

2022



UK Dementia
Research Institute

Race to Cures

Discovery research will
fast-track dementia treatments

Founding funders:



Medical
Research
Council



Foreword



William Rucker

Chairman,
UK Dementia Research Institute

More than 885,000 people have dementia in the UK today, and this is projected to increase to **1.6 million by 2040**, with the prevalence of early onset dementia doubling every five years^{1,2}. The economic and personal cost of these figures is staggering. At £35bn per year, the cost of dementia to the UK economy is equivalent to nearly a **quarter of the NHS budget**^{1,3}. It's clear that investment in research cannot wait. The UK Dementia Research Institute is in a **race to find cures** for our greatest health challenge: dementia.

1 in 3

people born this year will develop
dementia at some point in their life⁴

The UK's united network of researchers in dementia has made unparalleled progress in the five years since the UK invested £150m in the UK Dementia Research Institute as part of the Prime Minister's Challenge on Dementia. This crucial investment was desperately needed: the Government recognised that investing now would save resources in the future and give the UK the best possible start.

Through the formation of the UK Dementia Research Institute, we created a community of scientists, clinicians, people living with dementia and their families, all of whom have contributed to answering some of the fundamental questions about the brain. The unique structure of the UK Dementia Research Institute draws together the expertise of **six great universities across the UK**, and the diverse skills in their individual research teams. The discoveries made by the UK Dementia Research Institute will inevitably lead to breakthroughs in treatments and – we dare to hope – cures.

While our work will make treatments possible, for many people it will be too late. Too many of us know someone touched by this terrible condition. My mother's diagnosis was not a shock – the signs and symptoms many of us are sadly familiar with were becoming clear before that date – but it was nonetheless devastating. For me, what now sits alongside that sadness is hope. The scientists I speak to are confident that the discoveries made by the UK Dementia Research Institute, and those of others in the UK and worldwide, will lead to a cure for the next generation. If we continue to take giant strides forward as we have in the last few years, I am confident that for our children's generation, things will be different.

Discovering hope

Globally, there are now more people living with dementia than cancer patients (47 million vs 42 million⁵), due in large part to extraordinary advances in the field of cancer research.

While it's frustrating that dementia, such a common and serious condition, still has no effective treatment, the progress made in cancer research gives us a blueprint for a solution and reason to hope. The life-changing impact of new discoveries in dementia would be immeasurable.

The sustained funding of research in cancer helped scientists discover that cancer is not a single disease but in fact a collection of many different but similar diseases, as well as highlighting the importance of the immune system, genetics and biomarkers in treatment, leading to a personalised approach to cancer medicine.

£2.4bn

investment in cancer research over 13 years has yielded unprecedented progress – turning previously incurable illness into a chronic disease⁶





This positive progress in cancer discovery has led to continued interest and investment from the pharmaceutical industry, while the opposite is true for dementia. Compared to cancer, dementia remains poorly understood, due to historic under-investment and the sheer complexity of the human brain. The UK Dementia Research Institute has made great strides, but there's still a long way to go to match the level of knowledge achieved in the field of cancer. Sustained public funding is crucial to drive the research pipeline and gather momentum in our **race to cures**.

74,000 **512**

clinical trials have been run in cancer since 2000 compared with fewer than **2,400** in Alzheimer's disease

drugs have been approved by the FDA for cancer in the same timeframe, compared with just **six** for Alzheimer's^{7,8}

The UK's investment to establish a world-leading Dementia Research Institute has attracted the best minds from around the world to create an A-list research group. In a short space of time, we have made discoveries that have galvanised the research community with a sense of hope that a breakthrough is around the corner. With discovery science investigating the fundamental causes and drivers of dementia, we have been able to generate knowledge and new leads that clinicians, biopharmaceutical companies and investors can now test and develop into new medicines, diagnostics and therapies. In the process, we're marking out the UK as a science superpower in dementia discovery research, which will help attract further investment.

Sustained research funding into dementia will help uncover more of the mysteries of this condition: what triggers it, how it progresses, and how to prevent, treat and even cure it. If the UK wants to lead in the **race to develop new cures for dementia**, it must continue to lead in the understanding of disease biology, through dementia discovery science.



Discovery science:

the crucial first step towards
treatment and cures

Today, we're much closer to new treatments for dementia than we were even five years ago, but we're not there yet.

To get treatments and potential cures to a clinical trial, or even to the stage where translational researchers can develop a molecule into a drug, we need to **fill the dementia knowledge gap** and understand more of the fundamental mechanisms of the disease. Without more of this basic discovery research, drugs cannot be developed.

In the **race to find cures**, the UK Dementia Research Institute has brought together and funded world-leading research on how our body's cells, circuits and systems work. The UK Dementia Research Institute has boosted the UK's capacity to investigate the causes of dementia, driving the UK into the position of a world leader in dementia research. And thanks to our unique 'hub and spoke' model that brings together expertise from six UK universities across many research disciplines, this has been done at a pace previously unimaginable.

The past four years have brought about **significant breakthroughs** in dementia discovery research. UK Dementia Research Institute scientists have been at the forefront of major advances, including studies on the genes that underlie Alzheimer's Disease, Parkinson's Disease and Huntington's Disease; the identification of changes in the diseased brain that contribute to nerve cell loss; and the development of new ways to stimulate the brain from the skull, to modify and treat abnormal electrical activity non-invasively. What we've learnt about the brain in this time has changed the shape of future research, making it far more focussed on finding cures.

Behind each of these breakthroughs stands the UK Dementia Research Institute.



43.6%

In cancer – a much better understood set of diseases than dementia – basic discovery science is still understood as the engine that drives all progress. **Cancer Research UK** still spends more on basic science (43.6% of total funding) than any other type of research⁹



Early warning system: a sprint start against dementia

The UK Dementia Research Institute has been involved in the discovery of biological and chemical markers in the body that signal disease onset many years before any clinical symptoms are apparent.

Prof Henrik Zetterberg (UK DRI Group Leader, UCL) is a world expert on **biomarkers**, having published over 1,100 papers on the subject and won numerous awards. Ultrasensitive new tests, many from blood samples, measure molecular changes in people with neurodegenerative conditions, facilitating early diagnosis and, eventually, treatment during the initial stages of disease when intervention is most effective.

This year we launched the **UK DRI Biomarker Factory**, a programme to share our biomarker discoveries with academia and industry. This high-performance analytical platform can be used for biomarker development, validation and measurement. To our knowledge, the UK DRI Biomarker Factory is the only available service of its kind. We will provide it at the highest quality and the lowest possible price, as widely as possible.

UK DRI researchers are also developing **functional maps of the brain**, which have allowed us to map changes associated with dementia, and begin to address how these changes may be corrected.

These two breakthroughs will be invaluable in the clinic as diagnostic tools, and in translational research to indicate whether potential drugs could be useful. In cancer, early detection has been critical for clinical advances, and the same will be true for dementia.

It's tempting to see the search for a dementia cure as a relay race, with discovery science handing the baton to translational researchers, who hand over to industry to develop treatments, trial them and bring them to market. However, it's more multi-directional than that.

Clinical trials can't succeed without the ability to identify patients with the right profiles, and targets often need biomarkers before they can be validated. As potential treatments go forward into clinical trials, the role of people with dementia who participate is critical.

We've seen a **staggering acceleration in breakthroughs** in the past four years, and that is the result of investment into a new way of doing research. Our progress is thanks to a well-connected research community across the UK, including our own 650+ UK Dementia Research Institute scientists as well as our academic colleagues and friends, industry scientists, and Government-funded scientists, working alongside other world-leading researchers and institutes globally. Through initiatives such as our Research Themes¹⁰, the establishment of the Dementia UK Ecosystem (DUKE)¹¹ and building international partnerships¹², we have created a more unified and collaborative community to drive forwards as one. We have brought together experts in cell biology, genetics, imaging, data science and clinical practice, to make breakthroughs possible.

But there's still work to be done to ensure progress is happening as fast as possible. We need to fund and support research at every stage of this process. Discovery research is a crucial first step before drugs can be developed: the strands of research must constantly be connected and learn from each other.

The UK Dementia Research Institute is a globally revered example of this connectivity. At our core, we have excellent science, cutting edge technology and a culture of collaboration. Through this, industry can collaborate easily at one single touch point with the best academic minds across the country, without needing to select each group to work with on separate projects. This helps bring all kinds of discovery science knowledge to the heart of translational research.



Culture of
collaboration

50%

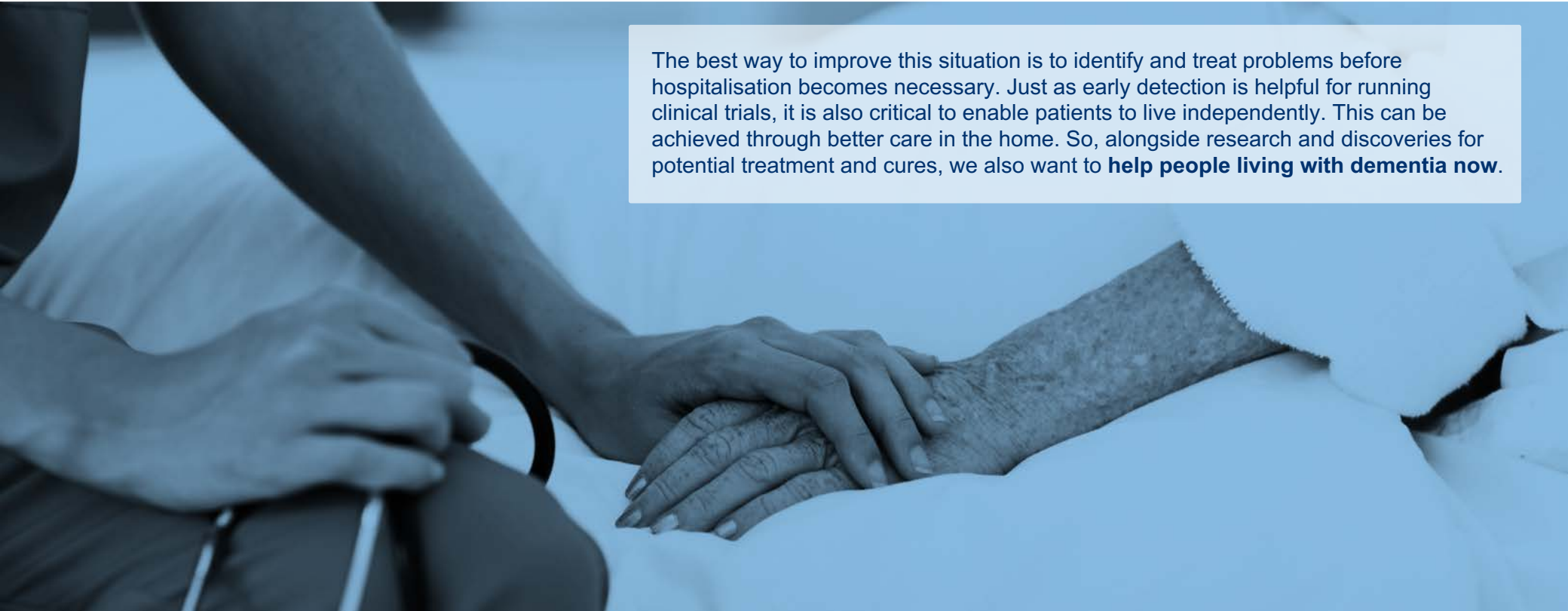
More than half of patients living with dementia will have at least one hospital admission each year¹³

1 in 4

More than one in four NHS hospital beds are occupied by people with dementia¹⁴

1 in 5

One in five of these admissions are due to potentially preventable causes such as falls, neuropsychiatric problems or infection¹⁵



The best way to improve this situation is to identify and treat problems before hospitalisation becomes necessary. Just as early detection is helpful for running clinical trials, it is also critical to enable patients to live independently. This can be achieved through better care in the home. So, alongside research and discoveries for potential treatment and cures, we also want to **help people living with dementia now.**

The Minder programme:

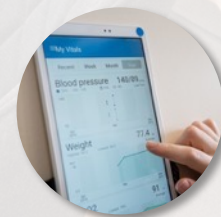
Creating dementia-friendly 'Healthy Homes' – intelligent environments that transform and personalise care

Dementia leads to cognitive impairment that makes normal day-to-day activities more and more difficult, takes away independence and reduces quality of life. The impact on individuals living with neurodegenerative disease and their family, friends and carers – as well as on the NHS – is enormous. The best way to improve this situation is to deal with problems before hospital admission is necessary.

The UK Dementia Research Institute's **Care Research & Technology Centre**, based at Imperial College London with close collaboration with the University of Surrey, brings together a diverse team of doctors, engineers and scientists to harness advances in artificial intelligence, engineering, robotics and sleep science to create new technologies that deliver the highest quality dementia care in the home.

The team is developing a range of low-cost devices and optimising them in a model home environment, deploying them in real-world evaluation studies and then, having established an evidence base, delivering them to people living with dementia and their carers.

This type of monitoring for people at home not only provides immediate outcomes that benefit people living with dementia, but also provides the infrastructure to set the UK up as a future clinical trials powerhouse in dementia. If home monitoring like this can enable future clinical trials reliant on this specialist infrastructure, UK patients could become some of the first in the world to access new treatments.



Unravelling the causes of dementia

The first step in the search for effective treatments is to grasp the complex and poorly understood **biological mechanisms** that lead to the various conditions that cause dementia.

The majority of our researchers do this fundamental discovery science – it is the engine driving all dementia research and finding treatments would be impossible without it.

For example, **Dr Soyon Hong's** team (UK Dementia Research Institute, UCL) is decoding the intricate symbiosis between specific immune cells and neurons to determine how and why this relationship can become dysfunctional and lead to the loss of synapses seen in dementia.



We have joined forces with pharmaceutical company **Lilly** to give an extra boost to this important work to identify which biological processes to target with treatments. Lilly's support will help accelerate the search and bring much-needed treatments to people sooner.

Our Research Themes foster collaboration across areas such as neuroinflammation, vascular and DNA repair, to bring together brilliant minds¹⁰.

Bridging the gap between discovery and translational research

This year, the UK Dementia Research Institute launched its **Translation Award programme**, an initiative to kick-start promising ideas and projects that have the potential to transform the lives of those affected by dementia. When it comes to translating research from bench to bedside, external investment can be difficult to secure. To address this need, the Translation Award programme gives selected researchers the opportunity to secure funds for pre-clinical analysis, drug target validation or other work directly related to finding treatments.



Dr Gabriel Balmus (UK Dementia Research Institute, Cambridge) was chosen for his work in targeting DNA repair for the treatment of Huntington's disease. In recent years, genetic studies have shown that a subset of genes involved in DNA

repair are important in the onset and progression of Huntington's disease. Evidence suggests that inhibiting just one gene can delay the onset of the disease. If successful, it could lead to an entirely new approach to treatment, complementing emerging therapies that target the main Huntington's gene.

Leadership on the global stage

The UK Government took a bold step in 2017 to reposition the UK as a Science Superpower and become a world leader in addressing the greatest global health challenge we faced then, and still do today. The Prime Minister's ambitious "Challenge on Dementia 2020" created the UK Dementia Research Institute, which became a reality thanks to the UK's biggest investment in dementia research. The Government's 2021 Life Sciences Vision built on this commitment by marking dementia research out as a priority.

The UK is a leader in biomedical research. The UK Dementia Research Institute demonstrates that collaborative and multidisciplinary research can make a significant contribution to the global **race to find cures** for dementia. If we are to maintain this momentum and capitalise on the breadth and depth of expertise brought together by the UK Dementia Research Institute, we need an investment in dementia research to at least match that of other international players.

Spend on dementia research as a percentage of the cost to the economy of treating the disease:

6.25%
Japan

4.51%
Canada

1.12%
United States

0.3%
United Kingdom

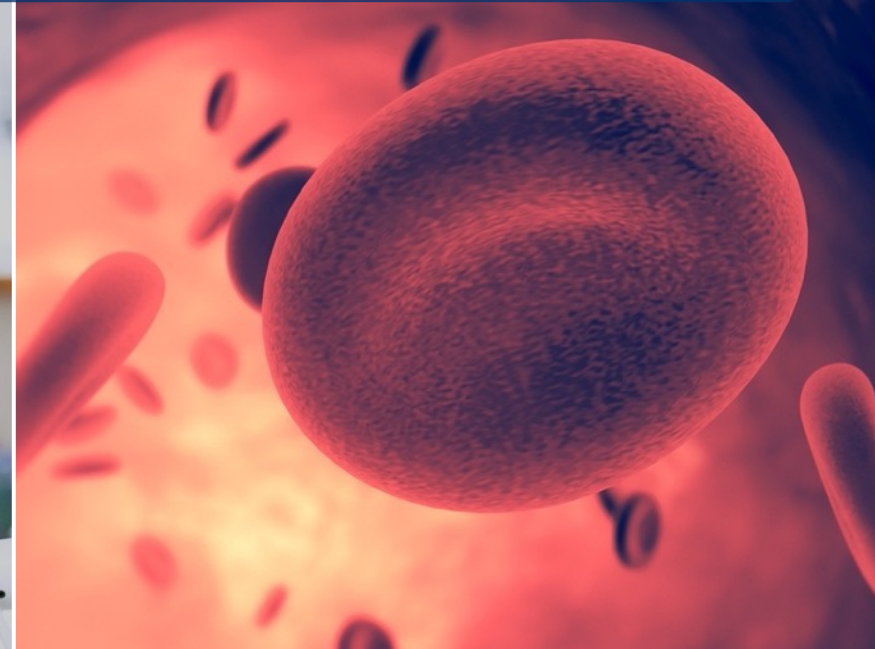


Harnessing the UK's rich research talent

The UK Dementia Research Institute's researchers accelerate, innovate, deepen and broaden discovery science in dementia, with the goal of filling the huge knowledge gap in this field. By harnessing each other's incredible strengths and sharing expertise, a thriving research ecosystem has been created.



UCL Group Leader **Professor Sarah Tabrizi** is an award-winning scientist who has published over 300 peer-reviewed publications, is a fellow of the UK Academy of Medical Sciences, co-founded the UCL Huntington's Disease Centre and helped set up the UK All-Party Parliamentary Group for Huntington's disease. Her research looks to understand the mechanism by which genetic modifiers influence the age of onset and progression of Huntington's disease, and her team collaborates intensively across our institute-wide **DNA repair research theme**. Harnessing these insights is enabling the development of new and targeted therapeutic interventions to slow disease progression.



This includes internationally-renowned researcher, **Professor Joanna Wardlaw CBE**, who is a UK Dementia Research Institute Group Leader and Chair of Applied Neuroimaging and Head of Neuroimaging Sciences and Edinburgh Imaging at the University of Edinburgh. Professor Wardlaw leads our **vascular research theme**

across the UK DRI: she and her team work to pinpoint changes in blood vessels in the brain linked to neurodegeneration. This will not only lead to new treatment opportunities but could also help predict who is most at risk of certain types of dementia. Her team aims to translate these into effective treatments for the NHS, improving lives for people at risk of dementia.

Funding the future

With all this positive momentum, there has never been a more important time to shore up funding for dementia discovery research. A survey of our UK Dementia Research Institute researchers shows we're right to be optimistic and **treatments are within reach** if sustainable funding continues.

In a survey of over 200 researchers from the UK Dementia Research Institute:

90%

think new treatments
will be found in the
next ten years

72%

think the pace of
breakthroughs is
increasing

100%

think additional funding
is important to enable
breakthroughs



Thanks to the Government's investment in 2017 and its ongoing ambition to become a science superpower, we're making progress at a pace never seen before.

All this knowledge and science is crucial to feeding the pipeline of translational research and ultimately developing treatments. But if the basic science discovery source dries up, there will be nothing to feed into the translation pipeline.

Further funding is essential. With sustained resources, the UK Dementia Research Institute will be able to supercharge the pace of discoveries across the field. We will generate new translational opportunities and de-risk novel interventions, ready for industry investment. With the right funding, the UK Dementia Research Institute is in prime position to feed an expanding pipeline of dementia therapeutics.

With more resources we can also explore new avenues in neurodegeneration. For example, **head trauma** is an under-funded area of research, with just a handful of labs in the UK investigating it, its consequences and best treatments. Yet there are substantial links between head trauma and dementia, such that head trauma research provides research opportunities to study dementia from an entirely new angle, promising to shed light on some of the same questions we're trying to answer around Alzheimer's as well as addressing the immediate needs of head trauma patients, whether associated with sports injuries, accidents, combat or other activities associated with the relatively young.

By developing areas of research like head trauma and Parkinson's disease, we will be helping patients with those conditions, as well as advancing our understanding and treatment of other neurodegenerative conditions.

We can't do all this alone. Our partnerships with industry and charities are crucial – discovery science is the foundation of an ecosystem that must work together to achieve real progress. It is excellent discovery science that will break down the barriers that are stopping industry from investing at the moment. Not only will we generate patentable discoveries that will increase momentum, but we will also make huge strides forwards in the **race to cures**.

Creating the right environment

Building has begun on a new 17,500m² state-of-the-art neuroscience facility at University College London. The new building will provide a headquarters for the UK DRI and house the largest of the Institute's seven research facilities, to provide the optimum environment for researchers doing discovery science alongside clinicians doing translational research. It will be home to 500+ neuroscientists and will become an internationally recognised symbol of the UK's commitment to conquering dementia.



Translation leading to new companies and jobs, today



The UK DRI's first spinout company, AviadoBio, has recently received an **investment of \$80m** in its Series A funding round, creating 35 new jobs (with plans to expand to over 100 FTEs by the end of 2023).

Professor Chris Shaw (UK Dementia Research Institute, King's College London) is translating his UK DRI discoveries to develop **innovative gene therapies** for people living with frontotemporal dementia (FTD) and motor neuron disease (MND).

This latest investment will allow the company to take their research through to **in-human clinical trials** for the first time. The funds will also help advance other pre-clinical work into neurodegenerative diseases.

Collaborating with industry to accelerate new therapies

Partnering with industry brings significant benefits to research, providing additional expertise and investment to support a shared goal of accelerating dementia discoveries.

In 2019, the UK Dementia Research Institute launched a £2m partnership with **Eisai**, one of the world's leading research-based pharmaceutical companies, to support post-doctoral research into dementia. Researchers benefitted from both the UK Dementia Research Institute's state-of-the-art research facilities and Eisai's drug discovery and translational expertise, to accelerate the development of new diagnostics, treatment and care.

Three neurodegeneration projects were selected, including one by Professor Valentina Escott-Price (UK Dementia Research Institute, Cardiff), who is leveraging human genetics to identify target populations for dementia therapeutics. To halt or slow the progression of Alzheimer's Disease, we need to administer treatment as early as possible, so her team is looking to identify those at highest risk and tailoring therapeutics to them.



Race to Cures: Discovery research will fast-track dementia treatments

References:

1. LSE. *Projections of older people with dementia and costs of dementia care in the United Kingdom, 2019–2040*. www.modem-dementia.org.uk (2019).
2. Nwadiugwu, M. Early-onset dementia: key issues using a relationship-centred care approach. *Postgraduate Medical Journal* 97, 598–604 (2021).
3. The King's Fund. *The NHS budget and how it has changed*. www.kingsfund.org.uk/projects/nhs-in-a-nutshell/nhs-budget (2021).
4. Lewis, F. *Estimation of Future Cases of Dementia from Those Born in 2015*. www.ohe.org/publications/estimation-future-cases-dementia-those-born-2015 (2015).
5. Global Burden of Disease. GBD Results Tool. www.ghdx.healthdata.org/gbd-results-tool (2016).
6. Maruthappu, M. et al. Investments in cancer research awarded to UK institutions and the global burden of cancer 2000–2013: a systematic analysis. *BMJ Open* 7, e013936 (2017).
7. ClinicalTrials.gov. ClinicalTrials.gov. www.clinicaltrials.gov.
8. American Cancer Society. www.cancer.org. (2020).
9. CRUK. *Facts and figures about our research funding*. www.cancerresearchuk.org/funding-for-researchers/facts-and-figures-about-our-research-funding-0 (2021).
10. UK Dementia Research Institute. *Research themes*. 2021 www.ukdri.ac.uk/research-themes.
11. Lalli, G., Rossor, M., Rowe, J. B. & Strooper, B. de. The Dementia UK Ecosystem: a call to action. *The Lancet Neurology* 20, 699–700 (2021).
12. UK Dementia Research Institute. *New European alliance formed to tackle urgent challenge of neurodegenerative diseases*. www.ukdri.ac.uk/news-and-events/new-european-alliance-formed-to-tackle-urgent-challenge-of-neurodegenerative-diseases (2020).
13. Torjesen, I. Figures show big increase in emergency admissions for dementia patients. *BMJ* 368, m249 (2020).
14. NICE. NICEimpact dementia . www.nice.org.uk/about/what-we-do/into-practice/measuring-the-use-of-nice-guidance/impact-of-our-guidance/niceimpact-dementia (2020).
15. Alzheimer's Research UK. Dementia Statistics Hub. www.dementiastatistics.org/statistics/hospitals/ (2018).

Contact olivia.marshall@ukdri.ac.uk