OUR RESEARCH STRATEGY 2022 - 2027

MAKING MORE SURVIVORS

breakthrough
CANCER RESEARCH

Chrys Ngwa,
Prostate Cancer Survivor

MAKING MORE BIRTHDAYS, WEDDINGS, MEMORIES

CONTENTS

FOREWORD

We are delighted to share **'Making More Survivors' - Our Research Strategy 2022 - 2027** which sets out how, through research, we plan to significantly impact the survival rates of the poorest prognosis cancers over the next five years.

We passionately believe in the power of research to transform cancer care and the patient experience, having already delivered new treatments with our find smart, fund fast approach. Our focus on the poorest prognosis cancers means we need to urgently have impact to remove the disparity in cancer survival rates between the so called 'good' cancers and 'bad' cancers.

This strategy reflects our ambitious vision to strive for **100% survival for 100% of cancers** through cutting edge patient-focused translational research at every point of the cancer journey. New diagnostics and better treatments are urgently needed. Building capacity and embedding research into the health system will increase the number of people who survive a cancer diagnosis and improve their quality of life during treatment and beyond.

Our core focus over the next five years of the strategy will be to:

- Target greater research investment into the poorest prognosis cancers, which are poorly served by current treatments
- Accelerate the translation of lab discoveries into new effective treatments for people with cancer
- Facilitate greater collaboration between scientists and clinicians across Ireland and internationally
- Build expertise and capacity to move from bench to bedside and from cancer patients back to the laboratory
- Focus on keeping the patient at the centre of all of our activities.

Our focus and specific research priorities have been informed by people with cancer and their families, our Scientific Advisory Committee, our Public Patient Involvement Panel, healthcare professionals, the broader research community and industry. This will be a collective effort as we work with stakeholders who already recognise our past successes and welcome our essential role in changing the future for the hardest to treat cancers, as well as forming new working relationships.

The challenge that Breakthrough is taking on is that, there hasn't been significant change in the survival of some cancers for decades and incidence of those cancers is also rising. We do not shy away from this challenge, instead we have developed a strategy that builds on the best aspects of our previous strategy, and in some ways will narrow our focus for even greater impact.

Research and innovation is by its very nature continuously changing, and as such this strategy will respond and adapt to significant emerging findings in order to have an even greater impact. We must continue to be agile and responsive. What will not change is the focus of our efforts to make more survivors of cancer. We know through research, people with cancer and their families get to have more birthdays, Christmases and moments together. Breakthrough Cancer Research is part of making that happen.

ORLA DOLAN

CHIEF EXECUTIVE

PROF BRENDAN BUCKLEY

CHAIR SCIENTIFIC ADVISORY COMMITTEE

OUR VISION

100% SURVIVAL FOR 100% OF CANCERS

Lily Walsh Curley,
Leukaemia Survivor

ABOUT US

Breakthrough Cancer Research is an Irish medical research charity focused on cancer. We work to significantly impact the number of children and adults who can survive this disease. We invest in world-class research in Ireland and beyond to impact the quality of life for people with cancer and save lives. We are particularly focused on improving outcomes for those cancers, which are poorly served by current treatment options.

Our Charitable Purpose, for which we were established, is the raising and application of money and other resources for the purpose of education, research and development, in the field of cancer prevention, diagnosis and treatment.

Breakthrough funds cancer research that responds to current clinical challenges and offers a clear and demonstrable path to positive clinical outcomes. Research programmes funded by Breakthrough must focus on translating lab discoveries into new treatment opportunities. To this end we work closely with clinicians in practice all over Ireland and internationally so that our research is targeted at finding new options for poor prognosis and currently incurable cancers.

Breakthrough Cancer Research demonstrates openness, transparency and integrity to our donors, supporters, volunteers and funding partners by operating rigorously to the triple lock standards set out by the Charities Institute Ireland – ethical fundraising, transparent annual financial reporting and governance.

We are fully compliant with:

1. **GOOD FUNDRAISING:** Commitment to Standards in Fundraising Practice
2. **ANNUAL FINANCIAL REPORTING:** Statement of Recommended Practice (SORP)
3. **GOVERNANCE:** Governance Code for the Community and Voluntary Sector and Charities Governance Code

OUR MISSION:
MAKE MORE SURVIVORS OF CANCER THROUGH RESEARCH

OUR VALUES

CARING

We have tremendous compassion and empathy for people who are impacted by cancer, and we never forget they inspire the work we do.

INNOVATION

We are at the cutting edge, unstoppable. We will never settle in our pursuit of new discoveries to deliver a better future for people with cancer.

BOLDNESS

We are passionate, pioneering, agile and take action. We are unshakeable in our belief that we will make a difference.

INTEGRITY

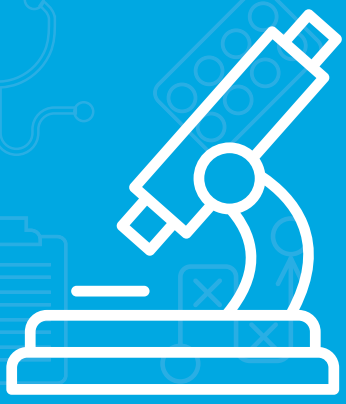
We only invest in the best. We do what is right and deliver what we promise.

ONE TEAM

One team uniting patients, researchers, clinicians and supporters; driven to make more survivors.

HERE IS HOW BREAKTHROUGH CANCER RESEARCH IS DELIVERING

300+
NOVEL DISCOVERIES



8
NEW TREATMENTS DEVELOPED

1000+
PATIENTS TREATED

THE NEED:
MORE CANCER SURVIVORS

Amie Ó Bric,
Bowel Cancer Survivor

1 IN 2 PEOPLE WILL BE DIAGNOSED WITH CANCER IN THEIR LIFETIME

1 PERSON DIES FROM CANCER IN IRELAND EVERY HOUR

More people are surviving cancer every day. But not for all cancers.

We know research is the most effective way of preventing future deaths from cancer. It has already delivered. It is the only proven way to make a difference.

OUR COMMITMENT TO IMPROVE SURVIVAL

We know that research works. Fifty years ago, breast and prostate cancer survival rates were less than 50%. With research funding, they are now over 85%. Still today cancer survival rates are cruelly unequal with some cancers like pancreatic remaining less than 10% (Fig.1).

In twenty years, our aim is that Irish survival rates double for people with poor prognosis cancers – making Irish survival rates among the best in the world.

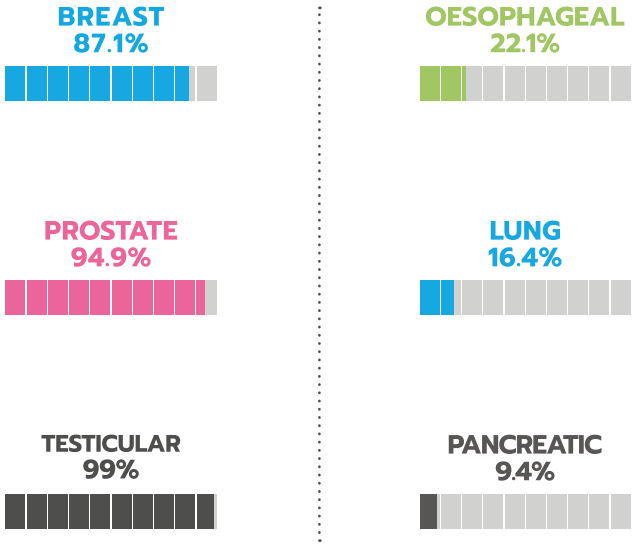


Fig. 1 Cancer Survival Rates in Ireland[1]

We remain committed to delivering new discoveries that will improve the quality of life and outcomes for patients and their families; improving early detection and treatment and supporting research-led innovations throughout the cancer journey.

We are narrowing our focus to have even more impact. We will significantly increase our investment in research over the next five years in the poorest prognosis cancers, prioritising oesophageal, pancreatic, lung, ovarian, stomach, liver and brain cancer research. Wide-ranging fundraising activities by Breakthrough enables this investment in research.

We remain committed to significantly increasing our year-on-year funding to invest in research. Furthermore, we will work to achieve an increase in national and international funding for poor prognosis cancers.

Breakthrough Cancer Research will work tirelessly to make the poorest prognosis cancers a greater national priority. To make the case for increased investment in these research areas, and show how research spending will improve prevention, diagnosis and treatment, improving survival and quality of life for people with these cancers.

This research strategy lays out how, over the next five years, we will work with world leading researchers and with people affected by cancer to support innovative and patient-focused translational research which will make more survivors of cancer.

"OUR AIM IS THAT IRISH SURVIVAL RATES DOUBLE FOR PEOPLE WITH POOR PROGNOSIS CANCERS"

OUR COMMITMENT TO PATIENT INVOLVEMENT

Breakthrough Cancer Research is committed to incorporating the patient voice at the centre of our research activities.

The goal of Public Patient Involvement (PPI) is to improve the quality, relevance and appropriateness of research and to ensure that it meets the needs and expectations of those affected by cancer to the greatest extent possible. In cancer research, the aim of PPI is that research is done with people with cancer, not to them."[2]

Our PPI panel take on many roles in the Breakthrough organisation as a whole, as well as within the research department. This panel is involved in all our research activities, from raising awareness of cancer symptoms, treatment and research advances to being co-creators of our research strategy and priorities. They help researchers, and us as funders, to understand the unmet needs of people with cancer and survivors. They are active in reviewing research applications; and disseminating research findings. PPI representatives have become collaborators on research applications and active participants on grant management committees, with some going on to apply for their own research funding.

"PPI creates dialogue between researchers, funding bodies and patients. I think that input from patients and others affected by cancer can help funding bodies and researchers in terms of their own insights or connection with their research - it takes the research from the theoretical to the practical."
Helen McGonagle, PPI Panellist

"My involvement in the Breakthrough PPI panel has introduced me to a whole new cohort of people - fellow cancer survivors with extraordinary tales to tell, and passionate research scientists who are devoting their lives to helping people like me. I have learned about the huge amount of research work which is going on to benefit cancer patients."
Nuala Ní Bhriain, PPI Panellist

PPI IS "RESEARCH DONE 'WITH' OR 'BY' MEMBERS OF THE PUBLIC RATHER THAN 'TO', 'ABOUT' OR 'FOR' THEM"

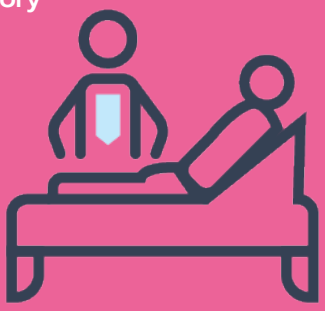
OUR AMBITION FOR THE NEXT FIVE YEARS IS TO:

TARGET greater research investment into the poorest prognosis cancers, which are poorly served by current treatments

ACCELERATE the translation of lab discoveries into new effective treatments for people with cancer

FACILITATE greater collaboration between scientists and clinicians across Ireland and Internationally

BUILD expertise and capacity to move from bench to bedside, and from cancer patients back to the laboratory



FOCUS on keeping the patient at the centre of all of our activities

"This research strategy is building on Breakthrough Cancer Research's decade of success, facilitating patient-focused research.

As we move forward, we are determined to facilitate advances in knowledge of the poorest prognosis cancers through research – to improve prevention, diagnosis and treatment, so that more people survive.

Our ambition, as we work with a growing number of researchers, clinicians, patients, industry and policy makers, both nationally and internationally is to see a doubling in the survival of these poorest prognosis cancers over the next twenty years. We believe that this is achievable through research."

DR. FRANCES DRUMMOND

RESEARCH MANAGER

DEVELOPMENT OF THE STRATEGY

Our original Breakthrough Cancer Research strategy was developed from the vision of our founder the late **Professor Gerry O'Sullivan** and continued following his passing in 2012.

Following a ten year period of delivering that strategy, we updated and developed our new research strategy, through a comprehensive review of all Breakthrough-funded research, outputs, policies, processes, grants programmes (internal and external), and internal resources/capacity, in tandem with a review of the National Cancer Strategy and research funding landscape was undertaken.

The Board, our International Scientific Advisory Committee, Management Team and Public Patient Involvement Panel worked closely to review and revise our research strategy to set out a new five year plan (2022- 2027) to expand and build on the considerable impact of the charity to date and to strive for even greater improvement in the survival of poorer prognosis cancers through research.

Extensive stakeholder consultation was conducted including, but not limited to, researchers, clinicians, allied health professionals, patients, survivors and family members nationally and internationally.

"SURVIVAL FROM THESE CANCERS ARE SO POOR. WE ARE DELIGHTED THAT BREAKTHROUGH ARE FOCUSING ON THEM" PPI PANELLISTS

CONSULTING ON OUR RESEARCH STRATEGY WITH OUR SCIENTIFIC ADVISORY COMMITTEE AND PUBLIC PATIENT INVOLVEMENT PANEL

SIX KEY STRATEGIC RESEARCH PRIORITIES WHICH WILL LEAD THE WAY FOR IMPACT

1. Increase research investment into poor prognosis cancers and currently incurable cancers prioritising lung, oesophageal, ovarian, pancreatic, brain, liver and stomach cancers.

2. Improve integration of cancer research into cancer care in Ireland and increase clinical capacity by prioritising funding for projects and programmes with significant clinical engagement.

3. Fund the discovery and development of new therapeutics, surgical approaches and technologies, including biological and immune approaches, to improve cancer treatment.

4. Fund research which aims to improve the effectiveness or specificity of current cancer therapies including investing in biomarkers discovery, nutrition and therapeutic delivery.

5. Invest in research harnessing the potential of big data to improve cancer detection, personalised treatment and patient outcomes.

6. Invest in research-led innovation at every stage of the cancer patient journey from first diagnosis through to treatment, clinical trials and palliative care to improve survival and quality of life.

Therese Murphy Cahill and Lucy Fahy
Survivors and Patient Representatives

RESEARCH PRIORITY 1

Increase research investment into the poorest prognosis and currently incurable cancers prioritising lung, oesophageal, ovarian, pancreatic, stomach, liver and brain cancers.

WHY THIS MATTERS

Fifty years ago breast and prostate cancer's five year survival rates were less than 50%, with research investment, they are now over 85% and 95% respectively. But cancer survival is unequal. Seven cancers make up almost half of all the cancer deaths annually in Ireland.[1] These lowest prognosis cancers make up 1-in-3 of all invasive cancer (excluding Non-Melanoma Skin Cancer (NMSC)) cases diagnosed annually in Ireland and the incidence of these cancers is increasing. It is estimated that the annual number of pancreatic, oesophageal, stomach, liver and lung cancers will more than double between 2015 and 2045. The annual number of both brain and ovarian cancer cases is also estimated to increase,[3] (see Table 1 & Figure 1).

Survival rates have generally increased, however, survival from these cancers in Ireland varies compared to other countries.[4] Ireland is in the top 9 countries for oesophageal, brain, lung, liver, pancreatic and stomach cancer survival of 23 European countries.[4]

However, Ireland has the second worst survival rate from ovarian cancer among 24 European countries.

Poor prognosis cancers have in common vague symptoms, late diagnosis, usually at an advanced stage, and a lack of effective treatment options. Knowledge of these cancers and their symptoms is poor. Additionally, they are not prioritised and research funding investment has been lower than for other cancers. New approaches for early detection and better treatment are urgently needed. We will find them through research.

KEY ACTIONS

- Target more funding towards research in lung, oesophageal, ovarian, pancreatic, liver, stomach and brain cancers.
- Adjust the focus of existing research and develop new strategic funding programmes to address critical problems in prevention, diagnosis and treatment and advance translation of research to the clinic.
- Leverage our research funding to increase investment into the poorest prognosis cancers using national and international partnerships, joint funding or strategic funding programmes.
- Provide a Breakthrough Innovation grant fund to support early stage pilot and seed projects such as proof of concept research.
- Educate and train researchers from undergraduates to leaders.
- Increase the importance of these cancers as a national priority.

WHY THESE CANCERS...

THE STATISTICS

Seven cancers make up nearly one-third of all new cases and almost half of all cancer deaths each year in Ireland[1]

	5 YEAR NET SURVIVAL	NO. OF CASES ANNUALLY (2015-17)	% OF ALL INVASIVE CANCERS ANNUALLY (N=16,723)	NO. OF DEATHS ANNUALLY (2015-17)	% OF ALL INVASIVE CANCER DEATHS ANNUALLY (N=9,063)
OESOPHAGEAL	24%	444	2.7%	412	4.5%
PANCREATIC	10%	563	3.4%	529	5.8%
LUNG	20%	2589	15.5%	1883	20.8%
OVARIAN	36%	407	2.4%	290	3.2%
BRAIN	24%	455	2.7%	305	3.4%
LIVER	19%	368	2.2%	334	3.7%
STOMACH	30%	570	3.4%	336	3.7%
		4458	32.3%	**3419**	45.1%

PROJECTIONS OF CANCER CASE NUMBERS

The incidence, or number of cases of these seven cancers is estimated to almost double for brain and ovarian cancer and to more than double for oesophageal, pancreatic, lung, liver and stomach cancers from 2015 to 2045[3]

PROJECTION TO 2045

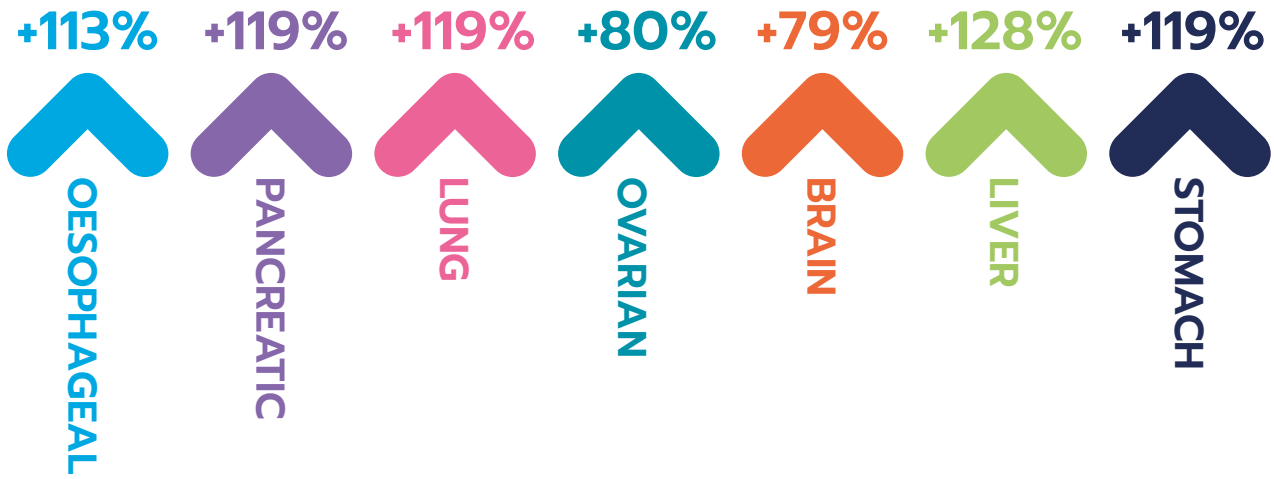


Figure 1: Percentage increase in new cases 2015-45 of seven of the poorest prognosis cancers in Ireland [3]

THE CONCORD STUDY

SURVIVAL IN IRELAND RELATIVE TO 24 EUROPEAN COUNTRIES[4]

RESEARCH FUNDING PROGRAMMES

- Summer Student Scholarship
- Musgrave Breakthrough PhD Scholarships
- Cancer Immunology Research Fellowship (2023)
- Cancer Research Fellowship (2023)
- Breakthrough Clinical Cancer Research Fellowship 2022 – 2027
- Strategic/Leadership Positions

CO-FUNDING PROGRAMMES

Breakthrough has successfully leveraged research funding, and will continue to do so through partnering in co-funding schemes led by national and international organisations. This strategy unlocks the potential to invest in even more research.

EDUCATION CAREER PATHWAY

EDUCATE AND TRAIN RESEARCHERS FROM UNDERGRADUATES TO LEADERS

UNDERGRADUATE

Summer Scholarships

POSTGRADUATE

PhD Scholarships

POSTDOCTURAL

Fellowships

INVESTIGATIVE RESEARCH LEADERS

Strategic Roles & Chairs


10 YEARS
breakthrough
CANCER RESEARCH
OVARIAN
LIVER
LUNG
STOMACH
BRAIN
OESOPHAGEAL
PANCREATIC

RESEARCH PRIORITY 2

Improve integration of cancer research into cancer care in Ireland and increase research capacity by prioritising funding for programmes with significant clinical and patient engagement.

WHY THIS MATTERS

Patient-focused translational research is the ability to move from bench to bedside, and also from cancer patients back to the laboratory to provide researchers with real world insights about the treatment challenges and unmet needs. A receptive community of clinicians, health professionals and patients who are actively engaged in research provide clinical context, patient experience, gather clinical and phenotypic information, participate in the identification of research priorities, and work with researchers to help to lead cutting edge clinical research. These existing and expanding networks are essential to maintain and grow Breakthrough Cancer Research's ability to impact the care and outcomes for people with cancer.

Our initiatives launched over the past few years, encompass career development across the research career trajectory, from training and educating early career researchers through to developing leaders in cancer researchers. These include the Gerald O'Sullivan Endowed Chair in Cancer Research, the Breakthrough Clinical Cancer Research Fellowship and the Breakthrough Summer Scholarship Programme. The following are examples of some of our activities, funding programmes and the researchers undertaking them.

KEY ACTIONS

- Build cancer research capacity across the career development trajectory from undergraduate to research leader.
- Identify and support key strategic cancer research positions to create bridges between the Third Level Academic and Clinical Institutions.
- Embed research and clinical trial expertise in the Irish health system through clinical fellowship programmes.
- Shape and expand the level of patient input in cancer research at all stages of the research spectrum.

PRIORITY 2 IN FOCUS

THE GERALD O'SULLIVAN CHAIR IN CANCER RESEARCH

In 2012, we launched our Memorial Appeal to create the Professor Gerald O'Sullivan Chair in Cancer Research. This new Chair, based in Cork, and jointly funded by Breakthrough Cancer Research and the Health Service Executive (HSE), was identified as a role of critical importance for the region to bring together all cancer research under one umbrella – bringing us into the next generation of ground-breaking research and cancer treatment.

In September 2019, Prof. Roisin Connolly was appointed to this position. Through Prof. Connolly's leadership, Breakthrough Cancer Research looks forward to supporting more ground-breaking research and helping to develop new and better treatments for cancer patients. She brings with her a wealth of experience in translational cancer research. Prof. Connolly was an Associate Professor of Oncology and Co-Director of the Developmental Therapeutics Program at the Sidney Kimmel Comprehensive Cancer Centre at Johns Hopkins University in the US.

PROF. ROISIN CONNOLLY

Prof. Connolly is excited about the opportunity this unique role offers. "Academic consultant positions are few and far between in Ireland. The benefit of these positions is to provide protected time for investigators such that they can take care of patients but also have adequate time for laboratory-based or clinical research."

A key area she will focus on is building a stronger connection between University College Cork (UCC) and regional hospitals. "One of my biggest goals will be to create networking and collaborative opportunities to bring together the basic science researchers and the clinicians so we can ultimately translate positive findings from the lab to clinical trials to improve patient outcomes." She will also work to ensure researchers have the resources they need so they can develop more trials, which will benefit more patients.

"My vision is that patients in Ireland will be able to access the best clinical care and access to clinical trials as is the case in a centre of excellence elsewhere in Europe or the United States." Through Prof. Connolly's leadership, Breakthrough Cancer Research looks forward to supporting more groundbreaking research, and helping develop new and better treatments for cancer patients. "My position would not have been possible without funding from donors to Breakthrough Cancer Research".

Prof. Roisin Connolly

THE BREAKTHROUGH CANCER RESEARCH SUMMER SCHOLARSHIP PROGRAMME

In 2021 we launched the Breakthrough Cancer Research Summer Student Scholarship. This programme is an initiative to facilitate the partnership of students with research teams nationally, and to foster the education of the next generation of cancer research leaders. It is open to researchers across all disciplines in Clinical, Biological, Epidemiologic, Public Health or Allied health fields. Eleven scholarships have been awarded to date across five institutes nationally. This will be an annual programme.

BREAKTHROUGH CLINICAL CANCER RESEARCH FELLOWSHIP PROGRAMME 2022 - 2027

In 2021, we launched the Breakthrough Clinical Cancer Research Fellowship This new programme, which is fully funded by Breakthrough, has been created for medical graduates who are dedicated to a career in the fields of oncology, haematology, or a related discipline. The programme will facilitate patient-focused research in UCC and its associated hospitals to help develop and improve cancer treatments for patients in Ireland. Bringing concepts from inception to completion is just one thing the training program aims to offer. The programme will create an environment where the Fellows will experience the full spectrum of clinical/ translation research and successful applicants can work closely with clinical scientists as well as research teams to take care of cancer patients in the Cork region and nationally.

This programme will provide a high-quality training experience in advance of, or instead of international training opportunities. The fellowship, which will be offered biennially, will also facilitate a certifiable educational experience such as an MD in Clinical Medicine. The first successful Fellow, Dr. Maeve Hennessy started in July 2022.

DR. MAEVE HENNESSY

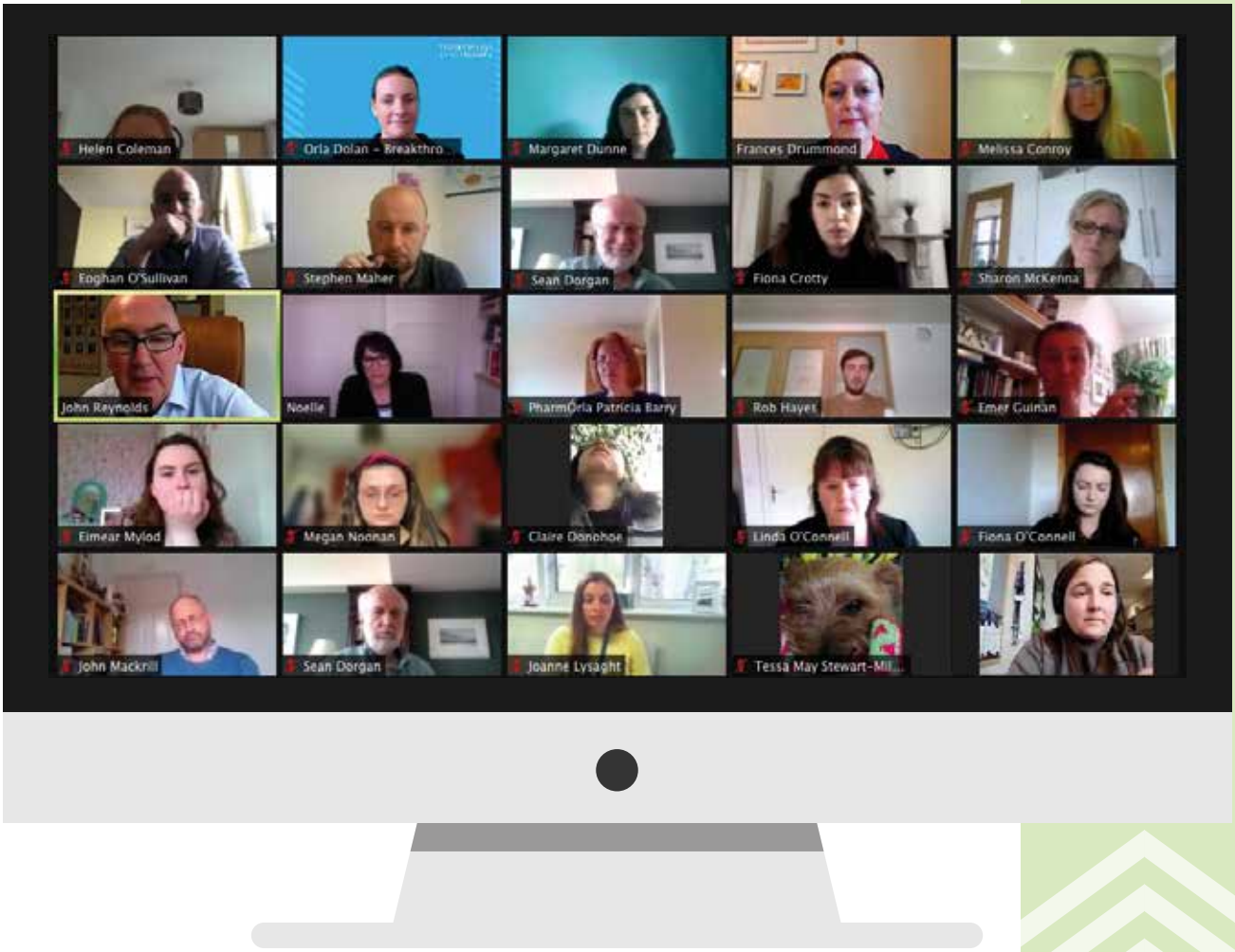
ALL-IRELAND OESOPHAGEAL CANCER SYMPOSIUM

In May 2021, we organised and hosted an All-Ireland Oesophageal Cancer Symposium. This brought together researchers, clinicians, survivors of oesophageal cancer and health charities across the island of Ireland. The theme was; "Doubling Survival by 2040".

This was strategic to understand the research capacity of oesophageal cancer research on the island of Ireland, and initiating the building of a national network of these stakeholders.

During this event, we identified some of the challenges and opportunities towards improving oesophageal cancer outcomes, and methods whereby Breakthrough can strategically organise funding in oesophageal cancer research going forward.

OESOPHAGEAL CANCER SYMPOSIUM



RESEARCH PRIORITY 3

Fund the discovery and development of new therapeutics, surgical approaches and technologies including biological and immune approaches, to improve cancer treatment.

WHY THIS MATTERS

Cancer treatments include the use of surgery, chemotherapy, radiation, and more recently, immunotherapy, targeted therapy or hormone therapy to eliminate a cancer, shrink a cancer or stop the progression of a cancer. But poor prognosis cancers are typically diagnosed at an advanced stage when surgery may not be possible due to tumour size or location. The spread of the cancer can already be so extensive that many of the available therapies are not effective. These cancers can also be resistant to existing treatments. We urgently need to expand our knowledge to increase the diagnostic and treatment options that are currently available.

We also recognise the growing evidence of the influence of bacteria in the tumour microbiome and the role of a patient's immune system in survival.

KEY ACTIONS

- Support research answering current clinical challenges and fulfilling unmet needs across the translational research spectrum, from increased understanding of the biology to translation of findings into clinical care.
- Support the development of new cancer treatments and the optimisation of current treatment modalities.
- Study the role of the immune system and tumour microenvironment in cancer progression and treatment resistance.
- Study the role of the microbiome in cancer.
- Maximise research supported through leveraging funding as partners in co-funding mechanisms.

PRIORITY 3 IN FOCUS

LITHIUM CHEMOTHERAPY CLINICAL TRIAL FOR PATIENTS WITH ADVANCED OESOPHAGEAL - GASTRIC OR COLORECTAL CANCER

In 2022, following a decade of research, where Breakthrough invested €1 million in researchers in UCC, a clinical trial opened and enrolled its first patients.

This lab-based research was led by Dr. Sharon McKenna at UCC. The research focused on cancer in GI tract – oesophagus, stomach (gastric) and colorectal cancers. 3905 people are diagnosed in Ireland every year with these diseases, and they are responsible for almost 1750 deaths annually. Colorectal cancer is the second most common cause of cancer-related death in Ireland (1010 annually). Oesophageal and stomach cancers have two of the lowest 5 year survival rates at just 24% and 30% respectively.

Many of these cancers are not detected early enough for surgery, so chemotherapy is the most common treatment. However, the cancer cells can become resistant to chemotherapy drugs, which limits the treatment options for these patients.

Recognising this challenge, the Breakthrough-funded research explored how cancer cells that responded to chemotherapy were different from those that did not. This research group identified that a cell recycling process called autophagy (self-eating) enabled the cells to repair themselves and recover. The researchers found that adding lithium to a chemotherapy regime blocks the cancer cells' ability to repair the internal damage normally caused by chemotherapy. They found that this makes the chemotherapy more effective and reduces the risk of the cancer returning again.

DR. TRACEY O'DONOVAN & DR. SHARON MCKENNA

Following on from this important finding a Phase 1 clinical trial was opened in February 2022, whereby a small number of patients receive Lithium and chemotherapy. Lithium has been used before as a mood stabiliser in the treatment of neurological disorders – but not in combination with chemotherapy, so this is a novel concept that is being tested in the Phase I clinical trial. During the clinical trial, the clinical research team will monitor the safety of combining lithium with standard chemotherapy, over a range of doses. It will also establish how well lithium works with a combination of chemotherapy drugs - Oxaliplatin and Capecitabine to treat patients with advanced oesophago-gastric or colorectal cancer. Because this is an alternative use of a known drug (lithium), it is likely to have a shorter timeframe to be adopted for treatment, should it prove safe after completion of this initial trial phase.

THERAPEUTICALLY REMODELLING THE IMMUNE PROFILE OF 'COLD' TUMOURS IN OBESITY-ASSOCIATED CANCER

Obesity has been linked with an increased incidence of oesophageal cancer and poorer survival. Dr. Melissa Conroy, Trinity College Dublin was awarded the 2021 Breakthrough Cancer Research Immunology Fellowship in partnership with '5ForTheFight'. Dr. Conroy will investigate the role of the immune system in cold tumours – tumours which do not induce a strong immune response, in obesity-induced oesophageal cancer.

DR. MELISSA CONROY & PHD STUDENT CAROLINE MARION

Natural killer (NK) cells are the cancer-killing assassins of the immune system. Dr. Conroy's group have reported that NK cells in obese oesophageal cancer patients are pulled into the visceral fat by a protein called fractalkine. Once in the fat, NK cells are profoundly altered and die and therefore cannot reach or destroy the tumour. Consequently, highest obesity levels are linked to the lowest numbers of NK cells in oesophageal tumours.

This group have demonstrated that a drug called a CX3CR1 antagonist blocks fractalkine from pulling NK cells into the fat. The aim of this research programme is to evaluate whether this drug can free NK cells to move towards and kill oesophageal tumours. Secondly, they will examine if NK cell therapies can be edited to bypass the fat and boost tumour death in oesophageal cancer.

Ultimately, they will confirm whether two novel immunotherapies have the potential to improve survival in oesophageal cancer.

Some of this work builds on the findings by the 2019 Breakthrough-funded PhD Scholar Eimear Mylod with supervisor Dr. Conroy.

EIMEAR MYLOD PHD SCHOLAR

5 FOR THE FIGHT

qualtrics XM

breakthrough CANCER RESEARCH

INVESTIGATING DNA MUTATIONS IN CHILDHOOD SARCOMA

PROF. MAUREEN O'SULLIVAN

Over the last 40 years there has been little improvement in patient outcomes for cancers of connective tissue origin, known as sarcomas, which include bone, soft tissue and some organ-based cancers. Sarcomas are rare cancers but they make up a large proportion of the cancers that affect children.

Professor Maureen O'Sullivan, Consultant Paediatric Pathologist, Children's Health Ireland (CHI), Crumlin & Trinity College Dublin is investigating one such cancer, clear cell sarcoma of kidney (CCSK)

Prof. O'Sullivan's group has made some significant discoveries about CCSK. During this project, the group will investigate genetic mutations in proteins called non-Canonical Polycomb Repressor Complex 1 (NC-PRC1). These proteins are important in development by controlling which genes, or pieces of DNA are turned on and off. Prof. O'Sullivan will investigate whether mutations in these proteins have an effect in CCSK and work with a strong team of international collaborators as they progress this work.

The ultimate goal of this research, funded by Breakthrough in partnership with the 2020 HRCI-HRB Joint Funding Scheme, is to greatly deepen our understanding of how genetic mutations can lead to CCSK developing, which will in turn lead to better treatments.

An exciting aspect of this project is that the mutation in this protein (NC-PRC1) also drives several other uncommon cancers and therefore everything we learn about NC-PRC1 in this project will be beneficial to those patients also.

BACTERIA AND CANCER

PROF. MARK TANGNEY

The role of the microbiome of cancer patients represents an evolving area of research. Breakthrough have been funding the research of Prof. Mark Tangney, who obtained his professorship in 2021, to investigate the role of the microbiome in cancer for well over a decade.

Through this support, Prof. Tangney was one of the first scientists to recognise that there are differences in the composition of the gut microbiome between different cancer patient groups. The existence of a tumour microbiome is an area of intensive research.

Prof. Tangney and others have conducted research assessing the viability of using the ability of bacterial colonisation of tumour environments as a diagnostic reporting tool, and also the affect of endogenous bacteria on chemotherapy. Breakthrough continue to fund his research on the impact of this 'oncobiome' (microbiome in cancer), and where this might take us in terms of cancer medicine.

INVESTIGATION OF NOVEL DRUGS IN CHEMOTHERAPY-RESISTANT OVARIAN CANCER

Dr. Marion Butler is a research group leader based in Maynooth University. A key focus of her group is to advance progress on ovarian cancer treatment through research. Breakthrough has supported Dr. Butlers' research through two Breakthrough Cancer Research project grants, as a charity partner in an Irish Research Council (IRC) New Foundations award, and an IRC Enterprise Partnership Award.

DR. MARION BUTLER

Ovarian cancer, the most lethal gynaecological cancer is typically diagnosed at a late stage, with 80% of people presenting at an advanced stage. Treatment usually involves major surgery and chemotherapy. But for 70% of patients, the cancer returns and patients receive chemotherapy again. Eventually, chemotherapy stops killing the cancer cells and this is called 'drug resistance.' These patients then face treatment with other drugs which have proven less successful. For this reason, we need to find new treatments for people with ovarian cancer.

Dr. Butler and her team have found that ovarian cancer cells grow much slower when they block a small number of proteins from working in the cancer cells. Dr Butler's team plan to measure the levels of these proteins in tumour biopsies taken from patients, to understand more about the biology of this disease. Importantly, blocking these proteins also reduces the growth of 'drug-resistant' ovarian cancer cells. The team are working to understand how targeting these proteins reduces the growth of chemotherapy-resistant ovarian cancer cells.

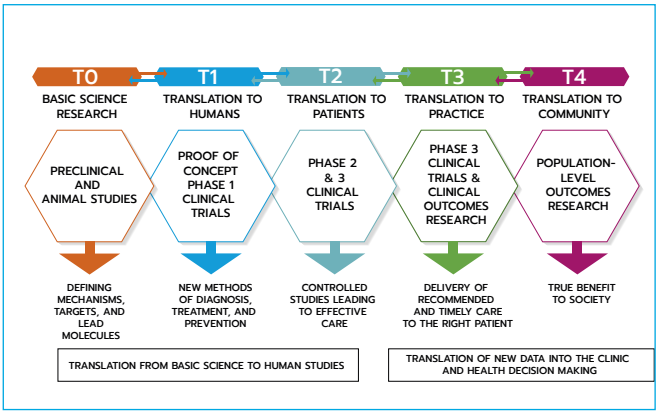
RESEARCH PRIORITY 4

Fund research which aims to improve the effectiveness or specificity of current cancer therapies including investing in biomarkers discovery, nutrition and therapeutic delivery.

WHY THIS MATTERS

The experience of people diagnosed with a poor prognosis cancer can often be characterised by rounds of non-specific therapeutic drugs; repeated cycles of treatment in hope rather than expectation, followed by the development of treatment resistance or treatment failure.

A lack of targeted drugs or biomarkers can have people going through unnecessary treatment when doctors cannot conclusively predict, in advance, who will benefit from available approaches. We need more specific and kinder treatments for these cancers. We also need better diagnostics to diagnose these cancers earlier, when they will have more treatment choices, and to determine which medical treatments will work best for each person.



The spectrum of translational research[5]

We fund research across the spectrum of translational research.[5] The following pages highlight some research projects which are aimed at addressing this priority.

KEY ACTIONS

- Support basic laboratory research to identify or define precise targets with potential for improved treatment specificity.
- Increase the effectiveness or specificity of current treatments through research to improve delivery of therapeutics.
- Invest in research aimed at improving earlier detection or therapeutic decision making through biomarker discovery.
- Expand evidence-based interventions, including nutrition information and resources for patients in treatment.

PRIORITY 4 IN FOCUS

NOVEL METHODS OF DRUG DELIVERY

PROF. JACINTHA O'SULLIVAN

Oesophageal cancer has a very poor response to treatment. This cancer is on the rise in Ireland and is linked with increasing obesity rates. Unlike other cancer types, we are still only using treatments that have existed for decades, chemotherapy drugs with radiation treatment (CRT) to kill the cancer cells, followed by surgery. However, 7 out of 10 patients do not respond to treatment so we need to increase our understanding of the tumour microenvironment and make tumours sensitive to treatment.

Prof. Jacintha O'Sullivan's group in Trinity St. James Cancer Institute is investigating a number of ways to improve drug delivery and the effectiveness of current treatment in oesophageal cancer.

GOLD-DRUG: TARGETING A NOVEL DUAL INHIBITOR DRUG WITH GOLD PARTICLES TO IMPROVE RADIATION RESPONSE IN OESOPHAGEAL CANCER

Cancer cells do two things to prevent radiation from killing them, they:

(1) generate a lot of energy

(2) send out signals to trick your body, for example, they encourage blood vessels to grow to the tumour so it can get more nutrients.

This allows the tumour to survive instead of dying. Prof. O'Sullivan's group, discovered a novel drug called CC8 that stops cancer cells doing these two things in oesophageal cancer cells and can increase response to treatment in resistant cells.

DR. SIMONE MARCONE

Dr. Simone Marcone, a post-doctoral researcher in this group is using this drug packaged with tiny gold particles in patient tumour samples and in mouse studies. They believe that this packaging will make the drug go to the tumour and target the powerhouse of the cells that provide the energy for the cancer cells to survive. The aim is to see how well this new combination works in oesophageal cells in the lab, in mice and patient tumour samples. This research is funded through a 2018 HRCI-HRB joint funding scheme with Breakthrough Cancer Research as the charity partner.

BOOSTING OXYGEN DIFFUSION IN THE RADIO-RESISTANT OESOPHAGEAL TUMOUR MICROENVIRONMENT TO IMPROVE RADIATION RESPONSE

Maitiú Ó Murchú was awarded a Breakthrough Summer Scholarship 2021 and the Breakthrough Cancer Research PhD Scholarship 2021. He joined Prof. O'Sullivan's team and is working in collaboration with Dr. Helena Kelly in the RCSI.

Maitiú's research tests if non-response of oesophageal cancer cells to radiation is due to a reduced level of oxygen in the tumour. He will investigate if this can be fixed by increasing oxygen levels using the new hydrogel, Oxygel, an oxygen-carrying gel which can be injected directly into the tumour.

This project will use oesophageal cancer cells which are resistant to radiation and tumour samples, consented by oesophageal cancer patients, to determine whether Oxygel improves response to radiation. His findings will contribute towards a pre-clinical data package where Oxygel could be used as a new treatment approach for oesophageal cancer patients, particularly for those who do not respond to radiation treatment.

MAITIÚ Ó MURCHÚ

MAKING A BLOOD OR URINE DNA TEST FOR THE EARLY DETECTION OF OVARIAN CANCER

Ovarian cancer has a 5-year survival rate of 36% in Ireland, with 6 in 10 cases diagnosed at an advanced stage. When caught early, survival doubles, and still there is no specific screening test for this disease.

ASIA JORDAN

Asia Jordan received an IRC Enterprise Partnership Scheme Award with Breakthrough as a partner in 2021 and is working in the lab of Dr. Antoinette Perry in UCD. Asia's research aims to identify DNA markers that could be used to detect ovarian cancer at an early stage using blood and/or urine. If successful, this project could lay the foundations for development of this test to improve the detection and survival from this lethal disease.

ELECTROCHEMOTHERAPY AS A FRONTLINE CANCER TREATMENT

Electrochemotherapy is a targeted localised therapy for malignancies of skin and non-skin origin. It has been gaining wide acceptance into clinical practice since the initial standard operating procedures were developed in an international multicentre clinical trial including Cancer Research at UCC. Additionally, electrochemotherapy for cutaneous tumours is becoming increasingly established in patients who are unable to undergo more conventional treatment due to advanced disease state or co morbidities.

PROF. JIM CLOVER

DR. PATRICK FORDE

The Cork group consisting of Prof. Jim Clover, Plastic Surgeon Cork University Hospital and Dr. Patrick Forde, Senior Research Scientist with the support of Breakthrough Cancer Research has remained central to the development of this technique and is a global leader in the advancement of this treatment and its delivery.

DR. DECLAN SODEN

The aim of this research is improving the quality of care for cancer patients, in the early curative phase of their treatments, improving survivorship and also in improving quality of life in later stage palliative care. This is achieved by liaising with clinical teams patients, families, caregivers and the wider community care services to ensure the patients receive to best possible care. Breakthrough are funding a number of electrochemotherapy research projects nationally including investigating its potential in lung and pancreatic cancer treatment in UCC.

Internationally, we are supporting research by Prof. Merete Haedersdal in collaboration with Dr. Soden, Mirai Medical, to develop a more effective methods for treating skin cancers, using electroporation. The goal of this research is to develop a simpler, more patient-orientated treatment solution that minimises the patient risk and also reduces the costs for both patient and hospital.

PROF. MERETE HAEDERSDAL

USE OF EXHALED BREATH CONDENSATE TO DETECT MUTATIONS IN LUNG CANCER

PROF. BRYAN HENNESSY

Lung cancer is the biggest cancer killer in Ireland and the 5-year survival is 20%. Lung tumours are known to have a number of different types of cells, each with different changes (mutations) in their DNA. Some mutations increase the risk of lung cancer recurrence after the tumour is removed through curative surgery.

It is not known how best to monitor patients after curative surgery or predict those whose cancer will return. Blood samples have been investigated to identify the mutations in a patient's lung cancer cells. These are called "liquid biopsies". Taking blood samples from patients is safer for patients than invasive biopsies. However, a large study has shown that blood-based liquid biopsies have predicted cancer recurrence in less than half of patients. In patients with adenocarcinoma (the most common type of lung cancer) this success rate was less than 1 in 5 patients. So while promising, blood-based testing is not always reliable for clinical use and needs to be improved.

This research group have shown that lung cancer mutations can be detected in the breath samples of patients. Indeed, breath analysis was better than blood-based testing. In 2020 Professor Bryan Hennessy at the RCSI received a HRCI-HRB joint funding scheme with Breakthrough as the charity partner to investigate whether breath analysis can be used to predict which cancers will return. This information is important in determining treatment decisions.

Prof. Hennessy believes that their breath tests can be used to meaningfully compliment the current blood-based approach and be used to improve outcomes for lung cancer patients.

IDENTIFICATION OF CHANGES IN THE MOST COMMON BRAIN CANCER, GLIOBLASTOMA, WHICH COULD HAVE THERAPEUTIC IMPACTS

Glioblastomas are aggressive primary brain tumours with limited treatment options. They are the most frequently diagnosed brain tumour and have a very poor prognosis with only 5% of patients still alive five years after diagnosis.

Natural and synthetic vitamin A derivatives called retinoids reduce the growth of tumours in various cancer types. This effect is via proteins in the cell called the retinoic acid receptors. These proteins control pathways that can increase or reduce cell growth.

PATRICIA FLYNN

Patricia Flynn, UCC was awarded the Musgrave PhD Scholarship, in association with Breakthrough Cancer Research, 2021. Patricia works with supervisors Dr. Andre Toulouse and Dr. Colette Hand. They are investigating which of these receptors are expressed in glioblastomas and if these proteins effect the tumour properties. Their aim is to identify proteins that reduce the growth of glioblastoma cells and attempt to modulate their activity using specific retinoids. In this way retinoid therapy might become a novel therapeutic option to offer to specific cancer patients.

RESEARCH PRIORITY 5

Invest in research harnessing the potential of big data to improve cancer detection and personalised treatment outcomes for people with cancer.

WHY THIS MATTERS

Cancer is a complex disease that involves many faults in the levels of DNA, RNA, protein and metabolites. Studies investigate each of these fields of biology - Genomic, Transcriptomic, Proteomic and Metabolomic research aims to systematically understand cancer at different biological levels.

This research generates large amounts of data which offers significant potential to increase the understanding of the disease, and to lead to advances in predictive, preventive and personalised medicine.

With world class computational capabilities this data along with other information on a persons' cancer, clinical teams can analyse and interpret the data to provide actionable insights.

Poor prognosis cancers are not the same in everyone and so every person deserves treatments that reflect that; a personalised treatment plan based on their unique profile.

"THE UNDERUTILISATION OF FAMILY HISTORY, OF GENETICS AND GENOMICS IS A MASSIVE BARRIER TO PEOPLE IN THIS COUNTRY, AND THE USE OF BIG DATA AND BRINGING IT ALL TOGETHER IS SO IMPORTANT FOR ADVANCING RESEARCH KNOWLEDGE AND PATIENT OUTCOMES." - ROBERTA HORGAN, PPI REPRESENTATIVE.

KEY ACTIONS

- Support basic laboratory research to harness expertise in the use of big data including data linking, computation modelling and artificial intelligence and apply to cancer diagnostics and treatment.
- Support strategic partnerships to build collaborations and infrastructure leveraging genomic discoveries to diagnose and treat incurable cancers.
- Support research into personalised and precision medicine for improved treatment outcomes.

PRIORITY 5 IN FOCUS

Precision Oncology Ireland (POI) is a unique consortium of five Irish Universities, six Irish Cancer Research Charities, including Breakthrough Cancer Research, and seven companies.

The aim of POI is to develop new diagnostics and therapeutics for the personalised treatment of cancer. Precision (or 'personalised') medicine uses data about a person's genes (genomics), along with additional information on their cancer, to understand the unique pathways of a disease or treatment response in that person.

With this new science, doctors can prescribe the right treatment in a timely fashion, saving the wasted resources and time our current 'trial and error' method incurs, while greatly improving response rates.

POI is a €11.9 million research collaboration in the field of precision oncology, which is supported by the Science Foundation Ireland (SFI) matched by a €6.9m investment from the Charity and Industry partners making up the POI Consortium – the first time that researchers, charities and industry have combined forces in this way.

In UCC, the team led by Prof. Mark Tangney consists of Ciaran Devoy (PhD Student and Dr. Yensi Flores (Postdoctoral scientist). The research of Prof. Tangney has been supported by Breakthrough for the last two decades. Through this support, The Tangney lab UCC, was one of the first to discover that bacteria exist in patient tumours, and were the first to describe a 'Tumour Microbiome'. Prof. Tangney, as part of POI, is investigating the potential of the bacteria in the diagnosis and treatment of cancers.

PROF. ROISIN CONNOLLY, PROF. MARK TANGNEY (PI), ORLA DOLAN, DR. FRANCES DRUMMOND, EOGHAN O'SULLIVAN

IDENTIFICATION OF PREDICTIVE BIOMARKER SIGNATURES TO ASSIST THERAPEUTIC DECISION-MAKING IN MULTIPLE MYLEOMA

DR. DESPINA BAZOU & PROF. PETER O'GORMAN

Prof. Peter O'Gorman, Consultant Haematologist received a 2020 HRB-HRCI joint Funding Scheme Grant with Breakthrough Cancer Research as the charity partner. His research focuses on Multiple Myeloma (MM). MM is an incurable cancer that originates in plasma cells, a type of white blood cell that makes antibodies.

MM is the second most common blood cancer with approximately 103,000 newly diagnosed cases per year worldwide. Treatment of MM has substantially changed over the past decade with the introduction of several classes of effective drugs that have greatly improved response rates.

However, drug resistance to therapy, at diagnosis or during a patient's treatment is a major problem and ultimately leads to death. Identifying the mechanisms of drug resistance will allow the development of new therapies that can overcome this problem.

This research aims to discover unique protein signatures of MM cells and their microenvironment (i.e. bone marrow stromal cells) that will help us understand why such resistance to therapy develops. The identification of these protein signatures will aid in the development of potential biomarkers to improve diagnosis and therapy.

"Using cutting edge research techniques, we hope to identify new biomarkers that we can harness to develop new tests that will allow us to pick the best treatment for the patient.

Charitable donations are vital in these uncertain times and are greatly appreciated by the research community." Prof. Peter O'Gorman

RESEARCH PRIORITY 6

Invest in research-led innovation at every stage of the cancer journey from first diagnosis through to treatment, clinical trials and palliative care to improve survival and quality of life of those with poor prognosis cancers.

WHY THIS MATTERS

People diagnosed with cancer interact with the health system and supportive services from the time of diagnosis through treatment and, if not cured, during palliative or end of life care. Each of these stages offer opportunities for research-led innovations to improve their experiences and outcomes.

We have more survivors now than ever. However, people who complete treatment may be left with reduced quality of life due to the impact of the disease and treatment. There are also people living long term with very advanced cancers but with stable disease. These new realities offer opportunities to redefine and redevelop our approaches to people's care throughout their experience to find ways to improve survival and quality of life.

1 IN EVERY 25 PEOPLE ARE SURVIVORS OF CANCER IN IRELAND

IRELAND HAS OVER 200,000 SURVIVORS

KEY ACTIONS

- Identify and support research and evidence-based interventions in allied health disciplines to improve survival or quality of life at every stage of a cancer pathway from early diagnosis to palliative care.
- Recognise and invest in treatments and interventions which significantly extend survival of patients with advanced cancer even if not curative.
- Highlight the impact of the poorest prognosis cancers at a national and policy-level.

PRIORITY 6 IN FOCUS

EVIDENCED-BASED NUTRITIONAL INTERVENTIONS FOR CANCER PATIENTS AND SURVIVORS

Breakthrough have supported the research of an exceptional team of registered dietitians in UCC led by Dr. Aoife Ryan, to develop and share evidence-based information, resources and recipes to support people with cancer and their families both in active treatment and post treatment. These resources are endorsed by the National Cancer Control Programme (NCCP), Irish Nutrition and Dietetic Institute (INDI), Irish Society for Clinical Nutrition and Metabolism (IrSPEN) and Irish Society of Medical Oncology (ISMO).

Eating a nutritious diet is essential during cancer treatment. Research has shown that weight loss caused by cancer and cancer treatment can reduce response to treatment, increase treatment related side-effects and reduce overall survival. This type of weight loss is stressful and can majorly affect people's overall quality of life and survival.

The Anti-Cancer Cookbook

A healthy diet includes a variety of foods including carbohydrates, protein, fats, vitamins and minerals. A diet rich in energy and protein helps people maintain a healthy weight during cancer. Side effects caused by the disease or its treatment can often make eating and maintaining a healthy weight a difficult task. Keeping well-nourished is vital for recovery and yields many physical and mental benefits. These award-winning resources have been made available free of charge to hospitals and cancer support centres nationally.

They include:

- Good Nutrition for Cancer Recovery
- Eating Well with Swallowing Difficulties
- Healthy Eating for Cancer Survivors
- The Truth Behind Food and Cancer

USE OF 3D PRINTING IN THE DESIGN AND MANUFACTURE OF BESPOKE SEALING DEVICES FOR ASCITIC DRAINS FOR PALLIATIVE CARE OF OVARIAN CANCER PATIENTS

EMMAJUDE LYONS

Ovarian Cancer is the leading cause of gynaecological cancer-related mortality in western countries. Stage 4 ovarian cancer is associated with a build-up of fluid in the abdominal cavity termed ascites. The standard treatment of ascites is the placement of an ascitic drain in the abdomen to remove this excess fluid (paracentesis).

Many people receiving palliative care for ovarian cancer require long term, semi-permanent ascitic drains. These drains come in standard sizes despite the wide range of individual needs and body shapes. This 'one size fits some' model is indicative of the commonly accepted neglect of innovation in women's health generally.

There are several challenges with current ascitic drains that greatly affect the quality of life of people with ovarian cancer;

- Controlling the rate at which the ascitic fluid is removed is crucially important to prevent intra-vascular volume depletion (hypotension) and renal impairment
- Leaking drains are associated with an increased risk of peritonitis and other adverse outcomes, such as mechanical irritant dermatitis around the entry/exit site
- Increased intra-abdominal pressure can lead to profuse leakage around the drain at the abdominal exit site due to inadequate sealing. In such cases, the ascitic fluid soils the patient's clothing and bed linen, leading to discomfort, embarrassment, and lack of dignity.

EmmaJude Lyons, a PhD student, received funding from Breakthrough and the Irish Research Council (IRC) to work in the University of Limerick in the lab of Prof. Leonard O'Sullivan. EmmaJude will develop bespoke 3D printed solutions to enhance the functionality and improve the quality of life of palliative care of ovarian cancer patients living with long-term ascitic drains.

INVESTIGATING THE VALUE OF DETECTING SUBCLINICAL LYMPHOEDEMA AMONG CANCER SURVIVORS

Lymphoedema, is a complication of the treatment of many cancers, most commonly breast cancer, colorectal cancer, melanoma and genitourinary cancers. In Ireland, it is estimated that there may be 1,500 new cancer-related lymphoedema cases per year, but there is a lack of data regarding lymphoedema following a cancer diagnosis.

Early assessment and diagnosis of lymphoedema is very important if intervention, is to be commenced early, to minimise the impact and progression of cancer-related lymphoedema.

This study aims to investigate the value of detecting subclinical lymphoedema to facilitate an early detection, early intervention philosophy; this is known as prospective surveillance. Research has already shown that by using this method, lymphoedema can be detected up to 10 months earlier than by clinical surveillance alone. This means that treatment can be commenced earlier, making a difference to the quality of life to those with cancer-related lymphoedema.

This study will investigate the value of prospective surveillance for those at risk of cancer-related lymphoedema using the SOZO® device. The SOZO device is the world's first interactive healthcare device to use ImpediMed's patented Bioimpedance Spectroscopy (BIS) technology to monitor a person's fluid and hydration status and body composition accurately measuring the amount of fluid in tissues allowing for even the smallest amount to be detected. This study will investigate the impact of early detection and treatment of lymphoedema on the quality of life of people with cancer.

DR. CONLETH MURPHY, BON SECOURS HOSPITAL, DR. DEIRDRE O'MAHONY, BON SECOURS HOSPITAL, COLETTE CUNNINGHAM, SCHOOL OF PUBLIC HEALTH, UNIVERSITY COLLEGE CORK AND MEADBH MACSWEENEY, THE LYMPHOEDEMA CLINIC CORK

WOMEN'S CANCER SURVIVORSHIP:

SUPPORTING AND INNOVATING FOR CHANGE

This Women's Cancer Survivorship initiative consists of a multidisciplinary team funded by Breakthrough Cancer Research and the Irish Cancer Society. The aim of this two-year project is to develop a nurse-led Women's Cancer Survivorship Clinic within the HSE South/South West Hospital Group.

This clinic will span the hospital system, community services (e.g ARC House Cancer Support) and the Irish Cancer Society-funded Daffodil Service on site at the CUH as well as other national survivorship efforts. The goal of this clinic is to identify and manage important symptoms experienced by women impacted by the effects of cancer treatment. These will include cancer-related fatigue, sexual health issues including menopausal symptoms, nutrition and exercise. This project also aims to educate both the women impacted and clinical teams regarding important survivorship symptoms and their optimal management and to provide easy web-based access to information for patients and clinical teams. In addition, patient-reported outcomes collected electronically during this two year project will be used for research purposes to assess the impact of clinical services and current/ future patient needs. It is hoped that this clinic will lead to a decrease in the frequency and burden of symptoms among women who have been treated for breast and gynaecological cancer and to improve their quality of life.

DR. LAIA RAIGAL, PROFESSOR ROISIN CONNOLLY, PROFESSOR JOSEPHINE HEGARTY, KATE O'CONNELL AND ANDREA DAVIS

HIGHLIGHTING THE IMPACT OF POOR PROGNOSIS CANCERS

Breakthrough Cancer Research are committed to highlighting the impact of the poorest prognosis cancers at a national level - both among the general public and among policy makers. We are dedicated to giving back to the community, with knowledge, empowerment, prevention strategies, earlier diagnosis, new treatments and survivorship supports to reduce the burden of cancer on society.

As an organisation, we approach this in a number of ways;

- Funding calls to address policy issues
- Membership of committees nationally
- Dissemination activities

PROF. JIM CLOVER AND DR. DEARBHAILE COLLINS

PATIENTS' ACCESS TO ADVANCED CANCER THERAPIES: ETHICS AND EQUITY OF ACCESS

Breakthrough Cancer Research partnered with Prof. Aisling McMahon, Maynooth University, in an IRC New Foundations Grant in 2020 to investigate patients' access to advanced cancer therapies: Ethics and Equity of Access. This project investigates the legal and ethical issues around delivering access to advanced cancer therapies, focusing on Chimeric Antigen Receptor T-cell Immunotherapy (CAR-T). CAR-T therapy involves isolating a patient's T-cells, which are engineered to attack the patient's cancer cells when placed back into the body. It offers immense potential for cancer-care, and where successful can lead to full remission of cancer.

However, CAR-T therapy can also pose risks of life-threatening side-effects in some cases, and careful choices around who would benefit from access to such therapies are needed. Furthermore, due to the costs of CAR-T therapy it is not currently accessible to all patients. This project examines the legal and ethical issues around the provision of and access to CAR-T therapies for patients.

PROF. AISLING MCMAHON

CANCER PREVENTION

THE IRISH CANCER PREVENTION NETWORK

Breakthrough Cancer Research, along with the Marie Keating Foundation, the National Cancer Control Programme and the Irish Cancer Society were the founding members of the Irish Cancer Prevention Network (ICPN) in February 2019.

This network produces quarterly newsletters and develops and hosts public webinars annually on wide ranging cancer prevention interventions. We also work together to produce national campaigns to raise awareness of cancer prevention tools and techniques among the public.

WORLD GO DAY

Breakthrough are also active members of the Irish Network of Gynae Oncology (INGO) Gynaecologic Oncology Day, which seeks to increase awareness of gynaecological cancer symptoms among the general public.

GO for...

BEAT CAMPAIGN

Breakthrough Cancer Research, OvaCare, Emer Casey Foundation, SOCK and the Marie Keating Foundation are highlighting the key signs of Ovarian Cancer with the BEAT Ovarian Campaign.

The BEAT Ovarian Cancer Campaign is advising women across Ireland that they can BEAT Ovarian Cancer by knowing their bodies, knowing the signs and getting help at an early stage if they have any of the following signs for three weeks or more:

- Bloating that is persistent and doesn't come and go
- Eating less and feeling full more quickly
- Abdominal and pelvic pain you feel most days
- Toilet, changes is in urination or bowel habits

The symptoms of ovarian cancer can be confused with other illnesses. However, the key difference is that these symptoms are persistent and do not come and go. The BEAT campaign is encouraging women to be aware of changes in their stomach, pelvis and abdomen and to speak to a GP where they are concerned.

B is for **BLOATING** that doesn't come and go

E is for **EATING** difficulty and feeling full more quickly

A is for **ABDOMINAL** and pelvic pain you feel most days

T is for **TOILET** changes in urination or bowel habits

OPEN YOUR EYES TO UVEAL MELANOMA

As the charity partners in IRC Enterprise Partnership Grants, we also work with research teams to produce evidence-based information resources and to develop awareness campaigns. For example, Breakthrough fund a number of projects investigating novel pathways and treatment targets in Uveal Melanoma (UM). UM is a rare ocular cancer, and Ireland is estimated to have one of the highest incidents of this cancer globally. Awareness of this cancer is low and in 2021, we worked with Prof. Breandán Kennedy's research group in UCD and Ocular Melanoma Ireland to develop and role out the 'Open Your Eyes to Uveal Melanoma'.

This included the development of an animated educational video and an eye patch competition among school children.

UV AWARENESS

Ireland has one of the highest mortality rates for melanoma in Europe and those that spend time outdoors regularly are at extra risk. Outdoor workers account for almost 25% of those that are diagnosed. Melanoma also kills more men than women, and it is the fourth most common cancer in men.

Breakthrough launched a campaign, targeted at outdoor sportspeople and outdoor workers, particularly in construction and farming. It draws attention to the phenomenon of 'patch tanning' where areas not clothed or sufficiently covered by high SPF sunscreen create a pattern that marks out skin that has been put at risk.

Breakthrough also conducted a survey which found that 73% patch burn regularly, which is where the danger lies. These films highlight the spots that are usually missed by outdoor workers and athletes, including the back of the neck, ears, and top of the forehead (where peaked caps provide little protection), the tip of the nose, the lower legs, and the upper arms.

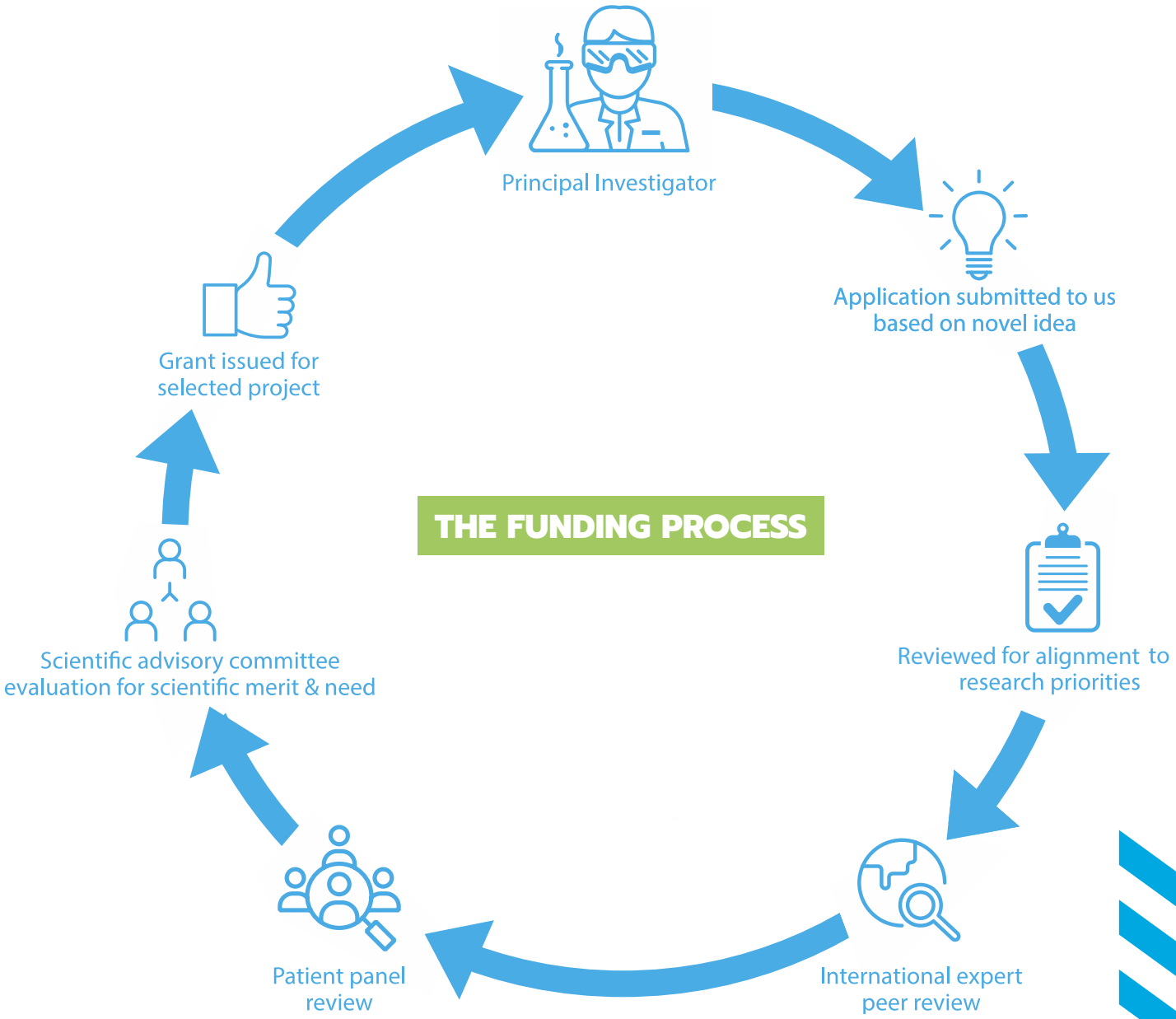
Breakthrough is calling on people who spend time outdoors regularly to not be complacent, to increase their UV awareness, and to be more vigilant when applying sunscreen, to achieve 100% coverage.

The 'Man Tan' campaign is part of Breakthrough's overall national awareness campaign 'Let's get to 100% Together', which warns about the importance of protecting skin from UV damage 100% of the time and the need for new treatment options in a strive to achieve 100% survival from the disease.

SCIENTIFIC EXPERTISE WITH PATIENT EXPERIENCE

Grants submitted to Breakthrough Cancer Research undergo a rigorous process of review before they are potentially awarded funding. This is to ensure they answer our research priorities, have scientific merit, appropriate project design and fulfil an unmet need.

International experts are involved in Peer Review. Our own Scientific Advisory Committee and Public Patient Panel (PPI) help determine our research priorities as well as providing opinion and analysis of applications during the review process.



OUR INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

All Breakthrough applications are assessed by international experts and our own Scientific Advisory Committee, themselves international experts in academia, clinical research, oncology and industry, are involved in Peer Review.

Importantly our Scientific Advisory Committee are also involved in the development of our research strategy and in monitoring and assessing whether our research investment is meeting our strategic objectives.

PROF. BRENDAN BUCKLEY

(CHAIR)

Chief Medical Officer at Tekro a Clinical trials software company. Prof Buckley, trained as an endocrinologist and has over 30 years' experience in the medical sector. He has been a board member of the Irish Medicines Board and of the European Medical Agency (EMA)'s Scientific Advisory Group for Diabetes and Endocrinology Ireland since 2005.

PROF. KEVIN HARRINGTON

Professor of Biological Cancer Therapies at The Institute of Cancer Research and an honorary consultant oncologist at The Royal Marsden. UK

PROF. MICHAEL GOGGINS

Dr. Goggins is a professor of pathology, medicine and oncology at the Johns Hopkins University School of Medicine. He serves as Director of the Pancreatic Cancer Early Detection Laboratory and is an attending physician in medicine in the Division of Gastroenterology and Hepatology at The Johns Hopkins Hospital. USA

DR. OWEN O'CONNOR

American Cancer Society Research Professor, Division of Hematology and Oncology and Director, Program for T-Cell Lymphoma Research, E. Couric Cancer Center, University of Virginia Cancer Center. Professor, Department of Microbiology, Immunology, and Cancer Biology, University of Virginia. Chief Scientific Officer, TG Therapeutics. USA

DR. ALISON O'MAHONY

Vice President for Recursion, a clinical-stage biotechnology company decoding biology by integrating technological innovations across biology, chemistry, automation, machine learning and engineering to industrialize drug discovery. USA

DR. KEVIN HORGAN

Protypia. Seasoned physician scientist with executive leadership experience in development of large and small molecules across multiple therapeutic areas with particular expertise in immunology, inflammation and immuno-oncology. USA

"I AM STAGGERED THAT YOU ARE DOING SO MUCH AND THAT YOU ARE ABLE TO DO SO WITH SUCH A LEAN RESEARCH TEAM. IT'S AMAZING."

PROF. KEVIN HARRINGTON

PUBLIC PATIENT INVOLVEMENT IN RESEARCH

Breakthrough Cancer Research are committed to incorporating the patient voice at the centre of our research activities.

Our first PPI research training workshop took place in September 2019, and was attended by 24 people. Since then our training workshops have continued and we are always seeking to grow our PPI in size, as well as ensuring equality, diversity and inclusion.

OUR PPI WORKSHOPS

Our PPI panel take on many roles in Breakthrough as an organisation, including;

- Co-developing research strategy and research priorities
- Reviewing grant applications and interviewing researchers
- Training early and mid-career researchers in scientific communication to the public
- Raising awareness of cancer research to the public
- Raising awareness of cancer signs and symptoms to the public
- Dissemination of research findings
- Becoming collaborators and co-applicants on research applications.

The following describe some of ongoing ways that our PPI actively participate in Breakthrough's research activities

DISSEMINATING RESEARCH KNOWLEDGE AND FINDINGS

Helen McGonagle and Mandy Quirke, cancer survivors and PPI representatives recorded publicly available interviews with Prof. Mark Tangney and Prof. Walter Kolch about their research on the role of bacteria in cancer and also the aims of Precision Oncology Ireland, respectively.

MANDY QUIRKE AND PROF. WALTER KOLCH

"What I have learned has helped with my fear of recurrence."
Mandy Quirke PPI panelist

TRAINING RESEARCHERS IN SCIENTIFIC COMMUNICATION

Members of Breakthrough's PPI panel help to train and also assess the research communication skills of Breakthrough funded researchers.

For example, some of our PPI panel assessed and determined the best lay presentation by the Breakthrough Summer Scholars following completion of their research, September 2021 (pictured).

ENSURING THE PATIENT VOICE IS HEARD IN RESEARCH

Breakthrough ensure that research is patient-focused.

Noreen Daly, who lost her husband to pancreatic cancer, presented to approximately 300 delegates at the Annual Irish Association of Cancer Research conference in 2022, during the Breakthrough Cancer Research sponsored session focusing on Poor Prognosis Cancer Research.

Her message to the researchers was "We need more treatments....Research is very important" Noreen Daly

For World Cancer Day 2020, The Tyndall Institute and Breakthrough held a HeathTecH Symposium, on 'How Technology is Transforming Cancer Screening, Diagnostics and Treatments.

Dr. Chrys Ngwa, was the PPI representative on the panel at the event.

In March 2019, Dr. Chrys Ngwa was diagnosed with an unusually aggressive prostate cancer. The prognosis wasn't good. With both a Bachelor's degree and a PhD in Microelectronics, Chrys has extensive experience applying for grants, as well as time spent as a cancer patient, Chrys likens his function on the PPI panel as a bit like insider trading – but for the good. "I know how it all works!" he says. Chrys says that the role of PPI itself is a great honour and is particularly important when it comes to cancer.

"I'm part of a group that can actually influence the direction of research that will potentially improve patient outcomes in the future...that's an incredible gift that someone's given to me, Absolutely, it is brilliant." Chrys, PPI representative

NOREEN DALY

DR. CHRYS NGWA

PPI PANELLISTS ASSESS GRANT APPLICATIONS

Members of our PPI assess grant applications received by Breakthrough and their review, with scientific reviewers, help us to decide the best research to fund and the research that will most impact cancer patients.

PPI PANELLISTS BECOME COLLABORATORS IN RESEARCH

Members of our PPI panel are now collaborators themselves in Breakthrough-funded research, and those funded through other mechanisms.

Mandy Quirke finished treatment for globular breast cancer in February 2016, and is an active member of the Breakthrough PPI panel since 2019. She is now also a patient advocate with the Breakthrough and ICS-funded LYSA (Linking you to Support and Advice) study, sharing the benefit of her experience to support the study. "It's great when you discover there are common reactions to having had cancer. Not everyone will have the same reaction as you, but your reaction will be common in the surviving population."

Mandy described how increasing her knowledge of cancer and research through the various PPI activities at Breakthrough has "helped with my fear of recurrence. It is essential that the voices of cancer patients, those who have recovered from cancer and their families are heard by those involved in the research process. These voices provide the lived experience which is so important in informing the decisions on funding and the researchers amazing work."

MANDY QUIRKE

PPI PANELLISTS BECOME RESEARCHERS

KAY MCKEON

Kay McKeon, herself a breast cancer survivor, has come full circle to being a PPI panellist and now a cancer researcher. The focus of Kay's research, funded by Breakthrough, is to investigate the information deficit experienced by cancer patients in Ireland and methods of information acquisition. This research will directly impact the design and development of a unique digital platform aimed at reducing this information deficit – which has the potential to significantly impact on an improved cancer experience and the outcome of those who experience cancer.

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NOTES

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