

CRUK RESEARCH STRATEGY: 2017 PROGRESS REPORT

FOREWORD

“ In 2014 we set ourselves a challenging ambition: to accelerate progress and see three-quarters of patients surviving cancer within the next 20 years. We published a strategy in support of this ambition, in which we set out our priorities for the next several years and outlined the approaches we would take.

This report sets out a high-level view of progress since the strategy's launch. Alongside ongoing dialogue with the UK and international research community, we've sought input and challenge on our progress from supporters, patients and those affected by cancer. Our aim is not just to support the best research, but to ensure that our focus and priority areas are those that will transform outcomes for patients.

The ability to fund research is of course fundamental to our strategy. Since 2014, despite the uncertain economic and political environment, I'm pleased to say that we've increased our annual research spend from £351 million to £386 million, allowing us to continue to invest across all areas.

At this three-year juncture, it's too early to measure research outcomes, or assess the long-term therapeutic impacts of our strategic activity. Instead, we've focused on whether we've been successful in building capacity – strengthening the researcher base in priority areas, encouraging and supporting novel, exciting work, and ensuring we have the infrastructure to progress important discoveries as quickly and efficiently as possible.

We've invested in new initiatives to encourage innovation and collaboration, both nationally and internationally, allowing us to draw in world-class researchers from diverse disciplines to complement our existing community. We've increased our spend in priority areas such as our cancers of unmet need, where we've more than doubled our investment in both lung and pancreatic cancer, and have seen a move towards more collaborative team-based research programmes. We've established major partnerships to accelerate progress and convene expertise in priority areas. And we're continuing to build on a network of research centres so our scientists can work together to make the best use of their combined expertise.

There has been a strong response from the research community, coming together to tackle the biggest challenges in cancer research, not just within the UK, but internationally. We're leveraging the excellence of our researchers to attract external investment, both financial and intellectual, from other research organisations, and from industry.

This means that more collaborations are forged, more research gets done and we see greater capacity and expertise helping to achieve our objectives.

Although we've made significant progress, there remain important areas in which we want to go further and plan to accelerate our progress. These include early detection and brain tumour research, where the baseline of research capacity remains very low and we are yet to invest at significant scale. We have recently taken action to increase our activity in these areas, celebrating a new partnership with the Knight Cancer Institute at Oregon Health and Science University in early detection, and sponsoring an international brain cancer research workshop which identified crucial gaps in knowledge, pinpointing the areas in which we need to work. We will continue to look at ways to further build research capacity in these fields, as a priority.

We are continually striving to do more to accelerate the translation of research, and have always encouraged our researchers to think hard about the potential of their work to benefit patients and the population at large. We've had some amazing successes: supporting the development of eight cancer drugs now in widespread use globally, testing over 100 new drugs in cancer patients, and taking many more anti-cancer therapies into clinical trials. We've recently created a new division, Research and Innovation, to greatly enhance our capability to go from the first funding of a research idea all the way through to a fully developed or commercialised innovation. This puts us in a strong position to partner with organisations that can help at the earliest stages and ensure those ideas progress as rapidly as possible.

Our organisation has never shied away from taking on the toughest challenges – from protecting future generations from tobacco, to tackling the cancers that are hardest to treat. There is still much to do, but I'm highly encouraged by the progress that we've made to date and remain confident that we're on the right track. We'll be reporting on our progress in more depth in the coming years, when we are able to fully evaluate the longer-term outputs, outcomes and impact we are making.

Iain Foulkes
Executive Director
Research and Innovation, CRUK

OUR STRATEGIC FRAMEWORK

In our 2014 Research Strategy we outlined four Objectives – the areas where we plan to focus our efforts over the coming years. Each objective is critical to improving long-term impact and outcomes, and together will get us closer to our ambition of 3 in 4 patients surviving cancer by 2034.

To achieve these objectives we outlined the Approach that we will take: five specific areas in which we plan to invest and drive new activity.

In the three years since we launched the Research Strategy we have focused on delivering new strategic activity, such as the launch of funding schemes, and funding research initiatives in each of these areas. We have been closely monitoring this activity and tracking short-term 'input' measures such as quantitative shifts in spend. In this report, we showcase some of the significant new activity and progress being made.

OUR OBJECTIVES

PREVENT

More than 40% of all cancers diagnosed in the UK are attributed to lifestyle and environmental factors, but even though we know the main preventable risks, achieving large-scale behaviour change is a huge challenge. We're tackling cancer prevention in a holistic way, from tobacco control to preventive treatments, using the range and breadth of our research and policy activities.

DIAGNOSE

Earlier diagnosis of cancer offers the greatest potential for transformational improvements in patient outcomes. In our strategy we pledged to take a leading role in this area, leveraging the range and breadth of expertise and infrastructure in our portfolio, and our close links with the NHS.

TREAT

Our strategy recognised a need for therapeutic innovation covering a breadth of treatments – drugs, radiotherapy and surgery – and bringing in new perspectives, mechanisms and methods. We pledged to continue investing in treatment innovations, and to lobby for more rapid adoption of them into the healthcare system.

OPTIMISE

We have a wealth of information with which to personalise cancer treatment, and our aspiration is to make precision medicine a reality in the UK. We want to see patient treatment decisions being made on a truly individual basis, and for doctors to have access to a wide range of effective treatment combinations.

OUR APPROACH

BUILD OUR UNDERSTANDING OF CANCER

FACILITATE A MAJOR SHIFT IN EARLY DIAGNOSIS RESEARCH

TACKLE CANCERS WITH SUBSTANTIAL UNMET NEED

ACCELERATE THE TRANSLATION OF RESEARCH

DEVELOP THE CANCER RESEARCH LEADERS OF TOMORROW

BUILD OUR UNDERSTANDING OF CANCER

Driving progress in understanding the causes and biology of cancer is an essential foundation for our work – providing the evidence that underpins our policy and information activity, and opening new avenues for translational and clinical research.

In our strategy we pledged to continue to invest a significant proportion of our overall budget in this area, as well as maintaining the shift from fundamental biology to tumour-specific biology, ensuring that we only fund discovery research with a clear link to cancer.

WE SAID WE WOULD: ESTABLISH THE FRANCIS CRICK INSTITUTE

Now a prominent part of the London landscape and a beacon of research excellence worldwide, the Francis Crick Institute opened its doors in 2016 to research groups from our London Research Institute alongside researchers from the Medical Research Council (MRC) National Institute for Medical Research, the Wellcome Trust and the Crick's university partners, Imperial College London, King's College London and University College London.

The Crick is the largest biomedical research facility in Europe under one roof, bringing together 1,500 scientists and support staff working across disciplines in a unique physical and cultural environment designed to encourage multidisciplinary collaboration. As a founding partner, CRUK contributed £160 million to the construction of the Institute and will continue to invest annually to support research. The collective vision is to radically increase our understanding of the fundamental biology underlying human health and disease, and includes a strong focus in cancer research.

“SOMETIMES I LOOK AT WHAT'S BEEN ACHIEVED SO FAR WITH THE CRICK AND I CAN'T QUITE BELIEVE THAT IT HAS ALL HAPPENED. WHAT HAS BEEN PRODUCED IS AN ADVANCED, EXCITING AND COMPLEX BIOMEDICAL RESEARCH INSTITUTE. THIS IS TO THE CREDIT OF ALL THOSE WHO HAVE BEEN INVOLVED IN THIS PROJECT. NOW WE HAVE TO DELIVER THE MISSION OF THE INSTITUTE – TO PUSH BACK THE BOUNDARIES OF OUR UNDERSTANDING TO HELP SOCIETY COMBAT HUMAN DISEASE.

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Sir Paul Nurse
Chief Executive and Director
Francis Crick Institute

WE SAID WE WOULD: DEVELOP OUR CORE-FUNDED INSTITUTES

Our Institutes in Cambridge, Glasgow, Manchester and Oxford are essential in the delivery of our strategy. Together, they provide an outstanding environment for us to support a long-term approach to addressing the broader challenges in cancer. They also play a key role in developing the future cancer workforce, and in recruiting and retaining international talent. In 2016/17 we invested £53.2 million in our core-funded Institutes, an increase of £6.6 million from 2013/14.

Each Institute has its own unique strengths and areas of strategic focus, which align with its associated Centre to facilitate the translation of research. Since the launch of the strategy, the institutes have continued to all align to areas of strategic priority. The CRUK Beatson Institute in Glasgow has increased its focus on pancreatic cancer, Manchester has an emphasis on lung cancer and precision medicine, Oxford remains at the forefront of leveraging the potential of radio-oncology, and the Cambridge Institute has increased its activity in early detection and brain tumour research.

WE SAID WE WOULD: INVEST IN OUR EXISTING FUNDING SCHEMES

Our strategy included significant new activity but we recognised the importance of continuing to invest in the funding schemes we already had in place: Science Committee, Clinical Trials Awards and Advisory Committee (now Clinical Research Committee), New Agents Committee and Population Research Committee. In 2016/17 we maintained our annual investment at ~£87 million. These committees support talented UK scientists to conduct five-year curiosity-driven programmes of research or shorter-term projects or fellowships in a range of disciplines – from behavioural research, to fundamental cancer biology, drug discovery and late-phase clinical trials. They are also a key route for building capacity and funding research that can lead to impact in our priority areas – such as brain, pancreatic, lung, oesophageal and children's cancers. We are already seeing increased representation of these areas in the portfolio and will monitor research outcomes and impact in the long-term.

WE SAID WE WOULD: LAUNCH A NEW AWARD TO SUPPORT INNOVATION

As part of the new activity outlined in our strategy, we said we wanted to provide a mechanism for researchers to test novel small-scale innovations that could make a difference in cancer. Our Pioneer Award was launched to support these high-risk, potentially high-reward pilot studies with grants of up to £200,000 over two years. Funding is awarded based on the quality of the idea, rather than the researcher's track record, and aims to support genuinely innovative approaches. Launched in 2015, our aim was to fund up to 10 projects per year and we have funded 18 projects to date, including two in partnership with commercial collaborators.

The award has attracted a wide range of disciplines to focus on cancer research, including areas such as computer science, nanotechnology and engineering. Pioneer Award recipients are working on ideas such as using palladium catalysts to target brain tumours and investigating whether the Zika virus can slow down brain tumour growth.

WE SAID WE WOULD: INCREASE OUR INVESTMENT IN CANCER IMMUNOLOGY RESEARCH

Immunotherapy holds great promise in cancer and other diseases and we are only just at the beginning of realising its potential. The UK has an outstanding base of immunology researcher expertise, and the Cancer Immunology Project Award was launched to attract this community to the cancer field.

Our aim was to fund up to 10 projects each year and since 2015 we have funded 18 grants of up to £300,000 over three years. Researchers are using their awards to explore ideas such as increasing understanding of mechanisms of immune suppression within the tumour microenvironment, and investigating novel pathways that suppress the immune checkpoint molecule PD-1, taking the brakes off the immune system's anti-tumour response.

We're also embarking on a new collaboration with Arthritis Research UK and will host a sandpit-style idea generation workshop with researchers that will help to identify new opportunities in this important field.

USING MATHEMATICS TO SOLVE METASTASIS

One of the first CRUK and EPSRC co-funded multidisciplinary awards was granted to mathematician Dr John MacKenzie from the University of Strathclyde and molecular biologist Professor Robert Insall from the CRUK Beatson Institute in Glasgow, who have brought together a group of mathematicians, statisticians and cell biologists to tackle the problem of cancer metastasis.

Classical mathematical approaches are excellent at uncovering linear pathways, but struggle to explain the complexity of positive feedback and self-organisation pathways involved in cell migration. To overcome this, the team are using a combination of theoretical and experimental components.

First, they'll design new realistic computational models to describe how individual molecules drive the shape, movement and steering of a cell when it is driven out of a primary tumour and into the blood, lymph and surrounding tissues. Next, they will test their theoretical results experimentally by tracking melanoma cells using video microscopy, and adapt their predictions based on comparison data derived from real tumours.

The pairing of skills between these teams has enabled real innovation in thinking about cell migration, with both researchers armed with new insight they can carry with them to other areas of their research.

WE SAID WE WOULD: LAUNCH A NEW FUNDING SCHEME FOR ENGINEERING AND PHYSICAL SCIENCES

To make faster progress against cancer we need the expertise of scientists working in different disciplines. In 2015, we launched the Multidisciplinary Project Award to foster collaborations between cancer researchers and scientists from engineering and physical sciences, with the aim of generating creative research ideas and implementing them in cancer research. The awards provide researchers with funding of up to £500,000 over four years and are funded in partnership with the Engineering and Physical Sciences Research Council (EPSRC), allowing us to further reach the engineering and physical sciences community.

Since 2015 we have funded a total of 21 projects against a target of 15 each year. These bring expertise from the fields of physics, biophotonics, nanotechnology, materials science, and chemistry and biotechnology. Projects range from using mathematical modelling to gain insights into the biological processes that drive cell migration and metastasis, to using a new form of spectroscopy developed in physics to map the response of tumour models to different treatments, aiding drug discovery and potentially determining the best treatment option for patients.

FACILITATE A MAJOR SHIFT IN EARLY DIAGNOSIS RESEARCH

Earlier diagnosis of cancer offers the greatest potential to transform patient outcomes. The UK has a growing, active research community focused on the role of patients, healthcare professionals and healthcare providers in early diagnosis, and, together, we have a strong track record in policy research and development in this area.

Research we funded provided evidence that underpinned the introduction of bowel scope as a national bowel cancer screening programme, which is already saving lives. Our input also informed the new five-year cancer strategy for England, which has early diagnosis central to achieving 'world class' cancer outcomes.

Yet, there remains a pressing need to increase the focus of research on early disease biology and the accurate detection of early cancers, as well as to drive innovation in existing areas of strength such as behavioural science and epidemiology. We are currently faced with a very low baseline of research capacity in early detection and hope that increasing our focus in this field will accelerate progress. We plan to tackle this in three ways: working closely with the emerging early detection community to understand how best to shape our activity, launching new funding calls to address specific knowledge, technological and/or skills gaps identified, and developing international networks to attract talent to the field and forge new strategic partnerships.

WE SAID WE WOULD:

ENCOURAGE A SHIFT TOWARDS EARLY STAGE DISEASE RESEARCH

The emphasis of basic cancer biology towards later stage or metastatic disease limits the identification of new approaches to early detection. To build capacity and drive efforts to understand the biology of early cancer development, our Major Centre in Cambridge has launched an Early Detection Programme. Although its primary focus will be on the biology of cancer initiation and progression to invasion, the programme covers a broad spectrum of early detection research, from clinical studies to the broader psychological, legal and economic implications of early detection strategies. The programme is already funding several research projects and in January 2017 held its first Early Detection Annual Symposium.

In partnership with the Dutch Cancer Society, we are co-funding an international team, led by Dr Jelle Wesseling, to interrogate the biology of one of the earliest stages of breast cancer – ductal carcinoma in situ (DCIS). Armed with a Grand Challenge award of £15 million and samples from the world's three largest clinical studies of DCIS in the UK, US and the Netherlands, the team hopes to determine the differentiating characteristics of DCIS that progresses to invasive cancer, and that which does not, to address its significant overtreatment (read more on page 16).

WE SAID WE WOULD: FORM EFFECTIVE PARTNERSHIPS

The challenge of early detection is a global one, and to accelerate progress we have joined forces with the Knight Cancer Institute at Oregon Health and Science University, a leader in precision cancer medicine. The partnership aims to address some of the barriers to studies of early cancer biology, such as a lack of early-stage disease models, shortage of tissue samples and the need for new technologies that can detect the earliest stages of cancer development. In 2016, we held a joint international Early Detection of Cancer Conference – a collaborative forum for international experts to come together and shape this priority research field.

We are delighted to be the US Cancer Moonshot Initiative's first international partner, focusing on detecting early signs of cancer. In this joint endeavour, Professor Caroline Dive from the CRUK Manchester Institute will collaborate with Professor Peter Kuhn's team at the University of Southern California to apply their combined expertise and technology in analysing circulating tumour cells to the study of patients with early-stage lung and bowel cancer. Evidence already suggests that circulating tumour cells and circulating tumour DNA could provide early warning signs of cancer relapse before it is detectable on scans in lung cancer, and if similar hallmarks are found in early disease, these markers could hold promise for the detection of primary cancer too.

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THE FULL POTENTIAL OF
PRECISION CANCER MEDICINE
WILL ONLY BE REALISED
WHEN IT IS COUPLED WITH
A SOPHISTICATED EARLY-
DETECTION EFFORT. WE ARE
COMMITTED TO UNITING
RESEARCHERS WORLDWIDE
AND ENSURING THE NEXT
GENERATION OF CANCER
DETECTION BECOMES A REALITY.
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Dr Brian Druker

Director
OHSU Knight Cancer Institute

THE SONDLAND-DURANT EARLY DETECTION OF CANCER CONFERENCE

As part of our partnership with the Knight Cancer Institute at Oregon Health and Science University, in June 2016 over 100 researchers working in biomedicine, technology and engineering, from all corners of the globe, attended a three-day meeting in Oregon to discuss the complex challenges of early cancer detection.

The programme included world-renowned researchers presenting overviews of the current state-of-play in their field, alongside opportunities for discussion and debate. Topics were wide-ranging within the early detection theme – from circulating tumour cells to the role of the immune system and microbiome in early disease.

Academic scientists were joined by those at the frontier of commercial development of new diagnostic tests for early cancers, providing diverse perspectives on the challenges.

The breadth of speakers, strong scientific content and the intimate, highly collaborative atmosphere of the first meeting laid a solid foundation for what will now be an annual international event, jointly hosted by CRUK and the Knight Cancer Institute. The location for meetings will alternate between the UK and US, the next being held in Cambridge in autumn 2017, and have the aim of identifying new opportunities in the field and building on the relatively small early detection research community.

WE SAID WE WOULD: BUILD A CONCENTRATION OF RESEARCH EXPERTISE

In addition to increased focus on early tumour biology, our aim is to support a wide range of disciplines from population studies to health policy research, and to support innovation and collaboration in the early detection field.

Our £5 million Catalyst Award provides international scientists in population research with an opportunity to team up and work together. We were excited to award the first Catalyst Award to CanTest – an ambitious international programme that aims to transform the GP office into a hub of diagnostic excellence for cancer, by assessing the accuracy, cost effectiveness and suitability of diagnostic methods for use in primary care. It also aims to leave a legacy – an International School for Cancer Detection Research in Primary Care – to support the next generation of researchers in the field.

Our Early Diagnosis Innovation Award supports multidisciplinary teams looking at ways to harness new technology to detect cancer earlier. We invited early-to-mid career researchers and healthcare professionals to a three-day 'sandpit' – an interactive, facilitated workshop where they formed new teams and developed novel research ideas. Five teams have been awarded with up to £20,000 seed-funding to conduct 12-month feasibility pilots of their groundbreaking ideas, which include using audio-technology to detect lung cancer earlier and using video-technology to raise awareness of paediatric cancers in healthcare professionals.

WE SAID WE WOULD: INVEST IN SAMPLE COLLECTIONS

We are making full use of previously funded patient sample collections, through a partnership with Abcodia, a biomarker validation company that focuses on developing new blood tests to detect cancer early. The partnership makes use of one of the world's largest prospective collections of serum samples available for biomarker research, from the UK Collaborative Trial for Ovarian Cancer Screening (UKCTOCS), which comprises more than five million samples curated at University College London and supported by CRUK and other organisations.

Our new Clinical Research 'Statement of Intent' outlines our plans to prioritise hypothesis-driven, data-rich, sample collections that support the discovery, validation and qualification of valuable biological information, ensuring we learn as much as possible from the patients on our trials. The pioneering UK TRACERx study, the first of its kind, is an elegant example of this (see page 11). The study is following 850 people diagnosed with non-small-cell lung cancer from their diagnosis through treatment, and in some cases, immediately after their death. Six samples from different regions of a patient's tumour, plus healthy lung tissue samples, pulmonary blood and three-monthly peripheral blood samples will be collected as part of this study, allowing analysis of individual lung tumours from early-stage disease through to local recurrence and metastasis.

TACKLE CANCERS WITH SUBSTANTIAL UNMET NEED

Despite a considerable increase in activity since we launched our strategy, maintaining a strong focus on lung, pancreatic, oesophageal and brain cancers continues to be a key priority. Our ambition remains to build long-term sustainable research capacity. But our ambitions stretch beyond this, and our activity in these areas won't be limited to the approaches outlined here. We are only at the beginning of our efforts to understand the critical questions and barriers that need to be addressed in other patient groups: older populations, children, teenagers and young adults, and those with rarer cancers, and will be looking to accelerate our progress in these areas in the next few years.

WE SAID WE WOULD:

INCREASE OUR RESEARCH SPEND IN LUNG, PANCREATIC, OESOPHAGEAL CANCERS AND BRAIN TUMOURS

We have increased spend across oesophageal cancer (£11.7m in 2016/17 vs £5m in 2013/14) and brain tumours (£13.5m in 2016/17 vs £7.1m in 2013/14), and particularly so in lung (£43.4m in 2016/17 vs £19.2m in 2013/14) and pancreatic cancer (£17.2m in 2016/17 vs £8.6m in 2013/14), supporting a breadth of activity. Beyond increased spend, we aim to build a sustainable research community in each tumour type, and are encouraged by a recent increase in the number of career development awards focused on these cancers. Of the 122 new fellowships and bursaries that we have funded since 2014, 32 (26%) were focused in lung, pancreatic, oesophageal cancers or brain tumours.

LUNG CANCER

In lung cancer, our biggest single investment is the TRACERx study – a multi-million pound programme studying tumour heterogeneity and evolution in non-small-cell lung cancer (NSCLC) patients, which is already delivering clinically relevant outputs, and being leveraged to develop new therapeutics.

Focusing the sharpest minds on the challenge of lung cancer and attracting research talent to the field is essential, and our Manchester and UCL Centres have created a collaborative environment for lung cancer research to flourish through the joint CRUK Lung Cancer Centre of Excellence. The Centre hosted its first conference in late 2015, bringing together the world's leading lung cancer experts, and will host a second in late 2017.

Other CRUK-funded major research initiatives in lung cancer include the National Lung Matrix Trial (NLMT) – the world's largest precision medicine trial in NSCLC. This innovative study, run by industry partners AstraZeneca and Pfizer through the Experimental Cancer Medicine Centre (ECMC) network, gives patients access to 20 different NSCLC treatment options under one UK-wide, standardised trial.

TREATMENT INNOVATION FOR LUNG CANCER

Cancer Research Technology and biotech investors Syncona have launched a company called Achilles Therapeutics to turn discoveries made by the TRACERx study into personalised immunotherapies for lung cancer.

The company was founded by cancer evolution expert Professor Charles Swanton from the Francis Crick Institute and UCL, with renowned immunotherapy researchers Professor Karl Peggs and Dr Sergio Quezada from UCL, and Professor Mark Lowdell from the Royal Free Hospital, London.

Achilles Therapeutics will design treatments that can target truncal tumour neo-antigens – which are unique to an individual patient's tumour and not expressed on healthy cells, so have potential to target and destroy tumours without harming healthy tissues.

TRACERx is tracking the evolution of cancer in 850 people with NSCLC, in different parts of their tumours and in response to treatment. Achilles has exclusive rights to develop and commercialise neo-antigen technologies arising from the study, translating the insights quickly to the clinic and providing much-needed new treatments for lung cancer.

OESOPHAGEAL CANCER

In June 2015, we brought basic, translational and clinical researchers together at an International Symposium on Oesophageal Cancer co-hosted by the CRUK Oxford and Cambridge Centres and the Cancer Hospital, Chinese Academy of Medical Science. The symposium was a unique opportunity to unite scientists and clinicians from two countries where the incidence of oesophageal cancer is steeply on the increase, and a chance for those not currently in the field to learn more about this fascinating disease. Following its success, we ran a second symposium in Spring 2017, followed by a workshop with key members of the international community to identify priority areas for research.

Our continued funding of the oesophageal cancer International Cancer Genome Consortium (ICGC) project is supporting sample collection infrastructure, pathology and clinical data annotation of longitudinally collected oesophageal tumours and matched control tissue. The curation of this sample collection is a springboard for future oesophageal cancer research projects from the wider community, several of which we are delighted to see are already coming through our response-mode funding schemes. We believe there is considerable further impact that can be made with the outputs of this initiative and are in ongoing talks with the oesophageal research community to establish what the 'legacy' of the ICGC project should be.

Cytosponge – the novel cell collection device to detect and diagnose Barrett's oesophagus – is advancing into the next phase of clinical evaluation. We are supporting the BEST-3 trial, which will test Cytosponge in 84 GP surgeries around the UK to determine whether it is cheaper and easier than current methods for diagnosing Barrett's. Identifying people with this condition and offering them surveillance could make it possible to diagnose oesophageal cancer early, when it is still curable, and even prevent it, by identifying and treating patients with pre-cancerous changes.

BRAIN TUMOURS

Brain tumours remain a challenging area with relatively limited research activity and it's an area where we are keen to accelerate progress. To identify the key research areas where we should focus our efforts, we held an international workshop in 2016 with leaders in the brain tumour field, who identified several outstanding research questions. These ranged from fundamental biology – such as identifying new molecular drivers of brain tumours – to clinically relevant questions, such as understanding the pathophysiology of the blood-brain barrier and its impact on therapeutic delivery, or determining the biological basis for clinical trial outcomes in brain tumours. We are now looking at ways to address these areas of focus and to further build research capacity in the field.

A long-standing challenge in brain tumour research has been the lack of good models or research tools, and the Edinburgh and UCL Centres recently secured an Accelerator Award to address this gap by establishing an international Glioma Cellular Genetics Resource. This centralised resource will offer glioblastoma cell lines, genome editing tools and novel engineered patient-derived cellular models for researchers worldwide, and a PhD programme associated with the award is hoped to encourage talented neuroscientists to enter the brain tumour field.

PANCREATIC CANCER

In pancreatic cancer, we joined forces with Stand Up To Cancer and The Lustgarten Foundation to fund an £8 million Transatlantic Pancreatic Cancer Dream Team to accelerate the translation of research into early phase clinical trials. Led by Professor Gerard Evan at the University of Cambridge, Professor Daniel von Hoff at the Translational Genomics Research Institute in Arizona and Professor Ron Evans at the Salk Institute for Biological Sciences in California, the Dream Team aims to understand pancreatic cancer's regulatory mechanisms, which the team believe to be hacked versions of the normal wound healing processes. This knowledge will inform trials of potential new treatments targeting these mechanisms and will include combinations of chemotherapy, immunotherapy, paracalcitol (a vitamin-D analogue) and drugs to perturb super-enhancer signalling programmes.

We're also funding PRECISION-Panc, an ambitious programme of research that seeks to uncover the molecular profile of individual patients with pancreatic cancer, to learn more about the disease and to facilitate patients entering clinical trials for treatments that match their tumour biology. At £10 million, it's our biggest standalone investment in pancreatic cancer to date, and will enable biomarker discovery research and two-way translation between the laboratory and clinic.

Key to our success in building capacity in this, and other, priority areas, is to engage with existing and potential pancreatic cancer researchers. To support this aim, we sponsored the 2016 International Symposium of Pancreatic Cancer, which focused on precision medicine approaches. The meeting attracted around 250 delegates from the UK, US and Europe to explore current thinking in pancreatic cancer and identify new research opportunities. We held a career and funding workshop as part of the meeting to showcase pancreatic cancer as one of our strategic priorities and to inspire researchers to consider moving into this burgeoning field – a step towards our ambition to develop and sustain a critical mass of researchers focused on this area.

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THE STARTING GUN FOR THE DREAM TEAM WENT OFF IN EARLY 2016, AND NOW THERE'S A RATHER FASCINATING DUAL TRACK PROCESS GOING ON. THE MECHANISTIC SCIENCE GRAFTS AWAY TRYING TO SORT OUT HOW THE REGENERATIVE PROGRAMME OF THE PANCREAS IS HACKED BY ONCOGENES, BUT, ON THE WAY, WE USE EACH MECHANISTIC DISCOVERY TO GUIDE INFORMED GUESSES ABOUT WHAT NOVEL DRUG COMBINATIONS WOULD BE MOST EFFECTIVE AT TREATING PATIENTS.

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Professor Gerard Evan
Sir William Dunn Professor of Biochemistry
University of Cambridge

WE SAID WE WOULD: INCREASE OUR SUPPORT FOR CHILDHOOD AND YOUTH CANCERS

Although rare, children's cancers – and especially children's brain tumours – present one of the greatest intellectual and clinical challenges for the cancer research community. In June 2015 we held a workshop with researchers, clinicians and parents to understand and identify the important barriers and opportunities that, if addressed, could transform outcomes for childhood and youth cancers. Armed with insights obtained from this workshop, CRUK engaged with a group of international researchers through a series of discussions and a two-day conference in June 2016, chaired by Professor Richard Gilbertson from the CRUK Major Centre in Cambridge. Many outstanding questions were identified, ranging from our understanding of the origins of cancers in kids and teens through to the design, delivery and evaluation of clinical trials. Our focus now is to work with the paediatric research community on refining each of these key areas and develop approaches to tackle them.

We also continue to drive the development of novel treatments for children's cancers. Our Centre for Drug Development is a pioneer in preclinical and early clinical studies for children with cancer, from chimeric antigen receptor (CAR) T-cell therapy to kinder, faster imaging techniques. An expanded paediatric Experimental Cancer Medicine Centres (ECMC) network, in close collaboration with the adult ECMCs, also means that children are getting more effective therapy and increased access to novel treatments.

WE SAID WE WOULD: SUPPORT RESEARCH INTO RARE CANCERS

We continue to co-fund the International Rare Cancers Initiative (IRCI), which aims to facilitate the development of international clinical trials for patients with rare cancers in order to boost the progress of new treatments for these patients. The partnership encourages the use of innovative trial methodologies and by bringing international funders together at an early stage of trial development, smooths the process of making parallel funding applications in different countries. Nine rare cancers have been selected as priorities for IRCI to date, including rare forms of brain tumours and melanoma, small bowel cancer and metastatic anal cancer, with several trials being led by UK clinical investigators. For many of these cancers there is no effective or even consensus standard of care, and these trials are likely to lead to much-needed new treatment options and changes in clinical practice for these patients.

ACCELERATE THE TRANSLATION OF RESEARCH

We pledged in our strategy to invest in infrastructure and new funding schemes to support translational research, and ensure that the right environment is in place to nurture it. Combining our commercialisation arm, Cancer Research Technology, with our science funding engine to create the new Research and Innovation division will further support this aim, by enhancing our scope and capability to go from the first funding of a research idea all the way through to a fully developed or commercialised innovation.

WE SAID WE WOULD:

BUILD A WORLD-LEADING TRANSLATIONAL NETWORK

Our unique network of CRUK Centres and the jointly funded Experimental Cancer Medicine Centre (ECMC) network, supported by CRUK and the devolved departments of health, provide a rich environment for translational research in the UK. They combine access to the highest calibre of academic research with world-leading clinical expertise – fertile ground for pioneering new cancer treatments and tests.

Both networks were reviewed in late 2016, with CRUK committing £190 million over five years to its network of Centres and Major Centres, the largest investment in the network to date. A joint investment of £36 million over five years was also committed to 18 adult ECMCs and a paediatric ECMC network. In 2014 we launched the Accelerator Awards to provide additional infrastructure support for Centres to build capacity and increase collaboration in areas of strategic priority. We have invested £29 million in eight awards to date, and the scheme is now evolving to include international research partners; a new partnership will capitalise on shared priorities across the CRUK Centres network and the Italian and Spanish cancer societies.

The ECMC network forms the bedrock for some of the most innovative trials in the world, including the National Lung Matrix Trial, TRACERx and the PRECISION-Panc initiative. This experimental medicine capability is further strengthened by the expertise of the CRUK Centre for Drug Development (CDD). As the world's only charity-funded drug development facility, the CDD's pioneering research is driven by the goal to see scientific breakthroughs bring benefits to patients sooner. Priorities include: first-in-class therapies, first-in-human clinical trials and projects where pharmacodynamic and stratification biomarker technologies can be used to identify and progress new treatments which have the greatest potential for patient benefit

WE SAID WE WOULD: EXPAND PARTNERSHIPS WITH COMMERCIAL AND INTERNATIONAL ORGANISATIONS

Partnership is an overarching principle of our strategy and fundamental to our efforts towards delivering better outcomes for patients. Within this report, we have highlighted examples of collaboration across UK research networks, with international research organisations, other cancer charities and with industry, where we are working together to innovate and build focus in areas of strategic priority. Examples include our collaboration with Stand Up To Cancer, through which we are funding the Transatlantic Pancreatic Cancer Dream Team (see page 12), joint funding of multidisciplinary research projects with the EPSRC (see page 6), and our partnership with the Dutch Cancer Society, through which we are co-funding an international Grand Challenge team (see page 16).

Partnerships with industry are crucial for us to drive the development of new cancer treatments, and our Stratified Medicine Programme, run with the unparalleled expertise of ECMC technical and clinical hubs, continues to attract new industry partners: Plexikon, a member of the Daiichi Sankyo Group, recently agreed to bring two new potential lung cancer drugs into the programme and provide additional finance for expansion of the second phase. Also in precision medicine, we established the S-CORT Stratified Medicine Consortium with the Medical Research Council – a £5 million programme that will use the latest genome-based technology to uncover the complex biology of bowel cancer to allow the most effective therapies to be delivered to bowel cancer patients. And in partnership with the European Society for Medical Oncology and Unicancer, we launched the Molecular Analysis for Personalised Therapy (MAP) conference in 2015, bringing together researchers for a range of talks and debates on personalising cancer treatment.

We also embarked on a global partnership with the US National Cancer Institute, the Wellcome Trust Sanger Institute and Hubrecht Organoid Technology, to generate new models of cancer that more accurately represent human tumours. The aim is to develop 1,000 models that more closely mirror tumour cellular complexity and architecture, using tumour tissue from patients with a variety of cancer types, including rare and paediatric cancers which are often underrepresented. This transformative resource will allow researchers to study aspects such as tumour heterogeneity, disease progression, and mechanisms of drug resistance, and relate these to genomic features of the models – helping to bridge the gap between new developments in the laboratory and effective treatments in the clinic.

WE SAID WE WOULD: ENHANCE OUR THERAPEUTIC DISCOVERY MODEL, INCREASING INVESTMENT IN BIOLOGICAL THERAPIES

The increasing complexity of cancer – its vast array of mutations and ability to evolve and evade therapy – requires an arsenal of innovative therapeutic approaches. In addition to small-molecule drugs, biotherapeutic approaches (monoclonal antibodies, cell therapies and viruses), offer remarkable potential for patients. In May 2015, to increase our support in this area, we established the Drug Discovery Committee (DDC) to fund and oversee Programme and Project Awards for biotherapeutics and small-molecule cancer drug discovery, from target identification through to early preclinical studies. The DDC also oversees our core-funded Drug Discovery Units (DDUs) and translational research alliances in this area.

To support this committee, a Biotherapeutics Expert Review Panel was established to review applications and make funding recommendations to the DDC for Biotherapeutic Drug Discovery Programme and Project Awards. These awards provide funding to outstanding individuals with an established scientific track record to support the discovery and development of novel biological therapeutic agents. To date we have invested over £7 million in therapeutic areas spanning antibody development, chimeric antigen receptor (CAR) T-cell therapy and viral therapy.

We have established the CRUK-MedImmune Alliance Laboratory, which brings together CRUK's cancer biology expertise with the world-class antibody engineering technology of MedImmune, the biologics research and development arm of AstraZeneca. The Laboratory collaborates with academic researchers to turn early discovery insights into potential new biological treatments, with scientists from both organisations working side by side in a joint laboratory in Cambridge, to accelerate discovery and development. The Alliance also allows scientists in the UK and overseas access to MedImmune's human antibody phage display library as well as their extensive expertise in antibody discovery and development.

WE SAID WE WOULD:
LAUNCH GRAND CHALLENGE FUNDING
TO TACKLE THE BIG QUESTIONS
IN CANCER RESEARCH

Our £20 million Grand Challenge initiative launched in 2015, articulating seven of the most significant challenges in cancer research. The scheme garnered worldwide interest and has galvanised the global research community, stimulating new conversations, new collaborations and new approaches that will accelerate progress.

We had intended to fund one new team every year for five years, to undertake ground-breaking research. However, the exceptional quality of the shortlisted teams and their submissions meant that there were several proposals the panel felt were too important not to fund. Through a combination of a philanthropic donation (the largest private donation ever received by CRUK) and a partnership with the Dutch Cancer Society, we were able to fund four of these remarkable teams. The resulting research commitment in the first round of Grand Challenge funding is up to £71 million over the next five years.

“

THE LAUNCHING OF A GRAND CHALLENGE IN CANCER IS NOTHING SHORT OF A CALL TO ARMS TO THE ENTIRE GLOBAL COMMUNITY OF PEOPLE THAT ARE INTERESTED, COMMITTED AND IN MANY WAYS DESPERATE TO FIND ANSWERS TO CANCER. I APPLAUD CRUK FOR BRINGING US ALL TOGETHER AND CREATING A NEW SENSE OF ENERGY IN THE GLOBAL ONCOLOGY COMMUNITY.

”

Dr Rick Klausner

Former Director of the National Cancer Institute
and Chair of the Grand Challenge Advisory Panel

TACKLING GLOBAL CANCER CHALLENGES

Grand Challenge was launched with a call to arms to the global research community: seven tough challenges set by an outstanding advisory panel, following input from the international research community, patients and industry.

Researchers worldwide came together in multidisciplinary teams to tackle the challenges – with high-quality applications submitted from across 200 institutes, spanning 25 countries, uniting more than 400 world-class research groups with a true breadth of research specialisms.

2017 GRAND CHALLENGE WINNING TEAMS

Mutographs of cancer

Lead PI: Professor Sir Mike Stratton
Wellcome Trust Sanger Institute

The team will study cancer samples from five continents to understand the DNA damage associated with different cancers, to understand what causes them and if they can be prevented.

Collaborators from France, the USA and UK

Creating a 'google earth' for cancer

Lead PI: Dr Josephine Bunch
National Physical Laboratory

The team will develop a way to combine new and existing technologies to create virtual representations of tumours, and a global database that catalogues their genetic make-up and metabolism, which could lead to new ways to diagnose and treat the disease.

*Collaborators from the USA
and multiple UK research centres*

PRECISION: Prevent Ductal Carcinoma In Situ Invasive Overtreatment Now

Lead PI: Dr Jelle Wesseling
Netherlands Cancer Institute

The team aims to distinguish between those women with DCIS (a condition that can develop into breast cancer) who need treatment and those who don't, to reduce overtreatment of the condition.

*Collaborators from the USA, UK and Netherlands.
Research co-funded with the Dutch Cancer Society*

IMAXT: Imaging and molecular annotation of xenografts and tumours

Lead PI: Professor Greg Hannon
CRUK Cambridge Institute

The team will create a virtual reality 3D tumour map which will allow scientists and doctors to examine – for the first time and in unprecedented detail – the cellular and molecular make-up of a patient's entire tumour to improve diagnosis and treatment for the disease.

*Collaborators from Switzerland, Ireland, Canada,
the USA and UK*

Read more about the winning teams in [Pioneering Research 2016/17](#)

WE SAID WE WOULD: SUPPORT A BROAD PORTFOLIO OF CLINICAL RESEARCH

We have increased trial funding via our Clinical Research Committee (previously Clinical Trial Awards and Advisory Committee) and New Agents Committee to ensure that we can continue to support a broad portfolio of clinical research, from £22.8 million in 2013/14 to £26.7 million in 2016/17. Our Clinical Research 'Statement of Intent' outlined plans to prioritise trials that maximise patient impact, such as those that are biologically rich or have efficient, innovative designs. In 2015, the Clinical Research Committee was established to help deliver this strategy with an expanded remit that now includes biomarker project grants, and additional opportunities to deliver translational work within trials. This includes the Experimental Medicine Programme Award, providing funding in the region of £1–5 million over five years, to allow investigators to address large, high impact translational questions in a clinical setting.

We maintain our focus in areas where industry interest is low (e.g. surgery and radiotherapy). In particular this includes continued support for the Clinical and Translational Radiotherapy Working Group (CTRad) and associated initiatives such as the Radiotherapy-Drug Combinations Consortium (RaDCom).

“

PREVIOUSLY CRUK FUNDING MECHANISMS DID NOT HAVE THE FLEXIBILITY, OR THE SCOPE, TO FUND MAJOR ADAPTIVE TRIAL PROGRAMMES. WE ARE NOW IN A BETTER POSITION TO SUPPORT RESEARCH IN NON-DRUG MODALITIES, SUCH AS RADIO THERAPY AND SURGERY, AS WELL AS TO INVESTIGATE NEW APPROACHES LIKE IMMUNOTHERAPY, WHICH ARE BECOMING MORE CENTRE STAGE.

”

Professor Tim Maughan

Clinical Director

CRUK/MRC Oxford Institute for Radiation Oncology

WE SAID WE WOULD: ESTABLISH NEW MODELS IN POPULATION, BEHAVIOURAL AND POLICY RESEARCH

In 2015 we established a Cancer Prevention Initiative in partnership with the Bupa Foundation, overseen by a newly appointed Cancer Prevention Champion, Professor Linda Bauld from the University of Stirling. Professor Bauld is world-renowned for her work in policy development and has conducted seminal studies in smoking cessation and tobacco control, which, building on our successful plain packaging campaign, remains one of our top priorities.

As part of the Cancer Prevention Initiative, we established the Policy Research Centre for Cancer Prevention (PRCP), which commissions and conducts research on lifestyles and behaviours associated with cancer to drive forward policy that can reduce the number of preventable cancers. A workshop hosted by the PRCP in February 2015 brought key leaders in the field of behavioural change and cancer prevention together to develop the centre's research strategy, identifying two key areas of focus. The first is to look specifically at public attitudes on alcohol and cancer and alcohol policy; modelling the economic impact of policy change; and the role of current marketing practises on youth drinking. The other priority is to look at the risk factors of obesity, diet and physical activity, focusing on public knowledge of the association of these risk factors with cancer and ways to impact these behaviours, such as the impact of a sugary drinks tax.

In addition to the PRCP, the Cancer Prevention Initiative included two new award schemes: the Cancer Prevention Postdoctoral Fellowship and the Cancer Prevention Innovation Grant. We funded three Cancer Prevention Postdoctoral Fellowships through this partnership on topics from promoting behavioural change in primary care to understanding low uptake of HPV vaccinations among ethnic minorities. The awards have now been merged with our Population Research Postdoctoral Fellowship scheme.

We also launched the Cancer Prevention Innovation Grant, awarded to teams generating promising ideas at a series of sandpit workshops on different prevention research challenges. To date we have provided seed-funding to 24 teams. Projects range from developing a mobile phone app that encourages inactive adults who are preparing to exercise to notice the emotional benefit they gain from physical activity, to understanding the everyday lives of teenage mothers from their own perspective to identify the barriers, and facilitators, of good health behaviours.

An ongoing collaboration with the US National Cancer Institute's Behavioral Research Program led to a joint International Cancer Prevention Innovation Grant Workshop in April 2017 focusing on facilitating behavioural research into cancer prevention across different health behaviours. We'll continue to build greater capacity in these areas through our Population Research Catalyst Award, which supports international, multidisciplinary collaboration in population health with awards of up to £5 million enabling groups to deliver impact over and above what they could do alone (see page 8).

“

WE'VE SEEN REDUCTIONS IN SMOKING RATES THANKS TO STRONG RESEARCH EVIDENCE THAT HAS INFORMED POLICY AND INFLUENCED PEOPLE'S DECISIONS ABOUT THEIR OWN HEALTH. THE CANCER PREVENTION INITIATIVE BUILDS ON THAT SUCCESS BY UNITING SCIENTISTS AND POLICY-MAKERS WITH THE EXPERTISE TO TACKLE OTHER IMPORTANT BEHAVIOURAL RISK FACTORS LINKED TO CANCER.

”

Professor Linda Bauld

CRUK Cancer Prevention Champion and
Professor of Health Policy
University of Stirling

DEVELOP THE CANCER RESEARCH LEADERS OF TOMORROW

In our strategy we pledged to support researchers at every stage of their career: attracting and inspiring the next generation, training outstanding individuals and developing and recruiting the leaders of the future. We work closely with the research community to identify skills gaps and evaluate our personal and training award schemes, run networking and career meetings for different peer groups, and conduct policy research, working with government to ensure the UK remains an attractive environment for researchers.

WE SAID WE WOULD: SUPPORT RESEARCHERS AT ALL CAREER STAGES

We remain committed to supporting researchers at all career stages, and offer a pipeline of funding opportunities for all levels – from PhD students through to senior scientists. For example, we have increased our training portfolio from 463 students and 88 active fellowships/bursaries in 2014, to 541 and 134 respectively in 2017. In addition to financial support, we run a series of events with our researchers, providing opportunities such as peer group networking meetings, sessions on career planning and training in non-scientific topics, such as communicating about research.

In 2016 we ran an All Fellows Meeting which brought all CRUK-funded Fellows to network and share experiences. Committee members and senior CRUK staff attended to meet the Fellows and give their input. Fellows presented their research in sessions on big data, cancer imaging, multidisciplinary research and immunology and were encouraged to present challenges they are facing. This approach is providing a valuable forum in which the Fellows can ask for advice and learn from senior staff.

“OUR NEW AWARDS FOR CLINICAL ACADEMICS AIM TO TACKLE SOME OF THE BARRIERS THEY CAN FACE WHEN FORGING A RESEARCH CAREER, BY PROVIDING FUNDING OPPORTUNITIES AT EVERY STAGE OF THEIR CAREER PATHWAY, OFFERING GREATER FLEXIBILITY, AND INCREASING THE NUMBER OF FELLOWSHIPS AVAILABLE.”

Professor Peter Johnson
CRUK Chief Clinician

WE SAID WE WOULD: INCREASE CAPACITY IN AREAS OF CRITICAL NEED

Clinician scientists were recognised in our strategy as a critical group for cancer research and one where there was a significant deficit. To be able to fund more of these important roles, we worked with the clinical research community to evolve our Clinician Scientist Fellowship (CSF) scheme, which now has increased flexibility, a larger budget, and is separated into two distinct strands – the CSF and Advanced CSF.

Since the two schemes launched, applications have almost doubled, and six CSFs and five Advanced CSFs were offered funding in 2016/17. Our aim is to fund up to eight CSF or Advanced CSF awards each year.

We launched a Postdoctoral Research Bursary for Clinical Trainees to bridge the gap between the Clinical Research Training Fellowship (CRTF) and the CSF, providing costs for trainees to maintain research activity. We awarded five bursaries in 2016/17.

To ensure that optimal training, support and career development is being offered to early career scientists throughout our Centres Network, we introduced guidelines that outline best practice and expectations for PhDs and CRTFs. This includes an emphasis on providing mentoring and ongoing support for clinicians who have completed their Fellowships to enable them to continue their research once they return to clinical training.

More broadly, CRUK continues to work with other organisations to ensure that the environment is conducive for academic clinical research. For example, we helped develop the Clinical Principles and Obligations Report, which provides national guidance for UK institutions for Clinical Academic Trainees, and we provided input into the implementation of the Junior Doctors Contract to ensure that this group is not disadvantaged by the changes.

Mathematics was identified in our strategy as becoming increasingly important in cancer research. In addition to funding more research that includes a focus on mathematical skills through our Centres and Institutes, we are delighted to see mathematics playing a key role in new projects such as Multidisciplinary Project Awards (see page 6) and Grand Challenge (see page 16).

In partnership with the Pathological Society we hope to address a crucial skills gap by enabling more pathology trainees to gain research experience and apply for a CRTF. We maintain a close collaboration with the Medical Research Council on its Molecular Pathology Nodes Call. This aims to bring together academic researchers, industry, and genetic and pathology diagnostic service laboratories, to establish multidisciplinary centres ('nodes') with high quality capability in the discovery and development of molecular pathology tests.

WE SAID WE WOULD: RECRUIT WORLD LEADERS TO ACCELERATE PROGRESS IN PRIORITY AREAS

This continues to be a key objective, as strong leadership in our priority strategic areas is crucial to making faster progress especially in areas where we need to gain momentum.

As only two selected examples, Professor Greg Hannon moved to the CRUK Cambridge Institute in 2015 after 23 years at Cold Spring Harbor Laboratories in New York. A pioneer in the field of RNA interference (RNAi), his achievements include defining the key components of the RNAi machinery, designing synthetic RNAs that can silence mammalian genes, and generating comprehensive libraries of these RNAs representing every gene in the human, mouse and rat genomes. Professor Hannon is now Chair of the CRUK Pioneer Award Committee, and is leading one of the Grand Challenge-funded teams to create a 3D map of a tumour.

Also at Cambridge, Professor Richard Gilbertson returned to the UK in 2015 to lead the Department of Oncology and CRUK Major Centre at the University of Cambridge after 15 years at the St Jude Children's Research Hospital in Memphis. One of the world's leading experts in childhood brain tumours, Professor Gilbertson has led international efforts that have dramatically advanced knowledge of the biology of several of these cancers.

SUPPORTING INDEPENDENT RESEARCH CAREERS

Dr Simona Parrinello, a stem cell biologist based in the MRC Clinical Sciences Centre at Imperial College London, is using funds from one of CRUK's new Programme Foundation Awards (PFAs) to take her research in a new direction by focusing on glioblastoma – one of our strategic priorities.

As a stem cell biologist studying adult neurogenesis, Simona hopes to use insight from this work to develop her understanding of glioblastoma, which contain stem-like cells and share many properties with normal neurogenesis.

CRUK's focus in brain tumour research and funding from the PFA allowed Simona to realise this potential, allowing her to double the size of her team and significantly increase the resources available to them.

This is crucial for allowing her to follow new lines of investigation in her work, she says: "The Programme Foundation Award allows me to build upon the current strengths of my lab team and consolidate the group to transition to the next stage of my independent career. Without the CRUK funding, our cancer work would not continue."

WE SAID WE WOULD: LAUNCH A NEW FUNDING SCHEME TO SUPPORT MID-CAREER RESEARCHERS

In June 2014 we launched the Programme Foundation Award (PFA) to address a gap in our support for exceptional mid-career scientists. Our aim was to fund up to 10 projects per year to allow excellent cancer researchers with 8–14 years' experience post-PhD to establish or further develop their own independent research group. We have funded 13 PFAs since 2015, and continue to receive high quality applications. We would hope in future to see PFA researchers competing for our senior academic programme awards.

WE SAID WE WOULD: ENSURE OPEN ACCESS AND RESEARCH INTEGRITY

We remain committed to ensuring all publications from CRUK-funded researchers are made freely available. In 2015 we joined several other research funders to form the Charity Open Access Fund to better support the costs of open access publishing and in September 2016 confirmed our ongoing commitment to this following a two-year pilot. Access to the fund by CRUK researchers has increased steadily since 2014/15 and we are now able to better measure compliance with our open access policy.

In addition to our continued support of Universities UK's Concordat to Support Research Integrity, we've also published *Research Integrity: Guidelines for Scientific Conduct* which defines scientific misconduct and provides guidance to host institutions regarding the kinds of policies and procedures we expect them to have in place.

Since early 2016 we've provided dedicated support to researchers in developing and implementing data sharing plans in accordance with our policy, and grant applicants can now seek data management costs as part of their grant application.

LOOK FORWARD

“ Our 2014 Research Strategy and priority areas remain key to supporting our vision of beating cancer sooner. We have seen a significant shift in focus and activity in many of these areas but there is more to do. We have identified areas in this report where there is a need to accelerate progress, for example early detection research, and will pursue them with increased focus in the immediate future.

In the three years since our Research Strategy was launched, we've seen the cancer landscape evolving at an extraordinary rate. There are new areas of promise opening up, drawing on advances in technology and our increasingly sophisticated understanding of biology. We are anticipating the revolution in smart medicine, where cancer treatment and care use new and precise diagnostic tools and an expanding range of treatments, many routinely personalised to each individual patient, working in redesigned primary and hospital healthcare.

We will remain flexible in our thinking and constantly on the lookout for new ideas, so we can identify the opportunities that will help us to reach our ambition of 3 in 4 patients surviving cancer by 2034. Immunotherapy continues to represent the greatest hope for cancer patients in decades, and our investment in tumour immunology will continue to expand, as we build our discovery science and translate novel ideas into potential treatments.

We continue to scan the research landscape for emerging trends with the potential to enhance our research and increase the impact of our funding. To take just two examples, the idea of exploiting the microbiome as a therapeutic intervention requires a substantial commitment to discovery research, to identify and understand the complex interactions between our bodies and the microbes

we live with. And the rise of artificial intelligence, with its potential for data collection and analysis, early diagnosis and digital epidemiology, is likely to be one of the key opportunities to accelerate progress on many fronts.

How will we stay at the forefront? As always, we will remain closely linked to researchers in the UK and worldwide, to identify the best opportunities in cancer research and make sure we overcome the barriers. We will meet the challenges of rapidly translating discovery science into patient benefit by expanding and fine-tuning our network of centres, forging new collaborations with partner organisations, and bringing our researchers together in ways that will spark their creativity and originality.

Ground-breaking discoveries are often made at the interface of research disciplines. Through a variety of forums and funding approaches, we will continue to support a world-class research community, encourage team working and facilitate multidisciplinary collaboration. We'll also continue to reach out to brilliant academics who haven't previously thought about working in cancer, whose new insights could be invaluable to the field of cancer research.

Progress in cancer research comes from the brightest minds following their ideas, with funders like CRUK providing the support for them to do so, and the resources to turn those ideas into real benefits for patients. We must continue to develop the next generation of research talent, attract the very best people from all over the world, and strengthen UK cancer research by our investment. Together with everyone at CRUK, we look forward to working with researchers, partners, supporters and patients, as cancer increasingly becomes something we survive and live beyond.

Karen Vousden
CRUK Chief Scientist

Peter Johnson
CRUK Chief Clinician

Read more at cruk.org/progress-report

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