R&D Roadmap Survey Questions

Overview

The Government's ambitious UK Research and Development (R&D) Roadmap aims to ensure the UK is the best place in the world for scientists, researchers and entrepreneurs to live and work. This will help to power up our economic recovery and level up the UK.

The roadmap is the start of a big conversation on what actions need to be taken and how. Over the coming months we will develop the proposals in our roadmap in a comprehensive R&D plan.

This plan will only be effective if it is developed with people and organisations across the UK. We therefore welcome responses to the high-level questions outlined in this survey.

We want to know:

- How can we best increase knowledge and understanding through research, including by achieving bigger breakthroughs?
- How can we maximise the economic, environmental and societal impact of research through effective application of new knowledge?
- How can we encourage innovation and ensure it is used to greatest effect, not just in our cutting-edge industries, but right across the economy and throughout our public services?
- How can we attract, retain and develop talented and diverse people to R&D roles? How can we make R&D for everyone?
- How should we ensure that R&D plays its fullest role in levelling up all over the UK?
- How should we strengthen our research infrastructure and institutions in support of our vision?

- How should we most effectively and safely collaborate with partners and networks around the globe?

- How can we harness excitement about this vision, listen to a wider range of voices to ensure R&D is delivering for society, and inspire a whole new generation of scientists, researchers, technicians, engineers, and innovators?

Raising our research ambitions

Researchers are driven by curiosity – by a desire to ask fundamental questions about how the world works and why – and by a drive to solve problems at the intersection of knowledge and societal need. By supporting research, we advance the frontiers of knowledge, increasing our understanding of the world and of each other. We form global collaborations and alliances. We invent the highly disruptive new technologies which can transform the world around us, improving living standards and health outcomes. And we use these insights to tackle the greatest challenges facing the world – those that cross boundaries and impact on our whole society.

The unprecedented increase in public investment announced at the Budget signals a step change in our overall ambitions for UK research, and will enable us to push harder at the frontiers of knowledge, unlocking brilliant new technological breakthroughs and enabling applied research to create transformative benefits for government, businesses and communities right across the UK.

1. How can we best increase knowledge and understanding through research, including by achieving bigger breakthroughs?

Please comment here (500 words max)

One of the key strengths of UK medical research is the diversity of the research base – the combination of public, private and charitable funding sources supports innovation by fostering a network of expertise and enabling a wide range of projects with diverse risk profiles. This creates a high-quality, globally competitive medical research environment and a magnet for international talent.

The Government's R&D strategy must support all elements of this vibrant research ecosystem to thrive. COVID-19 has caused significant disruption to the medical research landscape including universities, charities and the NHS. Existing Government support packages (universities, R&D businesses) are positive but don't go far enough to stabilise this diverse ecosystem.

Medical research charities are uniquely placed to set priorities based on patient insights, and to focus on areas of unmet need like rare diseases. Charities are also experienced at brokering meaningful partnerships with industry that bring both patient and economic benefit (See Qs 2, 3 for more information). Unfortunately, many medical research charities like CRUK have had fundraising significantly hit by COVID-19. The Association of Medical Research Charities estimate between a £252 - £368 million shortfall in medical research

charity sector investment in UK R&D in FY20/21 alone. The distinct contributions of charities to the UK's research base include initiatives like CRUK's Cancer Grand Challenge – the most ambitious cancer research initiative in the world which aims to achieve bigger breakthroughs (See Q7 for more information). For the UK to build on its strengths and cement itself as a world-leader in cancer research over the next decade, these contributions need to be preserved. This will support the UK's post-COVID-19 economic and social recovery and cement the UK as a science superpower.

- **The comprehensive R&D plan should include a Government commitment to a government-charity co-investment scheme that provides a level of match funding from government for future charity research over the next three years *via* a Life Sciences-Charity Partnership Fund**. We propose to co-design the Fund and have underpinning principles to be used as a basis (Further detail).

UK university income has been severely hit by COVID-19 and whilst existing support packages will provide some more stability to the sector, more needs to be done to support the long-term stability of university research. A vital part of this is the Quality-related (QR) research funding component of the dual support system, including its charity support element. Further work is also needed to streamline university research costs to ensure value for money. For research in the NHS, the NIHR plays a vital role in the life sciences sector as a funder of innovative research and for a supporter of researchers' training and development.

- **The comprehensive R&D plan should commit to an uplift to NIHR funding in line with uplifts to the science budget and commit to significant uplifts to mainstream QR funding.**
- **Government should initiate a review about the future of research in the university sector and take a strategic view on how to support expensive research activities.**

The application of new knowledge

Research is critically important in helping to address significant issues, such as healthy ageing, achieving net zero carbon emissions, and addressing climate change. Applied research plays a vital role in ensuring that resilience, efficiency and effectiveness of public services is improved, that healthcare outcomes are advanced, and that evidence is deployed to solve real world problems and address threats to our security.

This requires having a healthy and vibrant ecosystem of institutions in which researchers are free to follow their curiosity, to test radical new ideas, to tackle complex societal problems, and to form new

connections, collaborations and networks. It requires a broad span of approaches, from people developing new theories and insights into natural phenomena and the application of research in technological and industrial settings, through to systems research to improve patient care or tackle the barriers to inclusivity in society.

2. How can we maximise the economic, environmental and societal impact of research through effective application of new knowledge?

Please comment here (500 words max)

Cancer research contributes to creating a healthier society through research progress that leads to the application of knowledge to better prevent, diagnose and treat cancer.

Cancer Research UK (CRUK) creates research collaborations that lead to patient impact and facilitate industry investment. For example, we have brought 10 drugs to market through commercial partnerships with industry which have treated hundreds of thousands of patients around the world. We have also been able to take a strategic approach and identify cancer types where progress in survival has been slower – lung, pancreatic, brain and oesophageal – and increased our efforts and funding to tackle these cancers with substantial unmet need.

Charitable life sciences research also brings an added benefit to the economy – every pound invested in medical research delivers a return equivalent to around 25p in perpetuity. For example, over £500m of IP related gross revenue has been generated through CRUK's commercial partnerships to date – and last year, commercial partnerships led to £43m reinvested back into CRUK.

One of the greatest health challenges facing our society is the early detection of cancer, which could transform survival rates. The importance of this challenge is recognised by Government and the NHS Long Term Plan, in the commitment to detect 75% of cancer at an early stage by 2028. As well as the survival benefit, there is a globally rising tide of industrial and private finance interest in this space. However, the field is beset by a lack of research funding and infrastructure, and a market failure/lack of industry investment due to excessive R&D costs, high regulatory barriers and an undervaluing of early detection technologies by the health system. Progress in the early detection and diagnosis (ED&D) of cancer will only be possible through collegiate action from many sectors and stakeholders which is why CRUK will shortly be publishing an ED&D of Cancer Roadmap. This shared vision for the community will lay out a series of recommendations for actions needed to accelerate the UK towards this vision; government support for such holistic visions will be essential in securing public health and economic benefits. The production of the ED&D Roadmap is an example of the value that charities bring to the UK research ecosystem – brokering collaborations between different parts of the system to unite under a shared vision. The actions we propose will also have the potential to feed into solutions for other diseases and lead to a future where there is the maintenance of health, rather than

firefighting symptomatic disease. The UK has the potential to be the global leader in R&D and commercialisation in this space which will save lives and create and support a thriving R&D sector and economy in the UK.

- **The comprehensive R&D plan should identify ED&D as a key priority and include a commitment to work with CRUK to develop appropriate funding initiatives to meet the recommendations in our ED&D roadmap.**

Driving up innovation

Innovation is the process by which ideas are turned into economic growth – where discoveries are translated into new products, services and jobs, creating positive change in businesses, public services, government and wider society. The UK is ranked 5th in the Global Innovation Index 2019 and in the top 10 best countries worldwide to start, locate and scale a business. We already attract significant venture capital – at a level that exceeds that of Germany, France and Sweden combined. We are home to 77 unicorns (start-ups valued over US $1bn), more than a third of the total across Europe and Israel. And yet, we underperform in innovation compared to research.

We need to do more to make the most of our world-class research base and to increase the productivity of UK businesses all over the UK. We need to ensure our excellence in discovery research, design, engineering, data science, and creative arts translates into commercial applications – increasing the productivity of our existing industries and creating new growth opportunities for the UK. The UK has lower levels of R&D activity by businesses compared to our competitor nations, and that investment is focussed on large investors in a few sectors.

3. How can we encourage innovation and ensure it is used to greatest effect, not just in our cutting-edge industries, but right across the economy and throughout our public services?
Please comment here (500 words max)

Medical research charities have valuable experience innovating through investing in early-stage research to de-risk complex projects and forming valuable industry partnerships. Cancer Research UK's (CRUK) commercial partnerships are an important contributor to UK PLC by catalysing entrepreneurship, translating ideas from UK labs to industry, and generating wealth within the UK economy. CRUK has formed over 40 spinout companies, which have collectively raised over £1billion in third-party investment to date. In oncology, we are also the second biggest licensor in the world, fuelling the pipelines of companies such Astra Zeneca, Novartis, and mid-sized biotechs.

There is an opportunity for Government-backed funding agencies, including Innovate UK, to better stimulate commercial innovation. This includes placing more emphasis on this in grant applications, metrics of academic success, enhancing their training offer, and the adoption of new models that stimulate academic-industry partnerships through co-location (currently collaborating with industry on medical research is limited by VAT rules).

- **Charities should be represented on the Innovation Expert Group.** CRUK's expertise in end-to-end commercialisation of research make us well placed to contribute**.**
- **Government funding agencies should review incentives in grant applications and metrics of academic success to ensure they encourage commercial innovation.**
- **Innovate UK should take on more responsibility for providing well-resourced entrepreneurship programmes.**
- **Government should review VAT rules on sharing of buildings, equipment and facilities for R&D, to support collaborations and attract inward investment**

With the right focus, the UK has the potential to position itself as a an "early adopter" of innovation technologies. The NHS should position itself as a "laboratory for the life sciences", experiment widely and adopt new technologies early. As one of the UK's strongest areas for clinical research, cancer research will prove instrumental in maintaining the UK's competitiveness and is already paving the way with new research methods (e.g. genomic stratification, multi-arm trials) to produce ground-breaking scientific data. Whilst COVID-19 has severely disrupted many cancer trials, this has also provided an opportunity to re-evaluate clinical research conduct and learn and innovate from emerging best practice. We believe a world-leading clinical trials environment is enabled by: Improving patient participation by making clinical research more accessible, building on the positive role that research is playing through the pandemic; Embracing innovation in trial design and delivery including through making the UK a leader in delivery of Complex Innovative Design trials; Modernising our regulatory system in an increasingly global environment through developing an innovative and science-driven regulatory system that facilitates both domestic excellence and international collaboration; resourcing clinical research appropriately through NIHR funding and addressing the limited capacity of health service staff to conduct research (CRUK will shortly be publishing a report setting out barriers and solutions to health service staff capacity to conduct research) .

- **Government should set out how it will meet its ambition for the UK to be a world-leader in clinical research in the context of an increasingly competitive global landscape.**

- **UK Governments should address the barriers to health service staff capacity to conduct research including consideration of recommendations in CRUK's forthcoming report**

Inspiring and enabling talented people and teams

To achieve our ambitions for UK science, research and innovation, we must be world-leading in the way that we inspire and enable talented people. This means being the best place in the world for attracting, training and retaining diverse, talented people and teams across the whole spectrum – from excellent scientists, researchers, engineers and technicians, through to entrepreneurs, business leaders and investors.

4. How can we attract, retain and develop talented and diverse people to R&D roles? How can we make R&D for everyone?

Please comment here (500 words max)

Government's ambition to ensure the UK is the best place to attract, train, and retain diverse talent – including researchers, technicians and entrepreneurs - is very welcome. Cancer Research UK (CRUK) has a network of over 4,000 scientists, doctors and nurses and is committed to supporting the next generation of cancer researchers. Our experience in this extends beyond simply funding our research community to conduct science – we nurture our community to become the research leaders of tomorrow. Last year CRUK spend £40m on training and career development of our research community, including support via networking groups, training, mentoring. We also have an entrepreneurial programme which supports cancer researchers across the UK to accelerate the translation of their ideas and discoveries into products that will improve the lives of cancer patients.

We support plans to create a new R&D People and Culture Strategy. At CRUK we champion equality, diversity and inclusion in research, but we recognise we still need to do more. Some examples of our initiatives to address the barriers:

- Revising our funding culture and practices: to ensure that scientists from all backgrounds have a fair chance when pitching ideas to us
- Policies to tackle bullying and harassment in the research workplace
- Our Women of Influence initiative mentorship scheme pairing exceptional female scientists with leading business women
- Flexible research careers funding policies to accommodate varied career paths to become a research leader

  - Removing time-bound eligibility criteria and switching to a competency-based framework for fellows so researchers can apply at the right time for them
  - Clinical Academic Training Programme (CATP): This £50.7 million programme looks to overhaul training for clinician scientists where there is attrition among female researchers. To complement and inform CATP, CRUK is a partner on a systematic review on gender inequalities in clinical academic careers to help identify further solutions.
  - Commitments to do more to stand against racism and racial injustice toward the Black community and BAME researchers: we published 6 commitments to action including development of a strategy to understand and address bias in our research funding processes.

- **Medical research charities should be involved in the development of the R&D People and Culture Strategy** - collectively we fund 17,000 researcher salaries in the UK.

Genuinely cementing the UK as a go-to destination for global research and innovation talent will require building on positive changes to the immigration system like the Global Talent Visa (GTV) and taking further action on the cost of the UK visa system. A skilled worker coming to the UK under the GTV pays more than in eleven other leading scientific nations – the upfront cost is £2608 compared to £608 for the next highest costing nation.

- **A key priority for the Office for Talent should be to reduce the total visa costs for researchers and their dependants to bring UK visa costs to more internationally competitive rates**.

Levelling up R&D across the UK

The UK's research and innovation system has remarkable strengths right across the UK. From precision medicine in Glasgow to marine innovation in the Western Gateway, from compound semiconductors in South Wales, to future food processing in the Midlands and eco-Innovation in the North West Coastal Arc, the UK has centres of excellence in research and innovation across the country. At a local level R&D investment can transform areas by acting as a driving force for social innovation, local growth and improved productivity.

To unlock these benefits in more areas of the UK, we should do more to build on a wider range of R&D strengths. We should also do more

to enable places all over the UK to thrive and to fulfil their potential in R&D.

5. How should we ensure that R&D plays its fullest role in levelling up all over the UK?

Please comment here (500 words max)

Medical research charities currently fund around half of non-commercial UK medical research across universities, the NHS and other bodies in all parts of the UK. Therefore, it is critical they can contribute to discussions on R&D's role in the levelling up agenda.

- **The R&D Place Advisory Group should include representation from medical research charities.**

Cancer Research UK awards funding and makes investment based on quality and strategy wherever it is located across the UK. We make long-term investments in state-of-the-art facilities and resources to provide an outstanding research environment. In 2018/19, we spent £442 million for research in institutes, hospitals and universities across the UK. Our long-term investment in state-of-the-art facilities has created a thriving research network at 90 institutions in over 40 UK towns and cities. Unfortunately, due to the impact that COVID-19 has had on our income, we could be forced to cut £150m research funding per year, approximately 35% of our total research spend last year. Without support from Government, we will be forced to significantly scale back the research and research infrastructure we fund in some UK locations, reducing the regional spread of our research investment. Due to the critical mass of high-quality research capacity in the South East, our investment is likely to become even more weighted here, countering Government efforts to rebalance research investment across the UK.

In our experience, if a critical mass of high-quality research capacity in built in a location this has the potential to leverage additional research funding to expand and strengthen this capacity. To be effective, this will require clear UK-wide and local strategies that set out research strengths and priorities for each location with a strong focus on research excellence. For example, it is likely that each location could benefit from focus on a limited number of scientific and clinical areas that are core strengths rather than each area attempting to develop research capacity in a broad range of disciplines. Support and incentives for collaborations between research teams in multiple locations could also support successful collaborative grant applications that would enable research capacity to be built. Any local strategy would benefit from being in line with the strategic objectives of major public, private and charity funders as it could increase the ability to attract inward investment.

- **Government should consider a small number of research themes where it believes the UK can be truly world leading and back them accordingly. Cancer research is a proven example but is under threat. The R&D roadmap should include a Government commitment to a government-charity co-investment scheme that**

provides a level of match funding from government for future charity research over the next three years *via* a Life Sciences-Charity Partnership Fund

Developing world-leading infrastructure and institutions

Our future success in R&D will rely on a diverse network of infrastructure: internationally competitive, high-quality and accessible facilities, resources, data and services.

The UK is home to over 500 nationally and internationally significant research and innovation infrastructures, providing us with a breadth of expertise across sectors.

We need to take a flexible approach to supporting research infrastructure to deliver better value for money and keep assets continuously maintained and cutting-edge. Higher quality infrastructure will help attract and retain the best staff and create a more vibrant research environment.

6. How should we strengthen our research infrastructure and institutions in support of our vision?

Please comment here (500 words max)

Cancer Research UK (CRUK) covers around 50% of UK cancer research infrastructure which plays a crucial role in creating a dynamic and responsive research environment. Our infrastructure provides a breadth of capabilities, including 4 Institutes, 15 translational centres, a CRUK-AZ Functional Genomics Centre, 18 Experimental Cancer Medicines Centres (ECMCs) and more. We are a key partner of Government, industry, and others. It is critical there is effective collaboration between government research bodies, clarity on how all parts of the research landscape can be effective partners, and transparency on decisions.

- **The comprehensive R&D plan should set out clear mechanisms for funders, including charities, to collaborate and partner with government research bodies.**
- **The government should develop clear strategies for the development of research clusters of excellence built on quality and long-term infrastructure investment**

In the burgeoning era of big data and AI, the NHS holds a data set which could be the envy of the world and a major attractant for industry investment, if properly harnessed and made accessible by the government. This could be worked towards by unified data infrastructure

development across the fragmented NHS (both primary and secondary care), extensive public consultation and engagement, development of transparent, equitable and streamlined data regulation which protects the public but doesn't set unrealistic barriers for research use.

As set out in response to Q1, the UK has a diverse research ecosystem that universities are a key part of. The Roadmap mentions a review of mechanisms of support for university research, including Quality-Related (QR) funding, including working with funders to explore levels of full economic costs (FEC) of university research. Charities work in partnership with universities to deliver high-quality research: 87% of medical research charity grants go to university research and ~15% of university research income comes from UK charities. The Charity Research Support Fund (CRSF) underpins charity investment in university research across England, alongside devolved equivalents, enabling researchers to recover research costs that charities do not pay. When people donate to charities, they intend their money to be spent directly on research that benefits patients and charity activities must be consistent with and support their purpose from their Charitable Objectives in line with the Charity Commission regulations. Therefore, charities pay the direct costs of research and the CRSF provides an uplift to universities to cover indirect costs. The value of the fund has fallen over the years, although charities still pay a similar level of FEC to research councils, when the CRSF is considered. The CRSF ensures UK medical charities see UK universities as sustainable places in which they can make sound research investments. If this were to diminish and charities be levied with indirect research costs, they may choose to seek alternative locations for funding here or abroad where such costs may be cheaper. It is vital universities, Government and charities can work together to sustain their valuable research partnerships.

- **The unique position of charitable funders should be recognised and reflected in future discussions or reviews relating to FEC of university research.**

Being at the forefront of global collaboration

Research and innovation are inherently global, and international collaboration and mobility of talent are associated with more impactful research. The UK's leading researchers and innovators want to collaborate with the best talent in the world, in the best facilities in the world, regardless of borders. These international collaborations lead to new advances and discoveries, pushing the frontiers of knowledge faster and further. They underpin the UK's position as a world-leading knowledge economy and support trade, investment, diplomacy, defence and security.

7. How should we most effectively and safely collaborate with partners and networks around the globe?

Please comment here (500 words max)

Tackling the biggest challenges in cancer requires a global approach - nearly 50% of all UK cancer research involves international collaboration and evidence shows working with colleagues from overseas makes research more impactful. Cancer Research UK (CRUK) recognises this through our international research programmes which intentionally facilitate the creation of teams based in multiple countries working towards a shared goal. For example, our International Alliance for Cancer Early Detection is a £55m transatlantic partnership that unites world-leading research to tackle the biggest challenges in early detection, an important area of unmet clinical need. CRUK's Cancer Grand Challenge (CGC) is another example - a series of £20m awards seeking international, multi-disciplinary teams willing to take on the toughest challenges in cancer. Awards provide the freedom to try novel approaches, at scale, in the pursuit of life changing discoveries. Over £130m has been invested, funding 7 teams featuring 73 research groups and spanning 9 countries.

As the UK negotiates a new relationship with EU, it is essential cross-border collaboration can continue, and that the UK promotes the excellence of its research base globally, so it can continue to attract scientific talent. A close partnership with the EU is vital to future international scientific collaboration - at last count our researchers were partnering with over 400 EU organisations. Collaboration between the EU and the UK on clinical research is also a win-win. Over a quarter of CRUK clinical trials take place with at least one EU Member State. While as-close-as-possible a relationship between the UK and EU is to the benefit of patients and research in both jurisdictions, we appreciate that the UK's exit from the EU will necessitate a reduced level of cooperation than exists at present and that there will be opportunities for more collaborations beyond Europe. However, it is our view that it is the responsibility of all negotiators to protect the interests of patients, health and research in the future relationship.

- **Government should seek full association to Horizon Europe.** This will facilitate cross-border research schemes that we know help foster scientific cooperation.
- **The Future Relationship Agreement should formally recognise that a high level of protection for human health represents a shared value in the UK and EU's regulatory approaches.**
- **UK and EU negotiators should commit to reducing barriers to UK-EU collaborative clinical research, including the establishment of a Research & Innovation Committee or Working Group to facilitate future cooperation on research (including clinical trials**).
- **The UK should seek out new formal research partnerships beyond Europe and build in programmes that align to our goal as a net recruiter of talent**

Harnessing excitement about our vision

Our mission is to inspire and enable people from all backgrounds and experiences to engage and contribute to research and innovation and show that science is for everyone. We will nurture the whole system of innovation that will improve lives, services and businesses right around the UK and beyond – creating a fairer, healthier, more prosperous and more resilient society. And we will celebrate our successes far and wide, showcasing our strengths, and promoting the UK as a destination for talent and investment, and a partner of choice.

8. How can we harness excitement about this vision, listen to a wider range of voices to ensure R&D is delivering for society, and inspire a whole new generation of scientists, researchers, technicians, engineers, and innovators?

Please comment here (500 words max)

As the world's largest charitable funder of cancer research, Cancer Research UK (CRUK) responds directly, through donations, to the public's commitment to our ambition of improving cancer outcomes through research. More than 7 million people donated to medical research charities in 2018, demonstrating that charity-funded medical research is underpinned by a large public support base. The direct link between charity-funded research and the public means that charities have a wealth of experience in engaging the public in our causes to garner support, and in communicating the outputs from our life-saving research.

In addition, as a result of the pandemic, 2020 marks a paradigm shift in the public's awareness of the essential role research plays in our society. As a trusted and well-known organisation, CRUK is an ideal intermediary between the public's growing interest in research and the Government's research strategy. We are well versed in communicating with the public about complex health and research ideas including through our About Cancer information webpages, award-winning Science Blog, our forthcoming collaboration with the Science Museum and more.

At CRUK, we actively involve people affected by cancer in our work as the insight they bring will help us to beat cancer while ensuring that we're meeting the needs of patients and their families. Through our public and patient involvement (PPI) work we work together with patients, carers and loved ones, to shape, influence or guide projects as they develop. This includes working with us to develop our health and patient information, consulting on our policies and strategies, participating in our research funding committees and co-delivering training for staff and researchers. For example, people affected by cancer have been at the core of CRUK's Cancer Grand Challenges programme (detailed in Q7) from its conception. The seven Grand Challenges, and our Grand Challenge PPI strategy, were developed in collaboration with people affected by cancer. This includes the creation of our Grand Challenge Patient Advisory Panel, who have worked in partnership with us to develop the involvement and engagement questions in the research application, create PPI guidelines, and are responsible for reviewing and giving feedback on the involvement and engagement sections of funding applications.

- **Government should propose a set of clear mechanisms to involve medical research charities in developing their comprehensive R&D plan**. This will capitalise on both charities' experience involving patients and supporters in their work and on the current enhanced interest from the public in medical research.

Charities make vital contributions to the UK's R&D base that cannot be simply replaced by other funders. CRUK wants to work with Government to secure the future of our world-leading life sciences research base post—COVID-19, both to save lives through research and to kickstart the economy across all corners of the country.

- **The comprehensive R&D plan should include a Government commitment to a government-charity co-investment scheme that provides a level of match funding from government for future charity research over the next three years *via* a Life Sciences-Charity Partnership Fund**