



breakthrough
CANCER RESEARCH



ANNUAL REPORT 2017

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2017 IN NUMBERS



9

Research
Grants Awarded



4

Fellowships/Scholarships in Progress



Numerous Patients successfully treated
through clinical trials



10

Peer Reviewed
Journal Publications



5,000

Evidence based Cookbooks provided to
support Pancreatic Cancer Patients during
Treatment and Recovery

CHAIRMAN'S REPORT

In 2017 Breakthrough Cancer Research (Breakthrough) made great strides towards our goal to discover, develop, and advance new treatments for cancer patients and positively impact cancer care in Ireland and beyond.

Significant funding was invested in research staff, laboratory consumables, infrastructure, and equipment for cancer research with patient benefit at the core. Nine research project grants were awarded, all of which closely aligned with Breakthrough's current research priorities (page 11). We also agreed new partnerships in 2017 which will broaden our funding opportunities and provide additional research investment for the future.



INVESTING IN OUR RESEARCH VISION

The funds invested this year were primarily in research programmes but also in providing evidence based information and resources for the public. Breakthrough does not receive any state funds and as such relies on fundraised income to invest in our research priorities. The total funds raised in 2017 was €1,311,608 (2016 = €1,361,750). We were pleased to provide funding of €236,618 for nine projects over the course of the year, and allocated a further €401,741 for other projects which were undergoing peer review as at the end of 2017. I can confirm that these monies were subsequently taken up and all projects are commencing in 2018. The funds outlaid in 2017 included programmes aiming to develop new therapeutic approaches for the most difficult to treat cancers such as, oesophageal, pancreatic, acute myeloid leukaemia, osteosarcoma and ovarian cancer. Grants provided the funds for research staff, laboratory consumables, studentships and equipment, as well as providing support for clinical trials including trial nursing care. We also provided funding for new treatments which have completed trial phases and look forward to doing more in this area as more treatments exit the pre-clinical trial stage.

EDUCATION & INFORMATION

As part of our mission, Breakthrough has continued to provide up to date evidence-based information to clinicians, patients, and members of the public in 2017. €90,621 was invested in Education and Information, funding materials, media and public speaking engagements to provide fact-based information to the public and patients about cancer prevention, risk factors, myths, and nutrition. Our third cancer patient cookbook, aimed at pancreatic patients, was successfully launched after receiving tremendous feedback from patients, carers and dieticians regarding the first two award winning published books. These patient resources answer a significant unmet need.

PARTNERSHIPS ENABLE PROGRESS

Taking on a disease like cancer means finding like-minded companies and groups to work together. Here at Breakthrough Cancer Research, research partnerships are incredibly valued. This year we were delighted to have launched two new corporate partnerships to help raise funds and increase awareness. Breakthrough was thrilled to become an official partner charity of the GAA for 2017, receiving €20,000 and the opportunity to share a message of hope and progress in every community in Ireland. We also launched a brand new partnership and campaign with the global tech company Qualtrics called 5 For The Fight. The aim of this campaign is to fund a three person Cancer Immunology research team and we know already they will succeed.

We can't forget our resolute supporters, Musgrave Retail Partners, who once again through their Musgrave triathlon provided €100,000 for cancer research investment. There is no company in Ireland who has helped us invest so much in cancer research over the many years of our partnership. We cannot thank them enough for their unstinting support.

A VOLUNTARY EFFORT

Thank you to our incredible board of directors who volunteer their valuable time and expertise to the charity. This year the board continued its good governance and once again, together with the dedicated team at Breakthrough, worked to ensure the charity had in place the Triple Lock standards set out by the Charity Institute of Ireland - good fundraising, transparent annual financial reporting and governance.

At the end of 2017 our longstanding Chairman Declan Farrell stepped down after steering us expertly and proudly for multiple years. We would like to take this time to thank him profusely for his selfless dedication to seeing Breakthrough grow in size and significance over the years. He will be missed but has left a robust and forward looking charity behind him. I am proud to take on that mantle for the next number of years and build on the strong foundation in place.

I would like to commend Orla Dolan and the entire dedicated, hard-working team for their outstanding efforts in 2017. The staff in Breakthrough are passionate about our mission and are utterly committed to making an impact for patients. I would like to wish them all of the best in 2018.

Lastly, I would like to express my sincere gratitude to all our volunteers and supporters. Without your continued support we would not be able to make any of the progress that is much needed. It is truly a team effort. It is our supporters, researchers, clinical collaborators, volunteer board and charity staff which have already made the difference. We are even more confident, that together we will develop more treatments for cancer and improve quality of life and survival for more cancer patients and families.

Thank You,

Bryan MOHALLY
Chairman

CEO'S REPORT

Breakthrough was founded – and continues to grow - with the vision to support the discovery and development of new treatments for the cancers which do not respond to current therapies. We are singularly focused, on finding new ways to save the people whose lives will be heartbreakingly shortened by cancer.

Significant progress in the types and efficacy of treatments has happened in the past few decades for many cancer types. Regrettably, this is not the case for all cancers. Those cancers, often termed poor prognosis cancers, are often resistant to current treatments and/or diagnosed late, making treatment even more difficult. These are the cancers of which still need extensive research to provide hope for patients and families – and that is what Breakthrough works to do.



In 2017 we continued to invest in ongoing research programmes for Oesophageal, Colorectal, Lung, Leukaemia, Osteosarcoma, Melanoma, Pancreatic and Advanced Breast cancers to find new treatment approaches to improve quality of life and survival for patients. Towards the end of the year due to our membership of the Medical Research Charities Group, we were able to participate in a Joint funding scheme with the Health Research Board, allowing us to expand the number of projects we could fund.

In the autumn, Breakthrough opened a call for applications from researchers throughout the country seeking projects which aimed to increase the survival of patients with poorer prognosis cancers. We were thrilled with the response and while the projects were undergoing extensive peer review and assessment extending into 2018, funds raised in 2017 were held over in anticipation of these newly selected projects commencing in 2018. We believe that this investment is vital as it will help expand research funded by Breakthrough and provide opportunities to further improve treatment approaches for poor prognosis cancers with new and innovative research ideas.

In the field of cancer research, collaboration is essential and has always been important here at Breakthrough - 2017 was no different. On World Pancreatic Cancer Day we lit it purple with our worldwide partners in the World Pancreatic Cancer Coalition. Breakthrough also worked with multiple other Irish charities to host a patient event on World Ovarian Cancer Day which brought together several speakers on research, current state of care and nutrition. We also launched our #MySmallChange Campaign, working with local schools to inform students of cancer risks, myths, and evidence based preventative activities/lifestyle changes of which will help decrease their risk of developing cancer. The campaign also saw Breakthrough staff visit and speak with businesses across the country sharing how through small changes, they can stack the odds in their favour and lower their own and their families risk of developing cancer.

With the patient at the forefront of our minds to address unmet needs, we also continued to provide our free evidence based resources revolving around nutrition for cancer patients. This year we once again worked with Dr. Aoife Ryan to publish and distribute our third cookbook, 'Nourishing Your Body during Pancreatic Cancer Treatment', to cancer centres and hospitals throughout the country. Dr. Ryan's research has shown that more than half of patients suffer from involuntary weight loss during cancer treatment. This cookbook, and those previously released, aim to support cancer patients with healthy, but highly calorific recipes, to help prevent muscle wasting and other conditions associated with weight loss while undergoing treatment. The goal of these free resources is to support the patient and help improve their quality of life, ability to tolerate treatment or aid recovery and consequently increase survival.

Breakthrough Cancer Research believes that teams are essential to our vision of taking research projects from bench to bedside. It is vital that those who work directly with cancer patients work with those with expertise in a laboratory setting. Only by these types of collaborative projects and teams can we ensure that the ideas developed in the lab will be seen through until they can become novel and effective treatments for patients. In 2018 we will also add the patient voice to this process so we can be further assured that the patient is the focus of our research.

Collaboration, team work and partnerships are not only the drivers of our research vision but also it is our partnerships with companies and organisations which are allowing investment in this research mission. Our long-term partnership with Musgrave Retail Partners has and continues to have an immeasurable impact and our newest partnership with Qualtrics and Five for the Fight will allow us to boost investment in an area we have long wanted to aggressively pursue, cancer immunology. Also our partnership with voluntary organisations like the GAA allow us to connect our vision and mission with every community and county in Ireland, spreading our message of hope.

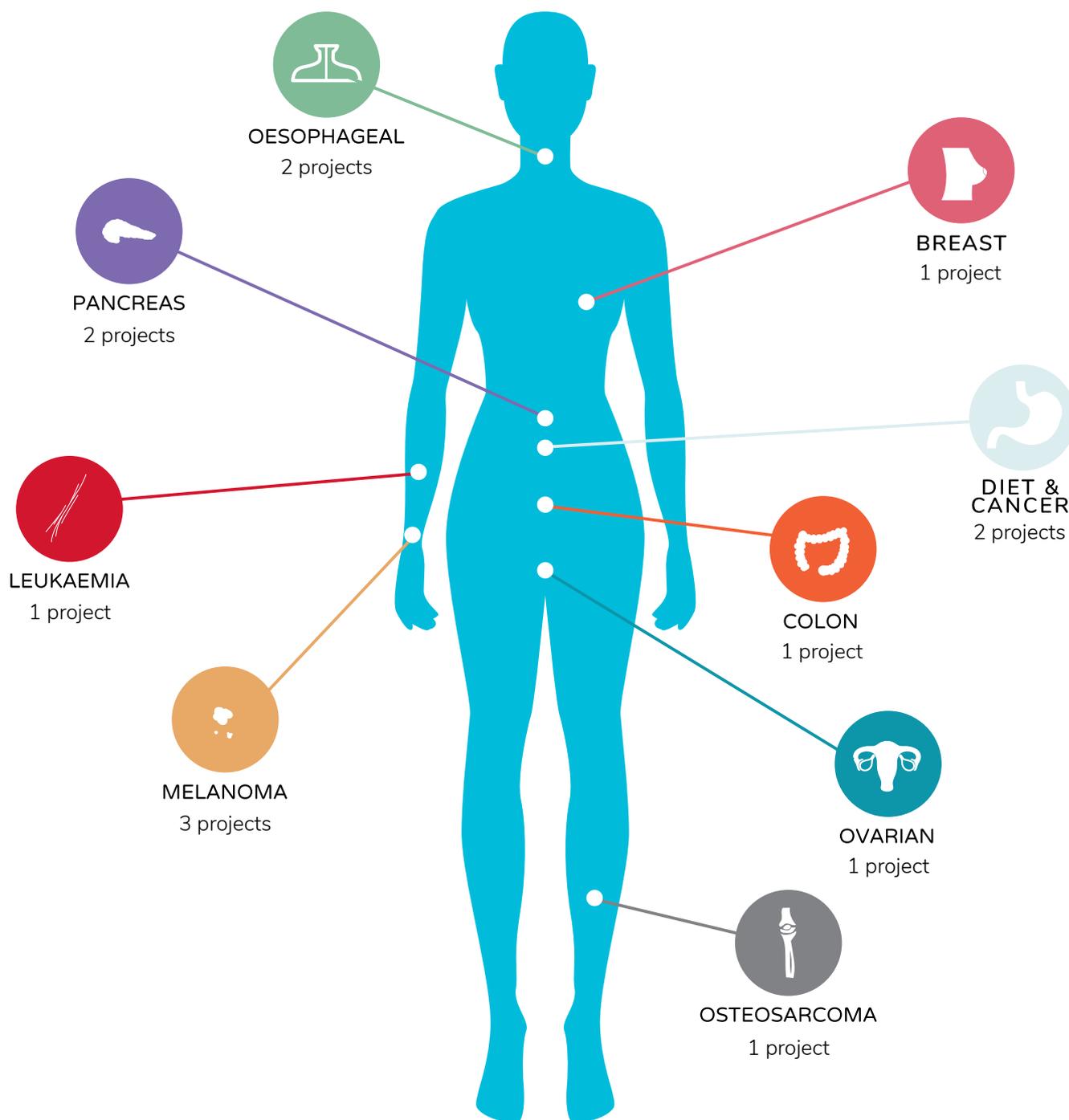
All at Breakthrough are very proud to share our achievements and accomplishments with the amazing companies, individuals, and families that help us raise funds again this year and every year. As we reflect back on 2017 and look forward into 2018, we are only too aware of how devastating a disease cancer is and the pain it has caused so many all over the world. I would like to thank all of our supporters, collaborators, board members, and team for their hard work, commitment and generosity, but primarily for their passion to make a difference. "Hope is our gift but it is only by working together can we give that gift to more people who need it."

Orla DOLAN

Chief Executive Officer

AREAS OF FOCUS

A selection of the cancer projects areas commencing or continuing into 2017 with Breakthrough research funding.



RESEARCH PROGRAMMES



“Research is essential to finding new weaknesses in cancers to exploit. Every cancer has an Achilles heel or two and we just need to find them.”

RESEARCH PRIORITIES

- 1 Increase our research investment into poor prognosis cancers and currently incurable cancers prioritising lung, oesophageal, ovarian and pancreatic cancers
- 2 Continue to significantly invest in research on the role of the immune system in cancer development and identify opportunities to harness the immune system to control and eradicate metastatic cancers
- 3 Improve integration of cancer research into cancer care in Ireland by prioritising funding for projects and infrastructure with significant clinical engagement/input
- 4 Continue to discover and develop new therapeutics and surgical approaches/ technologies, including increased investment in biological and immuno-therapies
- 5 Continue to fund research, which aims to improve the effectiveness or specificity of current cancer therapies including investing in biomarkers discovery, nutrition and therapeutic delivery
- 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



It is becoming apparent that the relationship between humans and bacteria can influence various diseases. A deeper understanding of the bacteria that live in our body is enabling identification of potential causes of, and potential treatments for, disease. This is what our funded researcher Venkata Vamsi Bhardwaj, working under the direction of Dr. Mark Tangney, is trying to do.

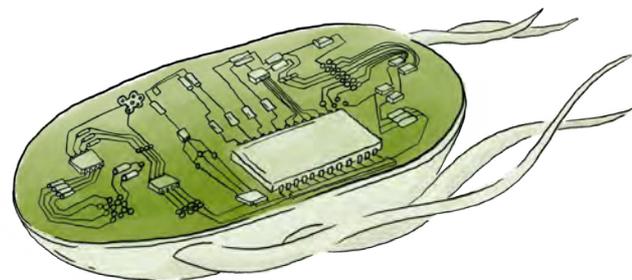
The Tangney lab in UCC, has recently discovered that bacteria exist in patient tumours, and were the first to describe a 'Tumour Microbiome'. A wide range of bacteria were found in all patient breast tumours examined, which varied between patients. It remains unknown if any of these bacteria influence tumour growth, positively or negatively but the Tangney lab has also shown that bacteria can both positively and negatively impact the efficacy of chemotherapy. A better understanding of this phenomenon may facilitate appropriate intervention, diagnosis or prevention strategies. Furthermore, certain bacteria found within tumours could be exploited as natural vehicles to deliver therapeutics to tumours.

Speaking about his project Vamsi said

"This project aims to characterise the bacteria naturally present in patients. The project is in the early stages, and we have been focussing on developing new ways of processing tumour samples that will facilitate the study of samples from larger numbers of cancer patients. We are also developing methods to turn bacteria we find, into drug delivery vehicles, by engineering these bacteria to become tumour killers and putting them back into cancer patients."



Bacteria Bio Factory

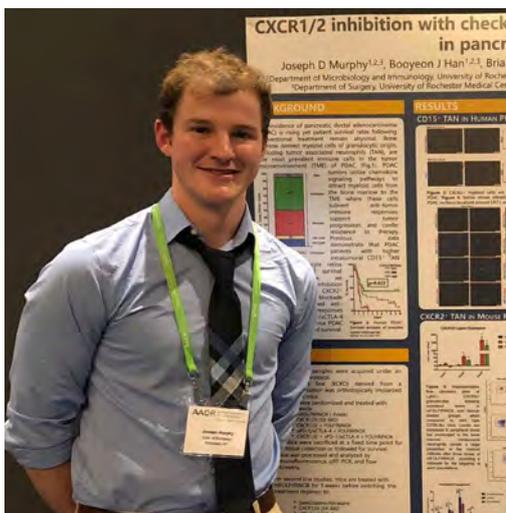


Engineered Bacteria

COMBINING ECT AND IMMUNE MODULATION FOR TREATMENT OF PANCREATIC CANCER

(CHARLIE FELL PANCREATIC CANCER FELLOWSHIP)

Achieving
Research
Priorities:
1, 2, 4



As part of his three year Breakthrough funded project, 2017 saw researcher Joseph Murphy departed for a year of research at the University of Rochester, New York, in the Center for Tumour Immunology, under the direction of Dr. David Linehan and Dr. Scott Gerber. This lab focuses on enhancing treatment of pancreatic cancer through preventing the migration of tumour immune suppressive cells. Their lab also specialises in enhancing the effect of radiation in pancreas cancer. Joseph's initial work is focused on combining radiation with various immune modulating (modifying) drugs in order to find

a synergistic combination. This involves examining the immune system pre and post treatment to see levels of suppressive cells and then delivering drugs to reverse this. Pancreatic cancer is extremely difficult to treat because it contains a large amount of these suppressive cells, known as tumour associated neutrophils (TANs) and tumour associated macrophages (TAMs). Blocking the factors that draw these into the tumour can help kick-start an immune response against the disease.

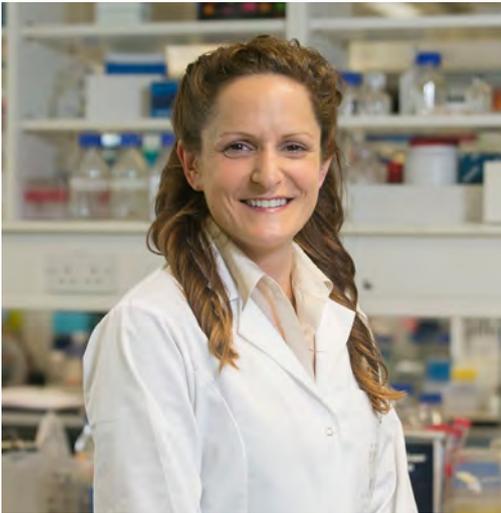
While in the US, Joseph is also bringing his knowledge of electrochemotherapy (ECT), a technique pioneered in Ireland by Dr. Declan Soden and Dr. Pat Forde, to combine it with their experience with immunotherapies and Pancreatic cancer. ECT has been shown to activate the innate immune system and increase the effectiveness of immunotherapies by providing an initial 'danger' signal. Trialling this approach in pancreatic cancer may lead to a clinically applicable treatment, due to the current progress of patient trials already underway using ECT in melanoma, oesophageal and colorectal cancer.

Breakthrough is proud to part of this important collaborative effort to impact a cancer which has not seen significant progress in survival for 50 years.



INVESTIGATION OF RESISTANCE MECHANISMS IN OESOPHAGEAL CANCER CELLS

Achieving
Research
Priorities:
1, 3, 4, 6



Oesophageal cancer can be highly aggressive and exceptionally drug resistant. This is why we were so passionate to fund Dr. Tracey O'Donovan's research project which is investigating the mechanisms of resistance in oesophageal cancer cells. Dr. O'Donovan is part of a research team which has identified that autophagy, the recycling process within cells, can help cancer cells recover from chemotherapy treatment. The team have also identified that this process happens in patients and that it is related to the long term survival.

During their previous exploratory work, unique structures were found within cancer cells that are highly predictive of outcome for patients - with high expression of these structures showing correlation to poorer response. These structures are labelled with proteins that we know are involved in Autophagy. Therefore this newly funded research aims to identify what these structures are in order to establish their relationship to poor survival in patients.

To conduct this research Dr. O'Donovan will be evaluating the function of these structures within tumour cells and looking at additional markers (labels) that will help identify the origin and potential function of these structures. "Due to its association with aggressive cancer biology, it is critical that we understand what these structures are and how to block their activity for patient benefit." Dr. Tracey O'Donovan. "We are so grateful to Breakthrough for the funding to progress this important investigation."

"The most difficult part of my job, is seeing patients you think are going to do well, do badly. People whose lives should have been longer, whose cancer should have been cured, or whose suffering should have been less. We must invest in research to change this."

Prof. Seamus O'Reilly, Consultant Oncologist

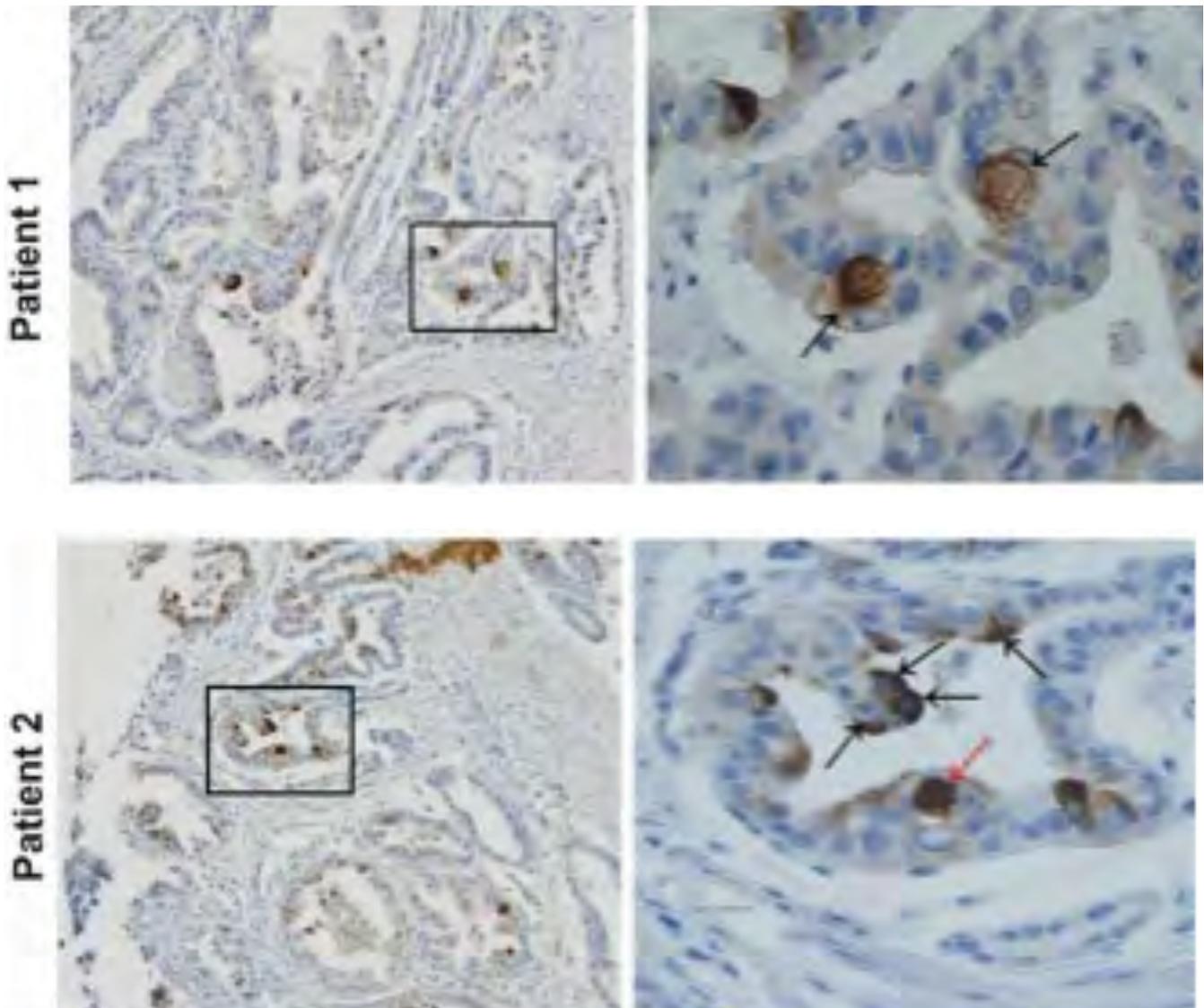


Figure 1. Shows these unique globular structures which are labelled with LC3B (marker for autophagy) in oesophageal tumour patient samples. The area within the rectangle is shown to the right at a higher magnification. These globular structures varied in size, but usually they were large, with some occupying most of the cell (examples shown with black arrows), or occasionally appearing to be within a vacuole (example shown with a red arrow).

OSTEOSARCOMA - COMBINATION OF ELECTROPORATION AND METABOLIC MODULATORS WITH LOW DOSE CHEMOTHERAPY

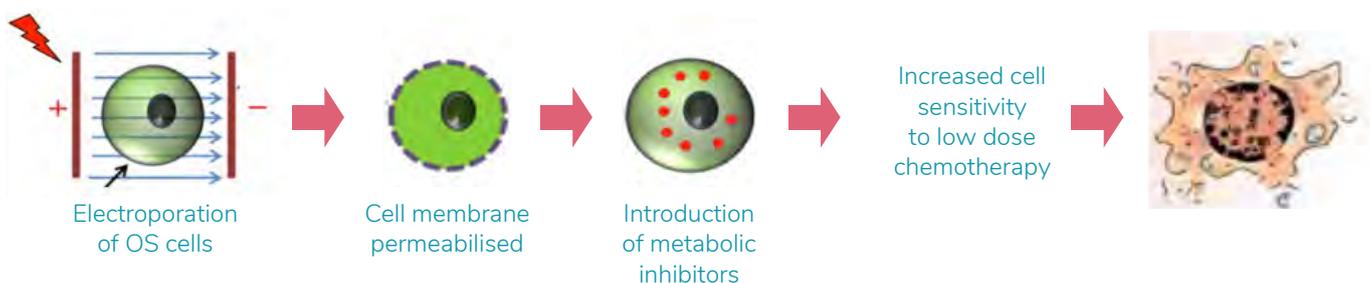


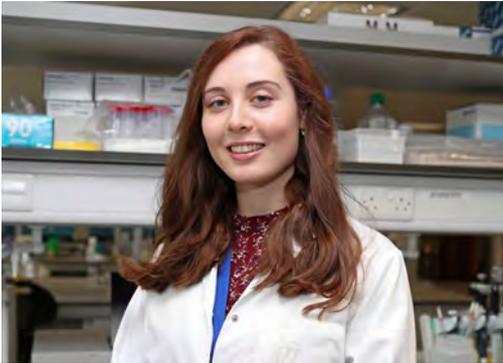
Osteosarcoma accounts for roughly 60% of all malignant bone tumours in children and young adults. While the five-year survival rate for localized tumours after surgery and chemotherapy is approximately 70%, it drastically reduces to 15 - 30% in metastatic cases, where the cancer has already spread to more than one part of the body. The nature of cancer cells is that they are highly metabolically active, thereby creating the necessary energy to keep dividing at a rapid rate. By modulating or changing the cell cycle of cancer cells you can slow down or speed up the metabolism and proliferation of the cancer cells. Metabolic

modulation is known to increase sensitivity of cancer to chemotherapy. Which is why this project aimed to develop a novel treatment strategy to battle a devastating disease in Osteosarcoma.

Dr. Khesh Gill's project involved performing metabolic modulations of Osteosarcoma (cancer) cell lines* with clinically available modulators delivered using electroporation, in combination with a low-dose of the chemotherapeutic drug Cisplatin. This allowed Dr. Gill to assess their sensitivity to chemotherapy when treated in combination with electroporation-delivered metabolic modulators.

To date, Dr. Gill's research has shown that electroporation-delivered metabolic modulators were more effective in halting the cell cycle at a certain stage of the cell cycle of Osteosarcoma cells which negatively affects their ability to recover and proliferate. At this cell cycle stage the cancer cells are more susceptible to the effects of chemotherapy and by halting the cancer cells at this stage, it allows the cancer cells to be exposed to chemotherapy for longer periods. Electroporation-delivered metabolic modulators increase's the sensitivity of Osteosarcoma cells to chemotherapy which reduces their survivability. This allows a lower dose of chemotherapy to be therapeutic while increasing efficiency, making it an ideal treatment for the patient.





Ovarian Cancer (OC) is the seventh most common gynaecological malignancy among women worldwide. In Ireland, ovarian cancer was the fourth most common diagnosed cancer among women between 1994 and 2010. Most women have an excellent response to chemotherapy at first, but unfortunately for around 80% of women, the cancer comes back and is even more difficult to treat. To help defeat this major issue in ovarian cancer treatments, this project aims to discover why the cancer is able to return following chemotherapy treatment.

Autophagy is a process that cells use to cope with damage and stress. We believe that ovarian cancer cells are using the autophagy process to recover from the damage inflicted by chemotherapy. This research has involved treating ovarian cancer cells with chemotherapy drugs used in the clinic to test this theory. These tests have shown that the autophagy process is increased during the cells recovery and that by blocking autophagy the survival of ovarian cancer cells following chemotherapy treatment has significantly reduced – indicating a role for autophagy in chemo resistance.

Speaking about this project PhD researcher Jennifer Quinn said “this is an exciting discovery which will be further investigated throughout the rest of my three year project which will aim to target autophagy in ovarian cancer patients to prevent the cancer from returning following chemotherapy treatment.



“My husband and I toured the facility where Dr. Sharon McKenna and Jennifer Quinn work. They gave a talk about their research in ovarian cancer. I spoke to the scientists. I saw cancer cells in petri dishes. I saw the innovations Breakthrough have come up with. And I saw all the tremendous work they’re doing to find new treatments for ovarian cancer. And I was absolutely humbled by it all. Afterwards in the car my husband asked me how I felt, and I said: “That was better than any medicine!” Because it was the first thing that had given me hope that someone, somewhere could beat this terrible disease and give women like me a chance.”

- Anne Herlihy, Stage 4 Ovarian Cancer Patient

INVESTIGATION INTO THE ROLE OF AUTOPHAGY IN DIFFERENTIATION IN LEUKAEMIA

Achieving
Research
Priorities:
1, 3, 4, 6



Dr. Dalyia Benjamin has been undertaking a joint research project between UCC and Weill Cornell Medical College, NYC and will be completing this three year project in the middle of next year. Dalyia's is tackling the role of autophagy in differentiation in leukaemia. It involves learning more about how leukaemia, and more specifically the blood cancer Acute Myeloid Leukaemia (AML), behaves and testing new methods to find improving treatment outcomes in the future. Dalyia has also been a Haematology Registrar over the three years and it is through this combination of roles that Dalyia sees the importance of both medics and scientists

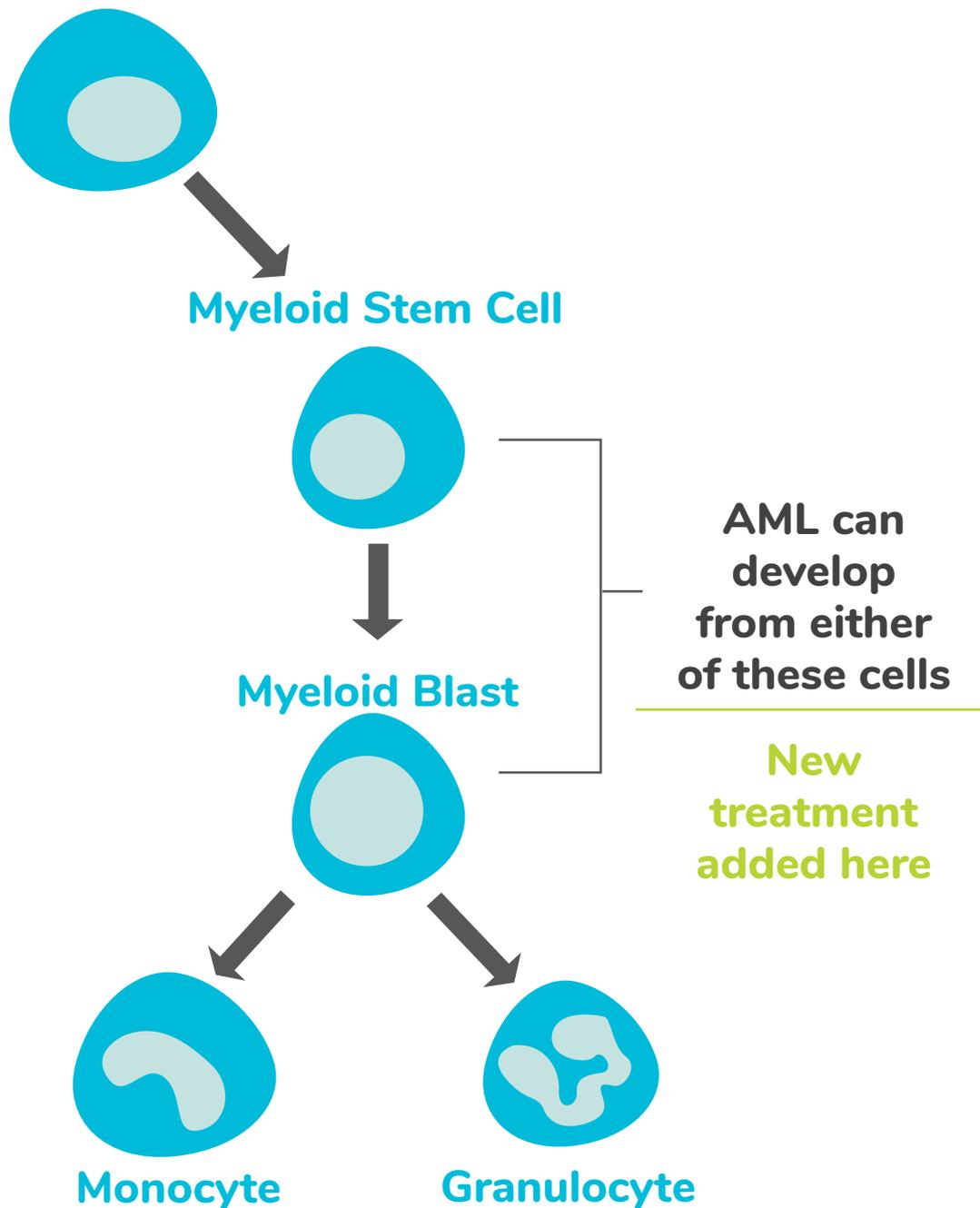
working together to form this translational step from the laboratory bench to the clinical trials which will ultimately produce better future outcomes for cancer patients.

AML is a cancer caused by the accumulation of immature white blood cells in the bone marrow and circulation – which is due to a failure in the cells ability to differentiate. AML is the most common acute leukaemia in adults and if left untreated, is fatal. Despite intensive research focus in recent decades, overall survival remains poor.

Current treatments for AML are poorly tolerated, hence the dire need for improved tolerable therapeutic strategies. One such strategy is a pharmacologic override of the differentiation block – which would be significantly less toxic. Success in “differentiation therapy” has been achieved with all-trans-retinoic acid (ATRA) for treatment of acute promyelocytic leukaemia (APL) – yet unfortunately for AML – a successful differentiation therapy has yet to be found.

We have previously shown that autophagy is required for ATRA-induced differentiation of APL cells and by inducing autophagy we can promote ATRA-mediated differentiation. In this work – we are using Valproic acid (an autophagy inducer) as a potential differentiation enhancer – which has the potential for clinical translation.

We have examined differentiation and autophagy in AML cell lines that are sensitive and resistant to ATRA – and found that valproic acid enhanced autophagy and differentiation in the presence of ATRA in all cell lines tested. This data has identified a combination treatment that can promote myeloid differentiation in cell lines – a combination treatment that is currently being tested in primary leukaemia cells. The validation of this combination in patient samples would provide promising indicators that this treatment could be implemented in the clinical setting, in treatment resistant and relapsed AML patients.



A new treatment which combines ATRA and an autophagy inducer – to drive differentiation

THE ROLE OF DIET, NUTRITIONAL ASSESSMENT AND INTERVENTION IN THE PREVENTION OF CANCER AND THE TREATMENT OF CANCER-RELATED MALNUTRITION

Achieving
Research
Priorities:
3, 5, 6

Breakthrough is proud to have supported Dr. Aoife Ryan and Dr. Eadaoin Ni Bhuachalla's research including the development of 3 free evidence based books distributed to thousands of cancer patients in Ireland and the U.K. In 2017 the team were looking to further develop their research in ***"The role of diet, nutritional assessment and intervention in the prevention of cancer and the treatment of cancer-related malnutrition."***

Nutrition plays a fundamental role in both the prevention and treatment of cancer with malnutrition being highly prevalent in oncology settings and is associated with adverse clinical consequences. The rates of malnutrition and muscle wasting in Irish cancer patients were unknown at the outset of the multi-year project and with rising levels of overweight and obesity it is incredibly difficult for the clinicians to identify malnutrition.

This project involved using CT scans to describe the relevance of malnutrition in Irish oncology patients and developed practice based solutions to address malnutrition in the oncology setting. This project initiated the patient resources to improve oral intake during treatment and a further resource aimed to support patient's recovery. Additionally, a further evidence based resource for cancer prevention through healthy eating and lifestyle advice was developed and will be published in 2018.



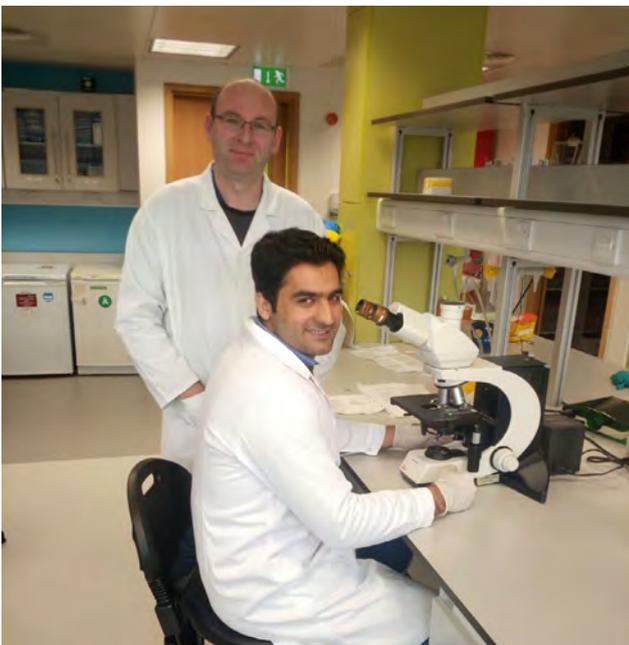
PANCREATIC CANCER - STEMNESS AND RESISTANCE TO TREATMENTS SUCH AS ELECTROPORATION/ELECTROCHEMOTHERAPY

Achieving
Research
Priorities:
1, 2, 4

Pancreatic Cancer is currently the fourth most leading cause of cancer-related deaths in Ireland, causing just under 500 deaths in 2017 alone (NCRI) and treatments are limited. Muhammad Shazad Ali is currently working alongside Dr. Patrick Forde for the “Pancreatic cancer – Stemness and Resistance to Treatments such as Electroporation/ Electrochemotherapy” project which will explore current treatments and electroporation delivered drugs.

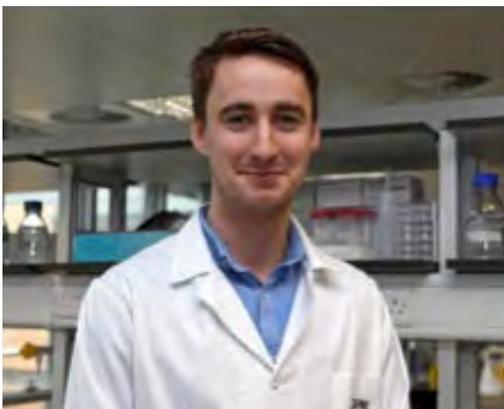
The use of electroporation in the clinic is on the rise. Dr Patrick Forde, Shahzad and their team plan to take a deeper looking into this treatment. As a treatment electroporation and electroporation delivery drugs has shown very positive responses in cancer. For some unknown reason some cells can be resistant to this treatment. Stemness is one proposed theory. Shahzad under the direction of Dr Forde will look into the effect of stemness and resistance to such treatments with hopes to discover how to reduce resistance and create a better way to use electroporation delivered treatments.

Shazad states “We have found that electroporation can modulate the workings of lysosomal activity and we believe the lysosome has a role in DAMP protein release and are currently working on immunogenic cell death through DAMP protein release. Meaning that, we hope to be able to link these findings and potentially find a new therapeutic target.” Thus, leading to a new form of treatment for pancreatic cancer patients.



THE ROLE OF MACROPHAGES IN MELANOMA AND THE TRANSLATION OF MACROPHAGE TARGETING IMMUNOTHERAPY

Achieving
Research
Priorities:
1, 2, 4

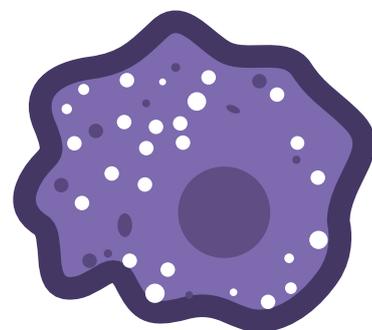


Macrophages are key cells of the immune system required for effective immune responses and tissue repair. This Breakthrough funded project is looking to examine the role of these poorly understood immune cells, in melanoma. Currently there is a very small amount of evidence on the role or even presence of macrophages in melanoma skin cancer. Because macrophages have a diverse set of functions, tumours are hypothesized to take advantage of this behavioural plasticity (flexibility) to promote their own growth and survival. In this model, instead of macrophages

promoting the destruction of cancer cells by the immune system, they could instead be attracted to the tumour and used to help the tumour block the efforts of the immune system to kill tumour cells and also support tumour growth and survival.

There are a range of experimental drugs that can beneficially change macrophage behaviour, but to determine if these therapies will be beneficial for melanoma patients we first have to understand their role within the tumour and how the tumour is using them to promote its progression.

While talking about the importance of this research, Liam explains that, “Melanoma has been shown as one of the most receptive tumour types to immunotherapies. However due to low response rates to current therapies we desperately need to widen the repertoire of therapies available to patients. My hope is that this project will identify if therapies focused at macrophages will have a beneficial effect in melanoma patients and also provide clues of how to design effective therapies that target macrophages or rely on macrophage behaviour for their effectiveness.”



Macrophage

“Cancer cells are clever – they multiply very fast. They also find ways of hiding from our immune systems. Researchers around the world are doing everything they can to develop new weapons to fight cancer, including immunotherapy. It involves the body’s own immune system being trained to recognise cancer cells and destroy them. This project looks at one element of the immune system and will help find new targets for us to exploit.”

- Dr. Declan Soden, Lead Researcher

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Bourke MG, Salwa SP, Sadadcharam M, Whelan MC, Forde PF, Larkin JO, Collins CG, O'Reilly S, O'Sullivan GC, Clover AJ, Soden DM.
Breast Cancer Res Treat. 2017 Jan;161(2):289-297. doi: 10.1007/s10549-016-4046-y. Epub 2016 Nov 22.
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Adv Drug Deliv Rev. 2017 Sep 1;118:8-23. doi: 10.1016/j.addr.2017.09.012. Epub 2017 Sep 12. Review.
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Murphy C, Rettedal E, Lehouritis P, Devoy C, Tangney M.
PLoS One. 2017 Jun 29;12(6):e0180034. doi: 10.1371/journal.pone.0180034. eCollection 2017.
- 10. Synthetic Biology in the Driving Seat of the Bioeconomy.**
Flores Bueso Y, Tangney M.
Trends Biotechnol. 2017 May;35(5):373-378. doi: 10.1016/j.tibtech.2017.02.002. Epub 2017 Feb 27.

For links to read more on these publications go to breakthroughcancerresearch/research

BENCH TO BEDSIDE



You're part of the story every single step of the way...

No one understands the importance of cancer research more than the people who make it possible – our wonderful supporters. But you might not know as much as you'd like about the process itself. To put you in the picture, this shows you the stage-by-stage process all of our research has to go through, and how your support is vital every step of the way.

A STEP-BY-STEP LOOK AT THE PROCESS ALL OUR BREAKTHROUGHS GO THROUGH...

1. BLUE SKIES & BRAIN STORMS

Breakthroughs are born by bringing scientists, doctors, surgeons and other medical specialists together to discuss their ideas, challenges and observations. The most promising ideas progress to the next stage.

Your support here keeps the ideas flowing



COLLABORATE

Identifying areas where patient outcomes could and should be much better.

2. BENCHWORK BEGINS

Our researchers get to work in the lab, designing and conducting rigorous ways to test our initial ideas and findings. Project fundraising begins. Research is funded through grants or individual donors via our charity partner Breakthrough Cancer Research.



EXPERIMENT

Validating initial results by performing thorough lab tests.

Our researchers would get nothing done in the lab without you!

3. BENCHWORK CONTINUES

More extensive and rigorous lab-work puts promising research to the highest of testing. We use tumour samples to test for toxicity and safety and prepare paperwork for ethics and trial bodies. Additional funding is secured from further grant applications and public support, to take the research project to trial.



TEST

Proving new treatment is safe, effective, and ready for application for clinical trials.

4. PATIENT TRIALS - PHASE 1

Only treatments which demonstrate clear benefits and pass ethics approval go to patient trials. Patients receiving these newly developed treatments often have no other hope. When safety and efficacy is proven, the treatment progresses to Phase 2.



TRANSLATE

Identifying dosage levels, toxicity, side effects, and ability to shrink cancers.

5. PATIENT TRIALS - PHASE 2 & 3

If a treatment passes Phase 1 trials, it moves into Phase 2. More patients are added to the program and further investigation takes place. If the results are positive the treatment moves into Phase 3, widening the scope to other centres, often in other countries.



REFINE

Improving protocols and patient outcomes by expanding and repeating trials.

This is where your support is first turned into real tangible benefits for patients

6. BENEFITS REACH ALL

The new treatment is no longer part of a clinical trial and is approved for use by clinicians where appropriate. Benefits reach all cancer patients.



DELIVER

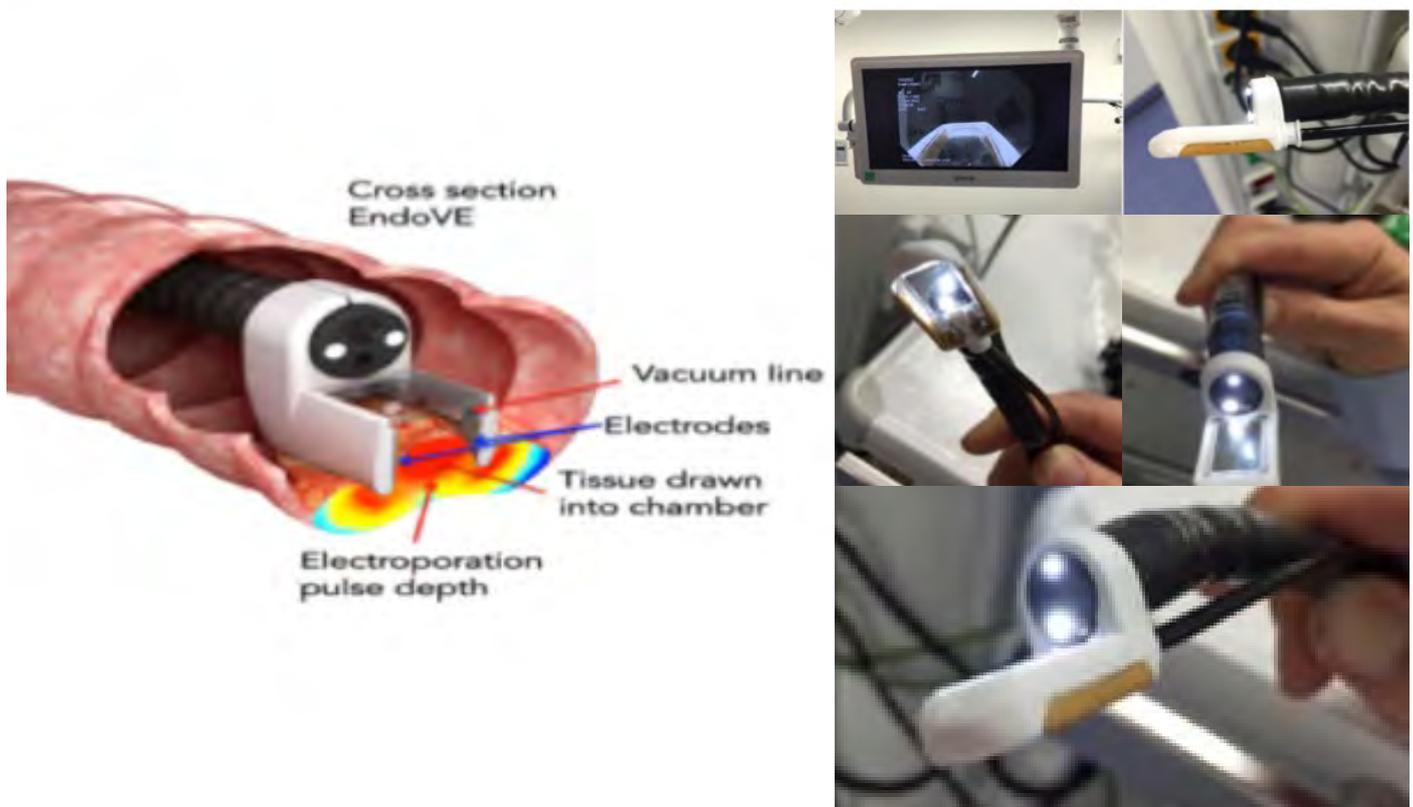
Saving lives by making a brand new treatment available to all.

SUCCESS AT LAST!

FROM BENCH TO BEDSIDE: YOUR SUPPORT IS HELPING DRIVE INNOVATION FORWARD

At Breakthrough Cancer Research we have been proud to fund pioneering work aimed at offering new treatment approaches for patients. One such technology has been pioneered by a team from Cork for number of years, for cancers presenting on the surface of the body. The team took their immense experience to try and develop new devices to apply this same approach for internal cancers and 2017 saw them take huge leaps forward.

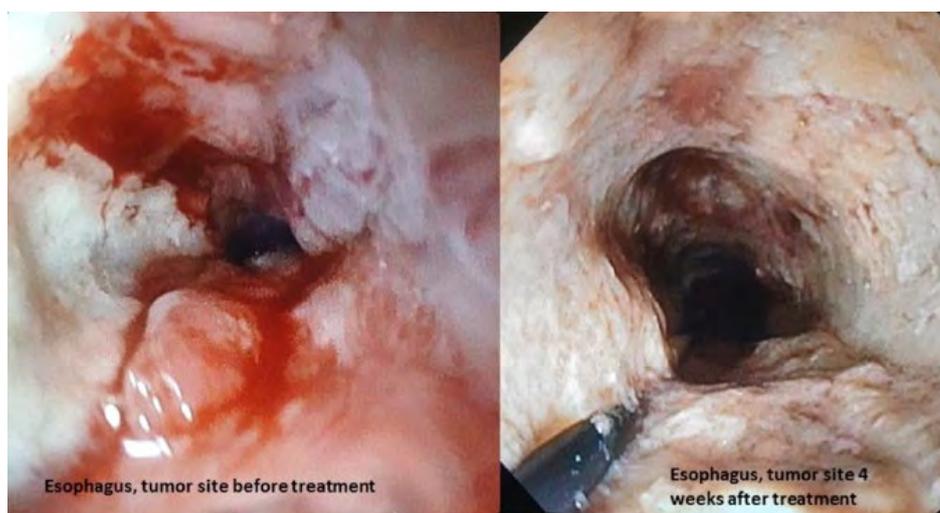
The world's first endoscopic electroporation probe was developed by the group led by Dr Declan Soden and the technology has demonstrated compelling results in human and animal clinical investigations. Preclinical data on the exciting canine results was published in the journal Endoscopy in 2016.



The Health products regulatory authority (HPRA) in Ireland approved the procedure with the device for clinical investigations on patients with inoperable colorectal cancer. These investigations were initially conducted in hospitals in Cork and Dublin with the study expanding to Copenhagen where it was completed. The results from this study were completed in 2017 and demonstrated excellent responses and improvements in patients overall quality of life. Overall all patients showed a reduction in tumour and improved symptom control.

A second study in oesophageal study commenced in late 2016 and finished enrolment in 2017. Similar to the first study all the patients treated showed excellent tumour reduction with no serious side effects from the procedure. The study was published in the journal Endoscopy in early 2018. A larger study is being planned to allow longer follow up on patients and to fully evaluate the quality of life benefits from this new technology.

The EndoVE colorectal study was performed as an outpatient procedure with patients under sedation as per standard endoscopy procedures. Discomforting muscular contractions were observed however will be eliminated with the new high frequency capabilities on the electroporation generator.

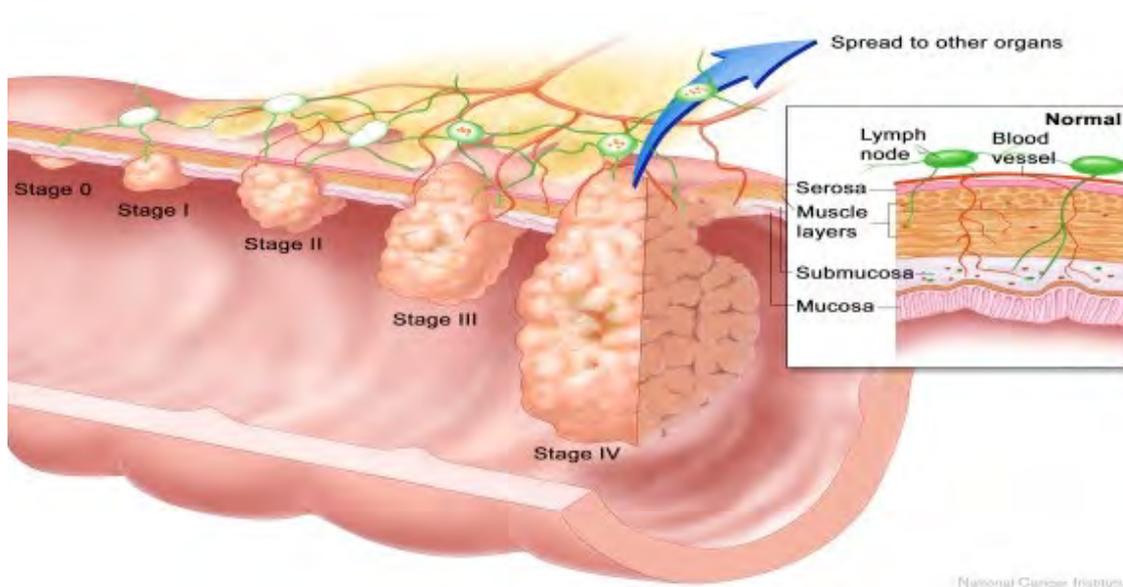


Inoperable oesophageal tumour pre and post treatment with the EndoVE device.

According to Dr Soden the next steps are about validating the early results they have seen in a larger group of patients, “we’re excited from the feedback by doctors on the early results from the technology. Normally patients with oesophageal cancer in particular have very limited options available to them and the early results we have seen are very encouraging.

We hope to build on this over

the next 12 months. We would like to thank Breakthrough Cancer Research and their supporters for all their backing over many years helping us reach this vital stage.” Dr. Declan Soden



Gastrointestinal cancer disease staging. The delivery of electroporation endoscopically allows for a brief outpatient treatment without the side effects associated with traditional approaches.

2011

Breakthrough Cancer Research was officially founded as an Irish Medical Cancer Research charity to inspire and enable financial support for exceptional research into cancer in Ireland leading to more effective treatments for patients in Ireland and Internationally.

2014

Launched the Sponsor a Scientist campaign which is a direct debit programme that has raised over €300,000 to date to support Breakthrough funded researchers.

2015

Breakthrough's 'Good Nutrition for Cancer Recovery' cookbook was awarded the 'Best Patient Lifestyle Education Project' by the Irish Healthcare Awards.

2016

Two Breakthrough funded research programmes progressed to clinical trial stages in the final quarter of the year.

2017

February

Launched 'My Small Change' campaign

Aimed to spread awareness of lifestyle changes

April

First Annual Teddy Daly Memorial Climb

Raised €31,787.00 for Pancreatic Cancer Research

May

Highlighted World Ovarian Cancer Day together with National and International Charities

Hosted a patient information evening with guest speakers including an oncologists, dietician, researcher, and lab tours.

June

GAA Partnership Launched

Named as one of five official GAA charity partners for the 2017/2018 year

July

Ring of Kerry Charity Cycle

Chosen as a Tier 2 charity partner at the Ring of Kerry Cycle, supplying over 40 volunteers to help over the weekend and raising €10,000 for Cancer Research

October

Open Call for MRCG-HRB Grant Funding scheme

Accepted applications from researchers all over the country for funding for their innovative, patient focused projects

Breakthrough's partnership with Qualtrics '#5ForTheFight' launched

Announced a new partnership with Qualtrics EMEA for their 5ForTheFight Campaign in their bid to invest €500,000 in a cure

November

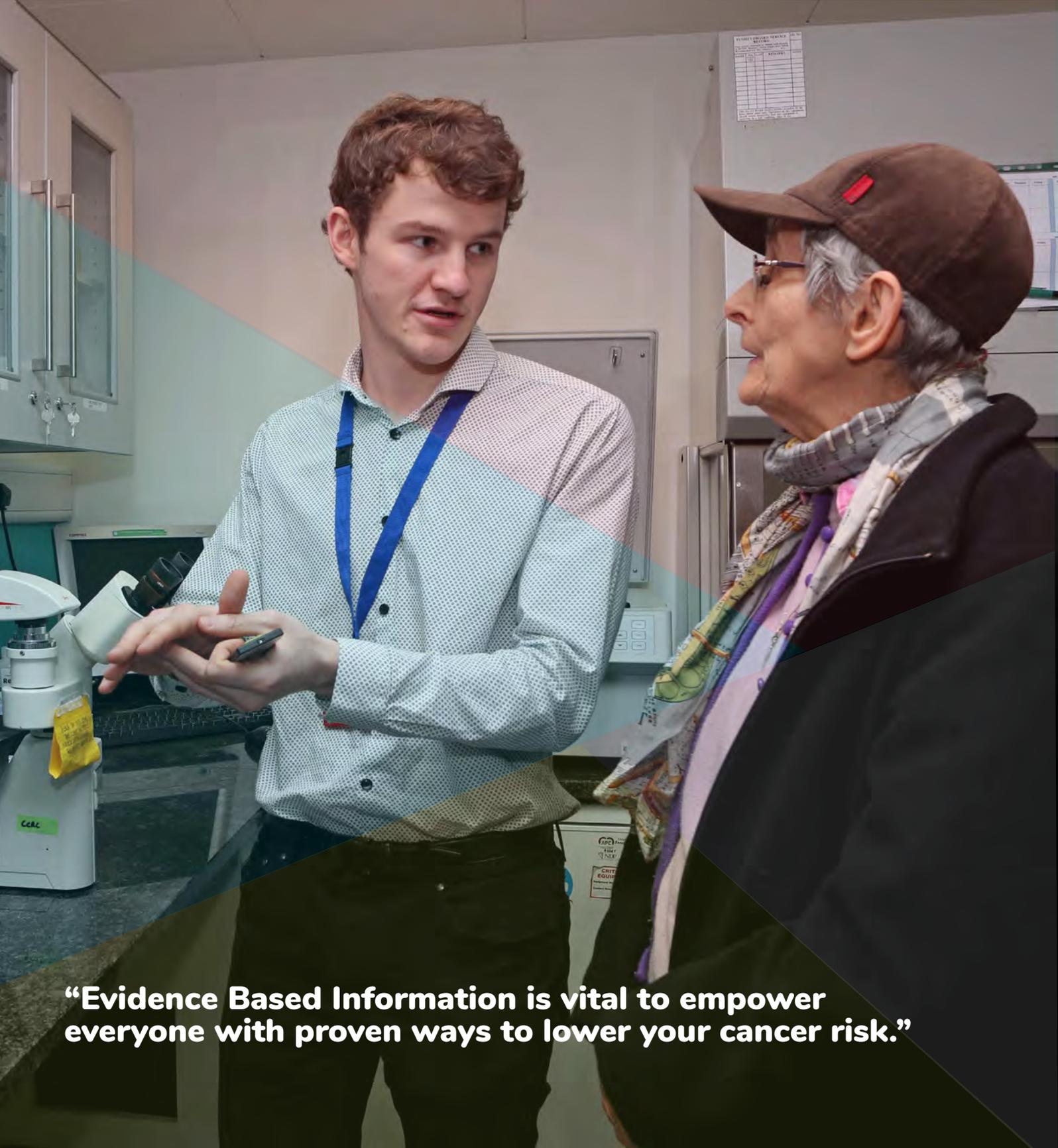
Alcohol & Cancer Week

Partnered with the European Action on Alcohol Week to help raise awareness between the relationship between alcohol and cancer

9,000 Pancreatic Cancer Patient Recipe Books sent to hospitals around the country in line with WPCD

As the only Irish organisation involved in the World Pancreatic Cancer Coalition, Breakthrough launched the book on World Pancreatic Cancer Day.

EDUCATION & INFORMATION



“Evidence Based Information is vital to empower everyone with proven ways to lower your cancer risk.”



#MYSMALLCHANGE CAMPAIGN

February saw the launch of the #MySmallChange campaign which aimed to educate the general public on the small lifestyle changes they can make to help decrease their risk of developing cancer.

With over 37,600 new cases of cancer diagnosed in Ireland every year, lifestyle changes have been proven to make a difference in preventing up to a third of the most common cancers. The World Cancer Research Fund (WCRF) outlined eight evidence based recommendations which formed the basis for our campaign, highlighting the lifestyle changes that have been proven to affect cancer risk.

The campaign was run through social media with images and videos to reach the general public, but was also designed as a lecture and interactive learning opportunity for both corporate and educational purposes.

Breakthrough visited several secondary schools to run short modules with their Transition Year students based on the #MySmallChange campaign. The module was based on four sessions and worked through what the students already knew and identifying common cancer myths, to teaching them facts and information they can use to decrease their risk, to finally measure what they learned and what changes they would make based on their acquired knowledge.

Corporate visits entailed on site seminars which outlined the small modifiable lifestyle changes adults can make for themselves and their loved ones to help decrease cancer risk. These sessions were carried out in many different locations throughout the country as part of worksite wellness programmes, in partnership with Laya Healthcare.

BOWEL CANCER AWARENESS APRIL

WATCH OUT FOR THE SIGNS & SYMPTOMS



1. Change in bowel habits such as going more often

2. Blood in your Poo



3. Pain in your Tummy

4. A Lump in your Tummy



5. Unexpected Weight Loss

TALK TO YOUR GP IF YOU ARE WORRIED!

BOWEL CANCER AWARENESS

In April, Breakthrough recognised bowel cancer awareness month. Bowel cancer, also known as colorectal cancer, is one of the most common cancers in Ireland with over 2,500 people diagnosed with the disease each year. Due to these shocking statistics we wanted to advise people of all ages to watch out for the signs and symptoms of bowel cancer. We also used the opportunity to advise those between the ages of 60 - 69 years of age to avail of the free, easy to use Bowel Screen home test.

Breakthrough also used the awareness month to stress to the public that bowel cancer is more treatable the earlier it is detected and therefore, it is so important people remember they shouldn't be embarrassed to talk about poo with our GP's as it can help early detection.

Breakthrough advised those who have one or more of the following symptoms for a number of weeks or are worried about their bowel health to speak with their GP.

Change in your bowel habits such as...

- Going to the toilet more frequently
- Blood in your poo
- Pain in your tummy
- A lump in your tummy
- Unexpected weight loss when you're not trying to lose weight



WORLD OVARIAN CANCER DAY

One voice for every woman.™

WORLD OVARIAN CANCER DAY SEMINAR

2016 saw the first year of Breakthrough's involvement in the BEAT Ovarian Cancer Campaign in conjunction with OvaCare, Emer Casey Foundation and SOCK. This year, the campaign was relaunched for May 2017 to highlight the signs and symptoms of Ovarian Cancer for women across Ireland. On 8th May, World Ovarian Cancer Day, Breakthrough hosted a patient seminar which was free of charge and open to the public to provide relevant and helpful information for Ovarian Cancer patients and their families.

Speakers included Prof. Seamus O'Reilly (Oncologist), Dr. Sharon McKenna (Principal Investigator), Fionnuala Muldoon (Dietician) and Orla Dolan (CEO) who each provided a unique perspective on current research, treatment and recovery for cancer patients as well as helpful tips and advice for patients who were undergoing treatment at the time.

Attendees of the seminar were also offered a tour of the research facilities to give them a closer look at the research projects focused on Ovarian Cancer specifically and what they aim to achieve.

BreakthroughCancer @
BreakthroCancer · Oct 28

Ovarian Cancer is often diagnosed late, making it harder to **#BEAT**. Make sure you're aware of the signs and talking to your GP if you're experiencing any of the symptoms listed below!

Comment Share Like Message



WORLD PANCREATIC CANCER DAY

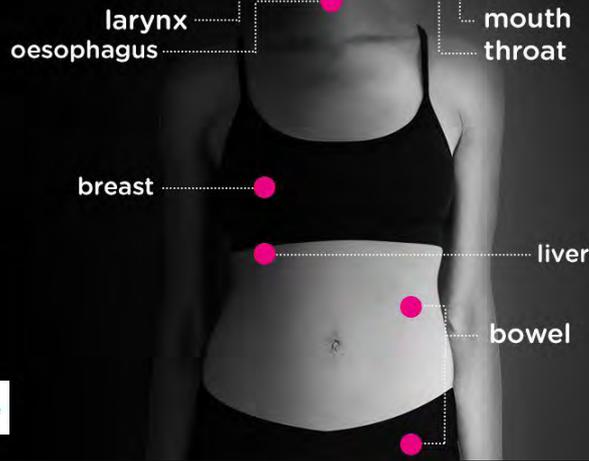
In November, Breakthrough Cancer Research joined forces to 'Demand Better for Patients with Pancreatic Cancer on World Pancreatic Cancer Day.' The annual one-day campaign is an initiative of the World Pancreatic Cancer Coalition, which is comprised of more than 60 organisations from 27 countries on 6 continents, Breakthrough being the only Irish Organisation involved in the campaign.

Every day, more than 1,000 people worldwide will be diagnosed with pancreatic cancer. Of that, an estimated 985 will die from the disease. In Ireland each year 518 people are diagnosed with pancreatic cancer with 483 dying from the disease. Additionally, pancreatic cancer has the lowest survival rate among all major cancers; and in nearly every country, it is the only major cancer with a single-digit five-year survival rate (2-9 percent).

Breakthrough, along with UCC and Cork City Council had two of the cities most famous buildings lit up in Purple for the day. Breakthrough staff as well as our funded scientists - who form the epicentre of Pancreatic Cancer Research in Ireland, all dressed in purple to help raise awareness.

Pancreatic Cancer is a major focus for Breakthrough funded research, having invested in a number of pancreatic focused projects, a fellowship, as well as a evidence based recipe book specifically for patients with Pancreatic Cancer. The Breakthrough funded book, 'Nourishing Your Body During Pancreatic Cancer Treatment' was launched and distributed to a number of hospitals and patient centres across the country in line with World Pancreatic Cancer Day 2017.

Dr. Aoife Ryan, Dietitian and Lecturer in Nutritional Sciences in UCC and co-author of the cookbook states, "Cancer-induced weight loss affects 30-80% of patients with solid tumours and is associated with poorer tolerance to chemotherapy, impaired quality of life, more frequent hospital admissions and significantly reduced survival. Scientific studies have consistently shown that patients with pancreatic cancer experience the most severe forms of weight loss and malnutrition. The result can be rapid weight loss over a short period of time which is often referred to as 'cachexia'. It is a huge challenge for these patients to stabilise their weight and an even bigger challenge to get them to gain weight. We hope these free patients resources will help overcome that."

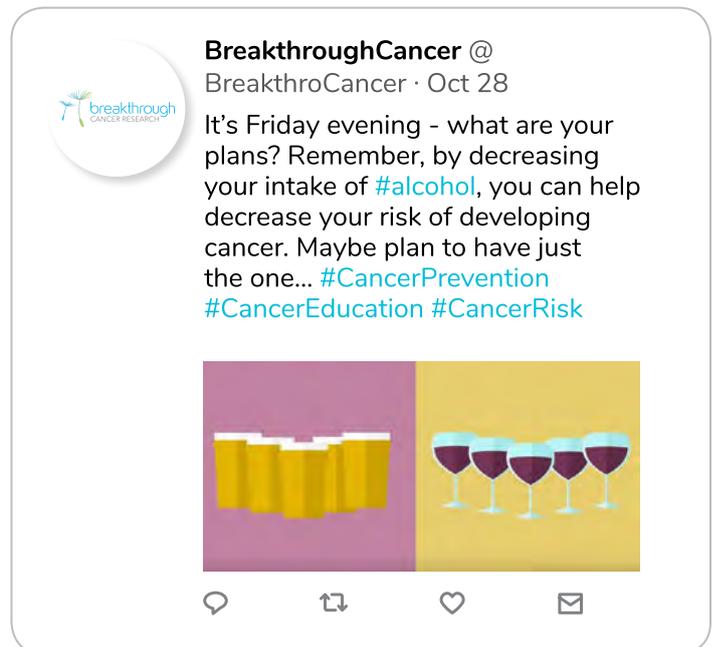


ALCOHOL & CANCER

At the close of 2017, Breakthrough supported National Awareness Week on Alcohol Related Harm and highlight the relationship between Alcohol and Cancer. Alcohol is proven to be related to 7 different types of cancer such as mouth, larynx, throat, esophageal, breast, liver and bowel. There are currently over 900 people in Ireland diagnosed with alcohol related cancers every year. Breakthrough worked with the HSE in order to make this information better known to make people not only aware of the link between Alcohol and Cancer but to give people guidelines and tips on how to reduce their risk.

Drinking in your teenage years and early twenties can significantly increase your risk of developing cancer later on in life, 1 in 8 Breast cancers is caused by alcohol, and alcohol plays a role in up to half of the cancers in the mouth, head, and neck. With this campaign, Breakthrough wanted to target specific audiences in which this information would be of most value -- speaking to four different groups based on these statistics in order to educate those at risk how they best can reduce their chances of developing one of the aforementioned types of cancer.

Breakthrough also supplied graphics and visual guidelines to be posted on social media and our webpage to make the information as accessible as possible to all demographics to help create awareness for the links between Alcohol and Cancer and what changes people can make to decrease their risk.



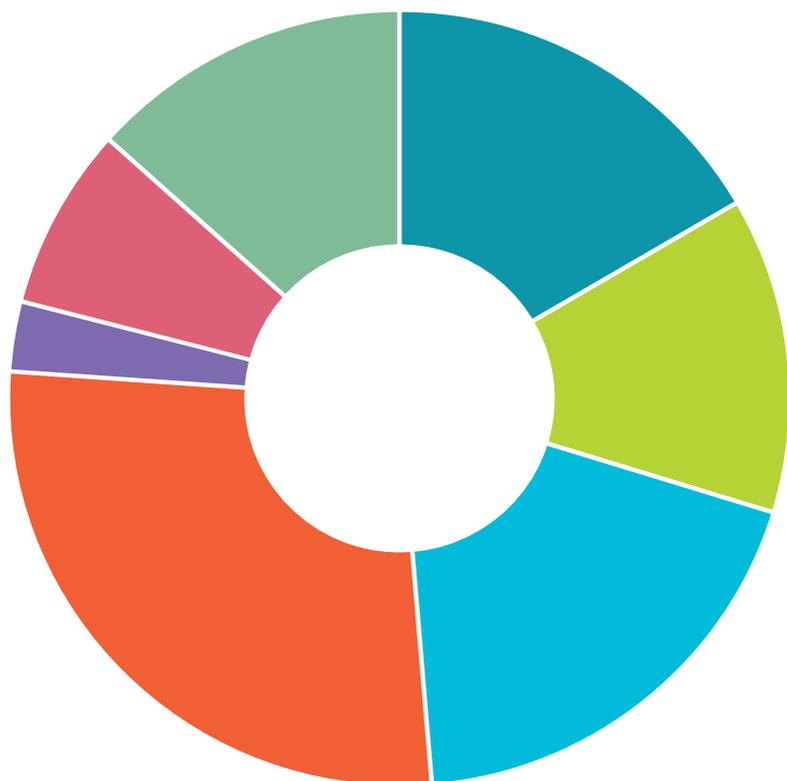
FUNDRAISING



TOTAL INCOME IN 2017

We couldn't fund life saving cancer research without your support.

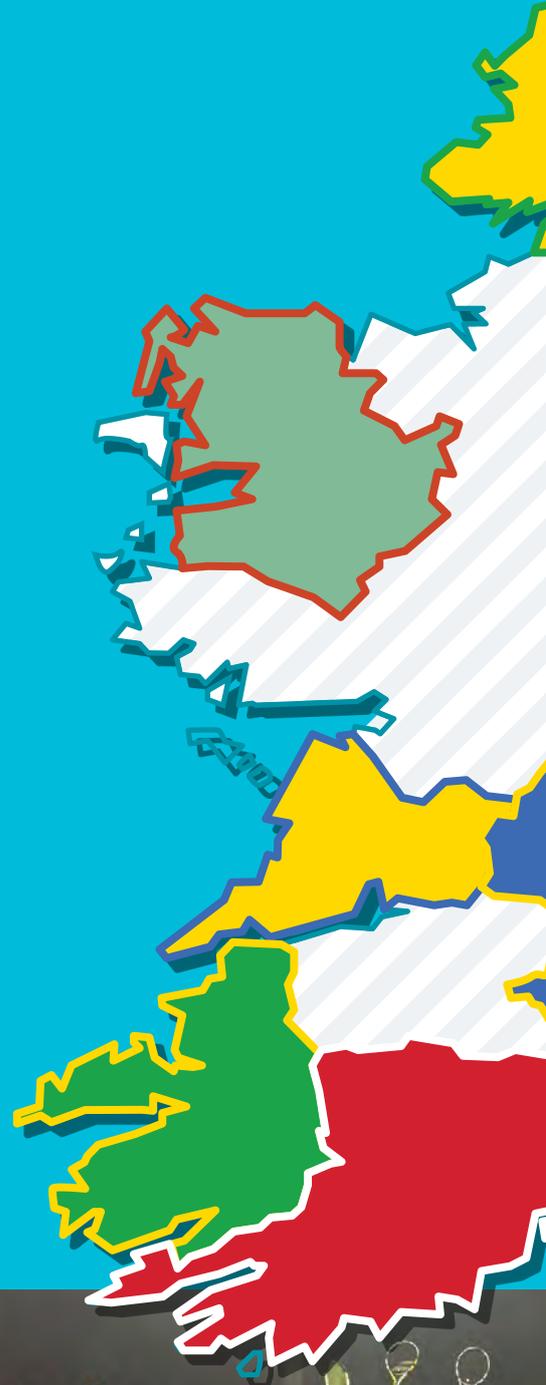
The Breakthrough community support us in many different ways from coffee mornings, fashion shows, corporate challenges to cycles and triathlons. This support ensures that we can continue to fight cancer. A breakdown of our funding is below.

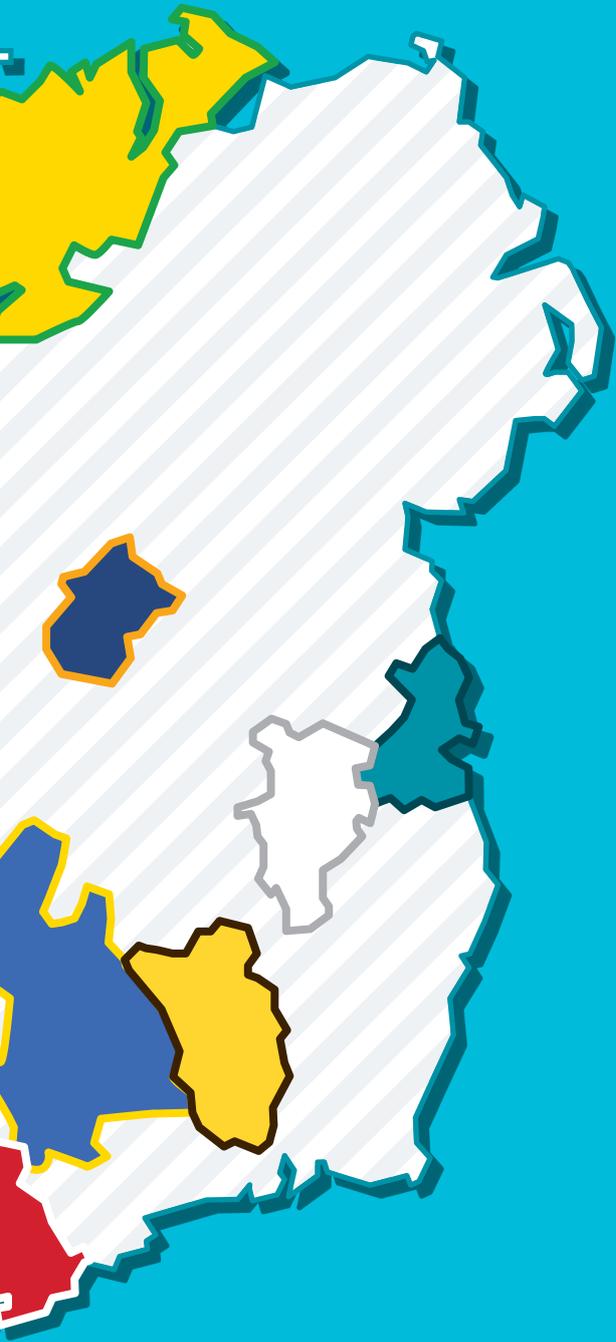


Corporate	€218,773
Challenges and Events	€171,505
Communities	€249,075
Individual Giving	€359,515
Campaigns	€36,382
Philanthropy	€100,358
Legacies	€176,000

Total: €1,311,608

CHALLENGES FOR CANCER RESEARCH





FIGHTING CANCER TOGETHER



WOMEN'S LITTLE CHRISTMAS AFTERNOON TEA & FASHION SHOWCASE

On Saturday, 7th January, Breakthrough hosted the 6th annual Women's Little Christmas Afternoon Tea and Fashion Showcase. Joined by over 150 women at the Cork Radisson Blu Hotel & Spa, the afternoon was filled with glamour, fun and luxury for all of the fabulous ladies in attendance.



VALENTINE'S BALL

Once again VIPs from across the Cork medical, scientific, academic, business and political worlds, were dressed to impress on Saturday, 11th February as they joined us at the annual Breakthrough Valentine's Day Ball to support Cancer Research at the luxurious and glamorous Fota Island Resort.



LEE GOLF VALLEY CLASSIC

Friday, 25th May 2017 saw over 100 golfers tee off for the 7th Annual Lee Valley Golf Classic in aid of Breakthrough Cancer Research. Returning to the great Lee Valley Golf & Country Club, the event was generously sponsored by The River Lee, Quish's SuperValu, Janssen Pharmaceutical and Snap Printing and helped raise over €13,000 for cancer research.



CORPORATE QUIZ

Returning as Quiz Master and MC, Jonathan Healy brought special guests including actress Hilary Rose and athlete Derval O'Rourke and RedFM's Ray and Jay to help test Cork businesses in this year's Corporate Quiz on Wednesday 8th November at The Clayton Hotel Silver Springs.

IN GOOD COMPANY

We are so lucky to have so many great partnerships and corporate supporters. Here are just some of the incredible companies and organisations we worked with in 2017!



MUSGRAVE TRIATHLON

MUSGRAVE TRIATHLON



CORK'S 96FM

CORKS 96FM RADIOTHON



RING OF KERRY CHARITY CYCLE

RING OF KERRY CHARITY CYCLE



Dennehy's Health & Fitness

DENNEHY'S DROP A DRESS SIZE TO HELP FIGHT FOR THE GIRLS



GAA

breakthrough CANCER RESEARCH

GAA CHARITY PARTNER 2017/2018



5 FOR THE FIGHT

5 FOR THE FIGHT

FINANCIAL REPORT

EITHNE O'LEARY
FINANCE
MANAGER



GOVERNANCE

Breakthrough is fully committed to openness, transparency and integrity to our donors, supporters, volunteers and funding partners by adhering rigorously to the Triple Lock standards set out by the Charity Institute of Ireland - **good fundraising, transparent annual financial reporting and governance.**

For more information on our Governance go to www.breakthroughcancerresearch.ie.

Our Board of Directors is made up of independent individuals with diverse backgrounds who volunteer their time, expertise and passion to our vision. The Board provides the advisory and governance role for the charity. We do not pay members of our Board, cover their expenses or provide recompense in any other way.

The Board of Breakthrough has formally adopted, is signed up to and is fully committed to achieving the standards contained within the Statement of Guiding Principles for Fundraising.

The Statement exists to:

- Improve fundraising practice
- Promote high levels of accountability and transparency by organisations fundraising from the public
- Provide clarity and assurances to donors and prospective donors about the organisations they support.

We, Breakthrough, have considered the Statement and believe we meet the standards it sets out.

Breakthrough's annual accounts are independently audited every year by Moore Stephens. We prepare our accounts in accordance with Irish accounting standards and with reference to the Statement of Recommended Practice (SORP) for charities.

This is a comprehensive framework that enables us to explain what we aim to do, how we go about it and what we achieve.

You can download and view our most recent audited accounts at www.breakthroughcancerresearch.ie

The Board of Breakthrough has formally adopted and is publicly signed up to the Governance Code for the Community and Voluntary Sector.



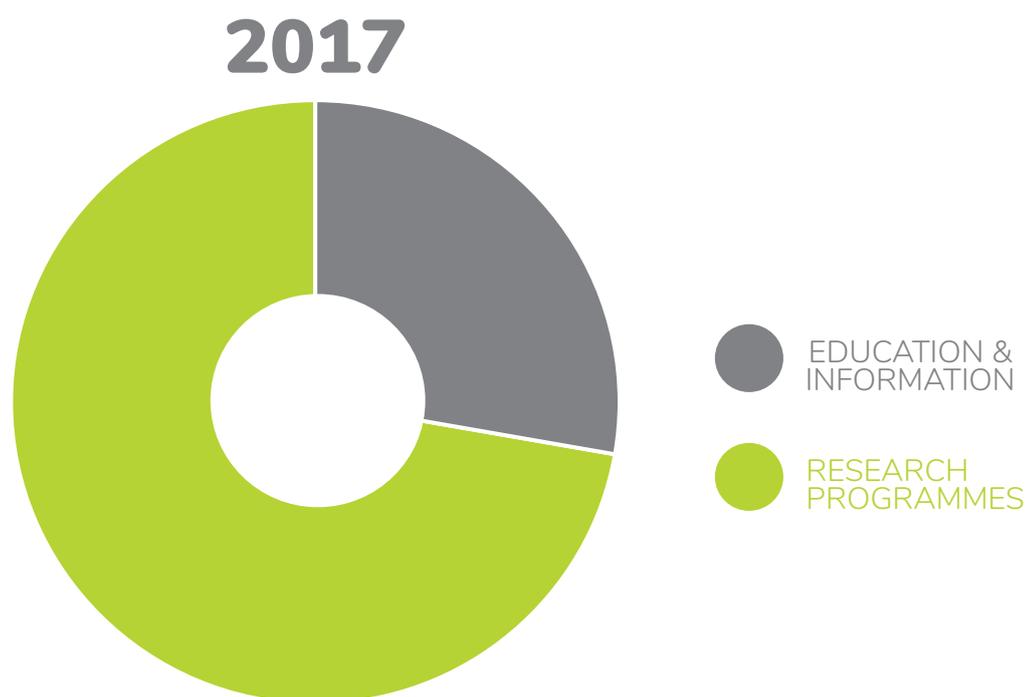
FINANCIAL REPORT

Statement of Financial Activities (Including Income & Expenditure Account) for year ended 31st December 2016

Funding is received from:

[100% Fundraising](#)

The investments made into the two priorities for the organisation in terms of research expenditure were:



Education & Information:
2017 - €90,621 (2016 - €98,552)

Research Programmes:
2017 - €236,618 (2016 - €676,685)

Total - €327,239

An additional €401,741 of non-ring fenced research funds were retained and made available for projects currently undergoing peer review but commencing in 2018

The figures presented represent the financial year 1 January, 2017 to 31 December 2017. The gross income was €1,311,608 (2016: €1,361,750)

BREAKTHROUGH CANCER RESEARCH

STATEMENT OF FINANCIAL ACTIVITIES

FOR THE YEAR ENDED 31 DECEMBER 2017

	Unrestricted funds	Restricted funds	Total 2017	Total 2016
	€	€	€	€
Income from:				
Legacies	176,000	-	176,000	110,500
Charitable activities	955,194	180,414	1,135,608	1,251,250
Total income	1,131,194	180,414	1,311,608	1,361,750
Expenditure on:				
Raising funds	355,004		355,004	424,246
Charitable activities	150,511		150,511	174,364
Research	270,729	56,510	327,239	930,237
Total resources expended	776,244	56,510	832,754	1,528,847
Net income for the year/ Net movement in funds	354,950	123,904	478,854	(167,097)
Fund balances at beginning of year	19,722	136,532	156,254	323,351
Fund balances at end of year	374,672	260,436	635,108	156,254

BREAKTHROUGH CANCER RESEARCH BALANCE SHEET AS AT 31 DECEMBER 2017

		2017	2016
	€	€	€
Fixed assets			
Tangible assets		1,737	3,473
Current assets			
Debtors	390,391		60,791
Cash at bank and in hand	<u>434,895</u>		<u>502,057</u>
	825,286		562,848
Creditors: amounts falling due within	<u>(191,915)</u>		<u>(410,067)</u>
Net current assets		<u>633,371</u>	<u>152,781</u>
Total assets less current liabilities		<u>635,108</u>	<u>156,254</u>
Income funds			
Restricted funds		260,436	136,532
Unrestricted funds		<u>374,672</u>	<u>19,722</u>
		<u>635,108</u>	<u>156,254</u>

The financial statements were approved by the board of directors and authorised for issue on €401,741 2018 and are signed on its behalf by:



Glenlee, Western Road, Cork, Ireland
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LoCall 1890 998 998

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Email: info@breakthroughcancerresearch.ie

Charity No: CHY 19801
Registered Charity No: 20077945
