new skills.

Professor Chris Goldring

In 2005, NWCR awarded a relatively small grant of £23,800 to Professor Chris Goldring which planted the seed for a new avenue of investigation into the effect of anti-oxidant responses to a protein Nrf2 in the fight against cancer of the liver. This protein is important as it is necessary to help our healthy cells defend themselves against chemicals in our environment that may cause cancer; unfortunately, however, cancer cells can use this protein to prevent some anti-cancer drugs from working effectively. Professor Goldring found that the level of this protein varied in different healthy individuals which suggests that our defence against cancer-causing chemicals can vary.

This small pot of money provided evidence which, in concert with other grants, acted as the catalyst for the

receipt of over £5,000,000 of funding during the last 15 years from major funders such as Medical Research Council and the European Union Innovative Medicines Initiative.

The funding from NWCR also partially supported the academic career development of Dr Ian Copple who worked on this project as part of his PhD. Dr Copple now leads his own research team at Liverpool and leads the work on Nrf2 with Professors Golding and Park. Yet another example of how NWCR has played a key role in developing capacity and the research stars of the future.

58

NEW FUNDING
OPPORTUNITIES

**Over £15 million
worth of further funding
developed on the back of
initial NWCR funding.**

9 COLLABORATIONS WITH PHARMACEUTICAL AND TECHNOLOGY COMPANIES

Working with industry is important in translating academic research findings into real clinical benefits for patients, whether by improving current treatments, detection or by repurposing current medicines to tackle different types of cancer. NWCR researchers are working

closely with pharmaceutical companies such as Abbvie, Boehringer Ingelheim, Celgene, Amgen, Astra Zeneca and MedImmune. It is hoped that these collaborations will lead to new diagnostic tools and new treatments for people with cancer in the North West and North Wales.

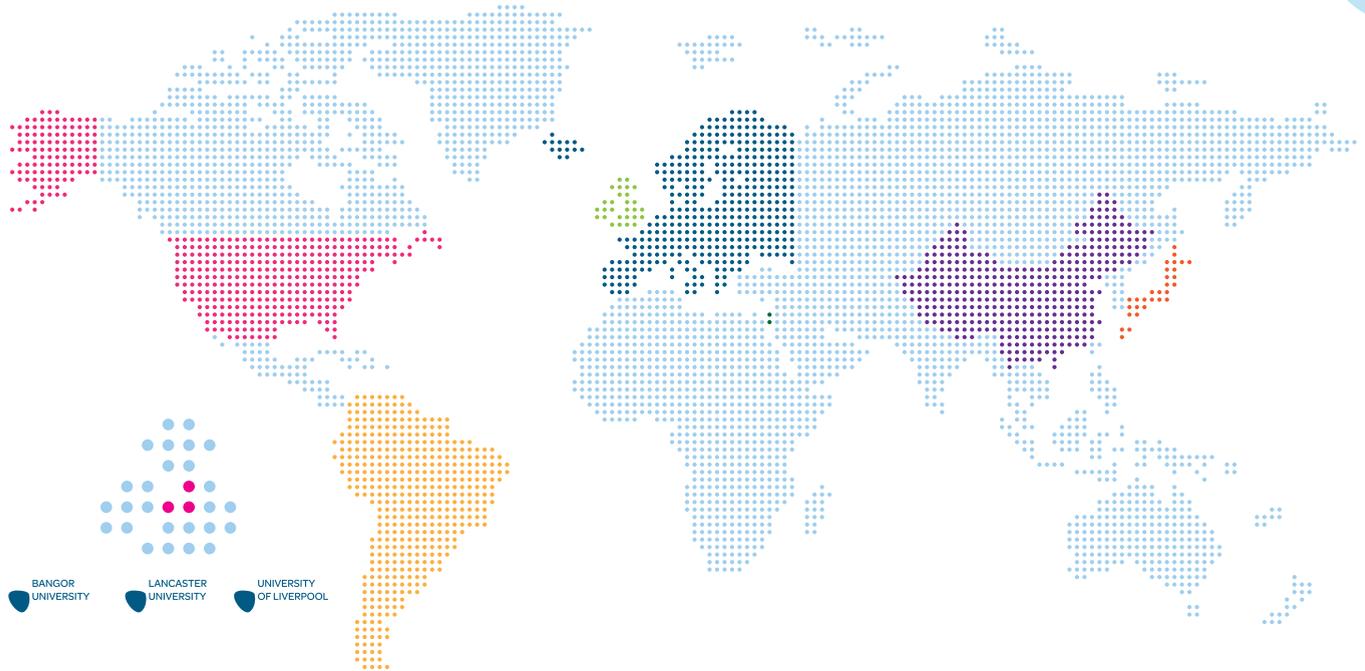


10 WORLDWIDE COLLABORATIONS

**Local impact
on a global
scale**

Cancer affects people across the globe, so research needs to be tackled on a global scale. By collaborating with their international colleagues, NWCR researchers can share their knowledge, discuss their

findings and work with other leading experts in the field to find new ways of treating cancers and improving the lives of people living with cancer.



Collaborations in 19 countries around the world

All the places around the world which the NWCR researchers collaborate with.

UK

Oxford
Manchester
London
Cambridge
Warwick
Birmingham
Glasgow
Southampton
Brighton

Europe

Sweden
Umea
Denmark
Copenhagen
Italy

Turin
Ireland
Dublin
France
Bordeaux
Paris
Netherlands
Amsterdam
Spain
Barcelona
Finland
Tampere
Germany
Berlin
Hungary
Szeged
Sweden

Umea
Norway
Trondheim

USA

Massachusetts
Florida
North Carolina
Texas
Arizona
Virginia
California
South Carolina
Alabama
Nebraska
New York

China

Hefei
Dalian
Chengdu

Japan

Niigata

Israel

Tel Aviv

South America

Brazil
Rio de Janeiro
Argentina
Buenos Aires

10 TYPES OF CANCER STUDIED BY NWCR RESEARCHERS

Although cancer is diagnosed in a particular area of the body, often the biological processes that have led to the development of the cancer in the first place are the same for each type of cancer. It is therefore crucial that in studying why we get cancer we look at the cellular processes and genetic mutations which may make one person more susceptible to cancer than another. NWCR has funded over 51 fundamental basic science research projects looking for the answers to questions like this.

NWCR researchers have been studying genes which may predispose people to certain types of cancer or make their cancer more

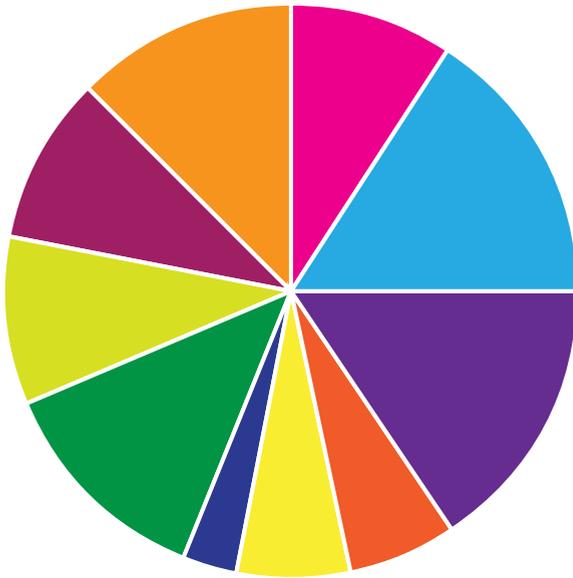
difficult to treat. Genes encode proteins which are the building blocks needed to make cells. If the protein is incorrectly made (i.e has a flaw in it) because there is a mutated gene then the cells and tissues which are made up of these proteins may become dysfunctional. Much work has been undertaken by NWCR researchers at the sub-cellular level looking at how genetic mutations lead to production of incorrect proteins which enable tumour growth.

Research targeted at 10 different types of cancer

NWCR has been instrumental in funding research targeted at 10 different types of cancer. Each cancer poses its different challenges and by learning more about the individual organs and applying their knowledge of how different genes and proteins interact within the tissues, researchers hope to find the answers, improve the lives of people with these cancers and end cancer sooner.

Funding 51 fundamental basic science research projects

Types of cancer studied by NWCR researchers



BREAST
3 PROJECTS

SKIN
5 PROJECTS

COLORECTAL
5 PROJECTS

PROSTATE
2 PROJECTS

HEAD AND NECK
2 PROJECTS

LUNG
1 PROJECT

HAEMATOLYMPHOID
4 PROJECTS

PANCREATIC
3 PROJECTS

OCULAR
3 PROJECTS

REPRODUCTIVE (TESTICULAR/OVARIAN)
4 PROJECTS

10 TYPES OF CANCER STUDIED BY NWCR RESEARCHERS

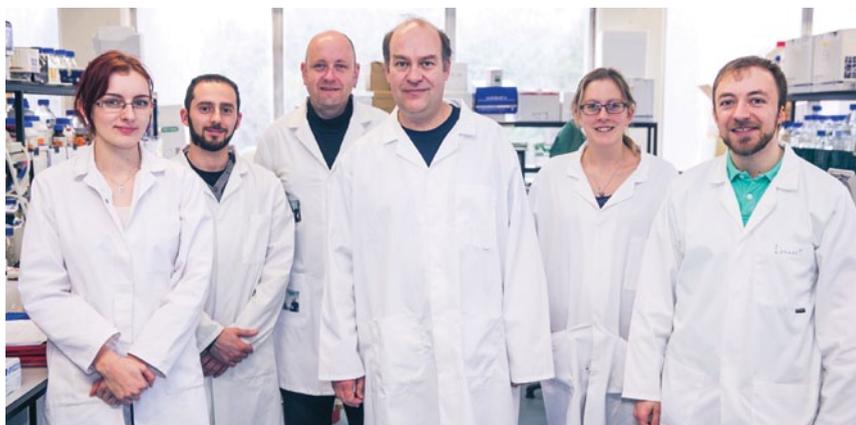
Case Studies:

Bangor University is the leading UK research centre for yeast research.

Dr Edgar Hartsuiker leads a team of researchers at Bangor University who specialise in studying the DNA of yeasts. "It is the question everyone always asks me – why yeasts?" Dr Edgar Hartsuiker explains that because we have studied yeast cells for decades we have a very clear understanding of their cell development and replication

processes and researchers can manipulate or change what the cells do by mutating genes. "Imagine you have a suspect gene which you think might cause cancer. We can manipulate the genome of yeast, inserting mutations into its DNA which model DNA mutations in humans". The researchers can eliminate certain genes from yeast and see what affect it has on cell growth and regulation i.e. whether a particular gene slows down cancer cells or

speeds them up. They have also been using the yeast genome to study resistance of chemotherapy drugs such as Gentamicin. If they can show that having gene mutation X will make you less resistant to a certain drug than having gene mutation Y, then patient treatment can be targeted and individualised saving time and enhancing outcomes for people with cancer.



Liverpool looks at the importance of RAS genes

RAS genes are mutated in 20% of human cancers. The RAS proteins produced by the RAS genes act as signals switching on cell growth. Every day our bodies are removing old cells that have become redundant and producing new cells to help the body to function. RAS proteins play a crucial role in this process and signal the production of new cells. However if a RAS gene becomes mutated, the mutant RAS protein continuously signals for new cells to be produced - resulting in the formation of a tumour. It is known that RAS proteins control a communication network and so there are many routes that RAS can influence to cause cancer.

Professor Prior has received £600,000 of NWCR funding over a ten-year period to look at how different RAS proteins contribute to cancer and to identify the

rewiring that occurs in the mutant RAS communication systems. He says “we now know what all of the important cancer-causing genes are but we don’t yet have a good understanding of the different ways that they talk to each other in different cancers or how they change with treatment. The different wiring of these communication systems in different patients over time is what doctors need to be able to measure and understand so that they can give the right cancer treatments at the right time”.

It’s a bit like knowing the alphabet but not yet being able to properly read or understand the different sets of words present in each tumour. This understanding is needed to be able to pick the very best combination of treatments for each person at each stage of the disease and to avoid undergoing ineffective treatments.

The funding provided by NWCR to Professor

Prior’s lab has improved the understanding of fundamental RAS biology and identified potential therapeutic targets that could eventually stop the mutant RAS proteins from causing cancer. His group is working with partners in the pharmaceutical industry to understand how patients can become resistant to the anti-cancer drugs targeting RAS - with the aim of prolonging the usefulness of the treatments. They are also developing tests using new genome sequencing technologies that they hope will help to individualise treatments for patients in the future.



THE SEARCH FOR BETTER TREATMENTS FOR AGGRESSIVE PANCREATIC CANCERS

Dr Ainhoa Mielgo and her team at Liverpool have a tough fight on their hands.

A characteristic of solid tumours such as pancreatic cancer is that they are surrounded by a variety of non-cancerous cells called stromal cells that include fibroblasts, immune cells such as macrophages, blood vessels and a dense extracellular matrix, which form what is known as the tumour stroma. The non-cancerous cells in the tumour stroma can support tumour progression, metastasis and drug resistance.

With this in mind, Dr Mielgo is studying a type of cancer called pancreatic ductal adenocarcinoma or PDAC. This is highly metastatic (i.e spreads easily) and causes up to 8,000 deaths per year in the UK. Her research is trying to identify why these non-cancerous macrophages in the tumour stroma cause cancer to spread and importantly, how they can be stopped. She says “Tumour associated macrophages are one of the most abundant non-cancerous cells in solid tumours and act as a double edged sword that can either support or inhibit cancer progression”.



10 MORE YEARS OF RESEARCH

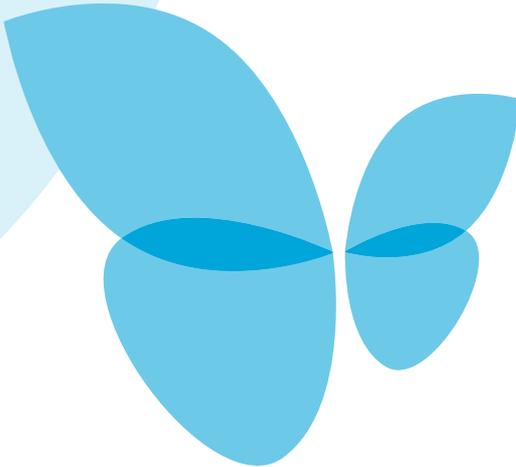
What will the next 10 years hold for our research?

In 2017, our Board of Trustees approved a new strategy considering the areas of research we will fund. It will come as no-surprise that this includes a concentration on the fundamental science which is at the core of so many advancements in cancer research. However, in addition to this NWCR also wants to focus on:

- Cancer treatment to improve the outcomes for patients
- Building the capacity of research institutions in our area
- Cancer inequalities in our region
- The future of research, supporting young researchers to develop their careers
- Understanding the impact which cancer has on our communities

At the core of this, will be a greater focus on the types of cancer which are most important for people in our area. We want to target our resources to ensure that we deliver progress for people and to ensure that we tackle the high levels of cancer which continue to exist in the North West and North Wales.

All of this depends on the funds which we have and the generosity of our supporters. We are ambitious in our aims and will always strive to do more to tackle cancer.





NORTH WEST
CANCER RESEARCH

Research today offers new hopes for tomorrow

Help us stop cancer sooner

You can also tex **GIFT37** with the amount
you wish to donate to **70070**.

HOW YOU CAN SUPPORT NWCR

We couldn't have funded these research projects without our wonderful supporters. If you would like to stop cancer sooner, then please consider the following ways to help.

REGULAR DONATION

Make a regular donation to help our researchers continue their life-saving work. A regular donation is easy to set up and will help us to support research in the areas where it is most urgently needed.

TAKE PART IN AN EVENT

We have a variety of places available in event challenges such as Marathons, 10k & 5ks, walks, swims and even sky dives. Or you could take part in our flagship fundraising event, Cycle of Hope!

If sport isn't for you, we also have a number of cultural and family events, more details of which can be found on www.nwcr.org

LEAVE A LEGACY

A significant amount of funding for NWCR's carefully targeted scientific research comes from generous, caring people who have made the battle to beat cancer part of their life's legacy. Any gift, large or small, makes a real difference and acting now means you can make sure that advances in cancer medicine will continue to benefit local people for generations to come.

There is something for everyone here at North West Cancer Research. Every participant, volunteer and supporter plays a vital role in the cancer research process.

For more information contact
info@nwcr.org or call **0151 709 2919**



www.nwcr.org



NORTH WEST
CANCER RESEARCH

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