UK Dementia Research Institute

# Race to Cures: How discovery research will fast-track dementia treatments

2021

Medical Research Council

Alzheimer's Society

Alzheimer's Research UK

Make breakthroughs possible

# Foreword

**William Rucker**

**Chairman, UK Dementia Research Institute**

**One in three people born this year will develop dementia at some point in their life.**

More than 885,000 people have dementia in the UK today – and this is projected to increase to over two million by 2050 with the prevalence of early onset dementia doubling every five years[1]. The economic and personal cost of these figures is staggering: it's clear that investment in research cannot wait. The UK Dementia Research Institute is in a race to find cures. Years from now, we will look back on this moment as the turning point in the race to solve our greatest health challenge: dementia.

No single institute can solve this problem alone. 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 from Government was desperately needed – the Government recognised that investing now would save resources in the future and give us the best possible starting point.

Through the formation of the UK Dementia Research Institute, we created a community of scientists, clinicians, people living with dementia and their families who have all contributed to answering some of the fundamental questions about the brain. The discoveries made by the UK Dementia Research Institute will inevitably lead to breakthroughs in treatments and – we dare to hope – cures.

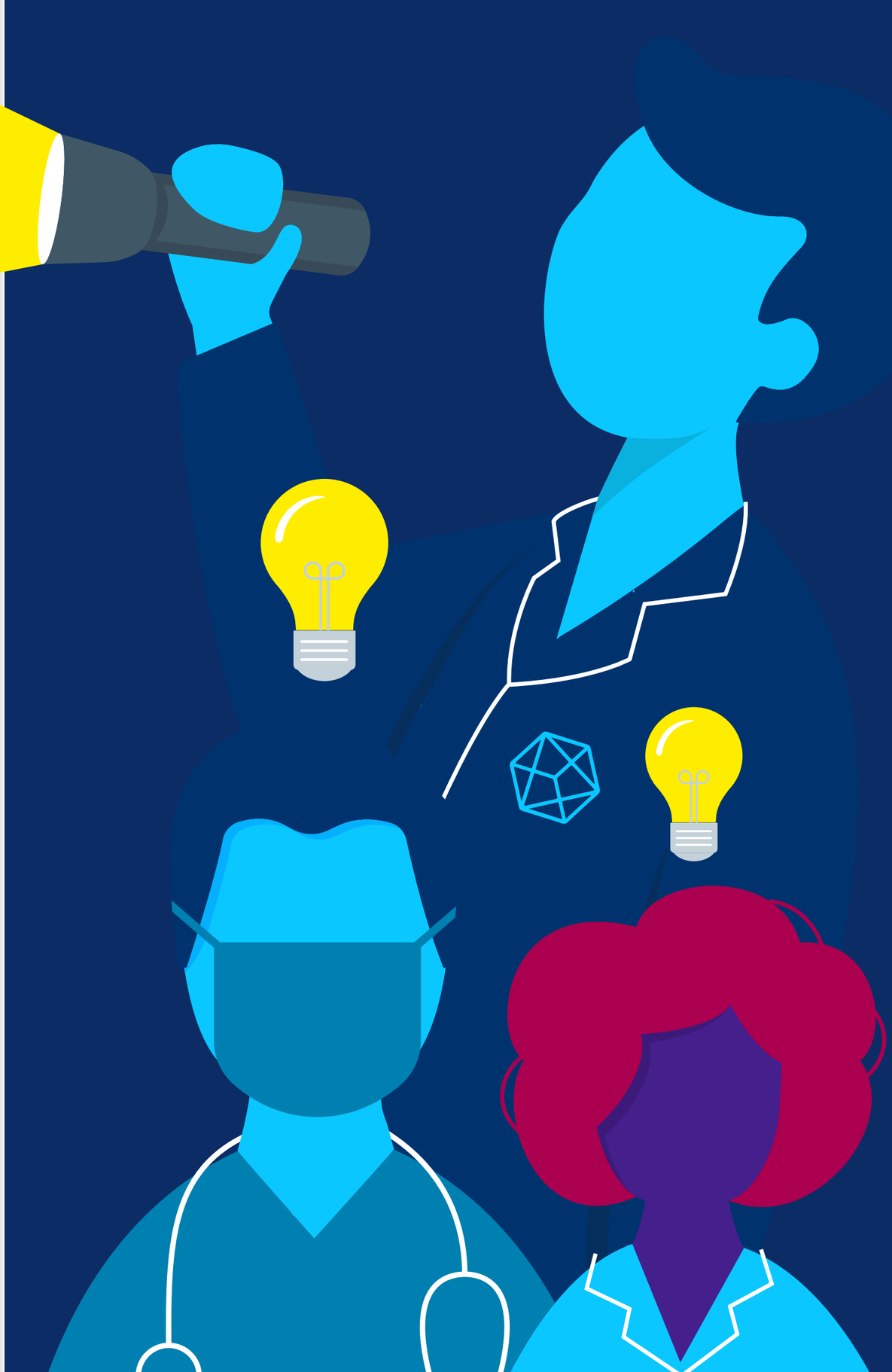
While our work will make treatments possible, for many people it will be too late. Too many of us know someone touched by this terrible condition. My mother's diagnosis was not a shock – the signs and symptoms many of us are sadly familiar with were becoming clear before that date – but it was nonetheless 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 our children will not experience what many families living with dementia today endure.

# Discovering Hope

**Globally, there are now more people living with dementia than cancer patients (47 million vs 42 million[2]), 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.

Over 13 years, £2.4bn in cancer research has yielded unprecedented progress – turning a previously incurable illness into a chronic disease[4]. The sustained funding of research in cancer helped us 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.



This positive progress and momentum in cancer discovery has led to continued interest and investment from the pharmaceutical industry, while the opposite is true for dementia. Dementia is still poorly understood compared to cancer and we have a lot of catching up to do to match that level of knowledge. While the UK Dementia Research Institute has made great strides, there's still a long way to go. Sustained public funding is crucial in helping us reach the finish line in the race to cures.

The UK's investment in establishing 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 leads that clinicians, biopharmaceutical companies and investors can now test and develop into new medicines, diagnostics and therapies. We're also marking the UK out as a science superpower in dementia discovery research, which will help attract more investment in translational research here.

Sustained research funding into dementia will help uncover more of the mysteries surrounding the disease, what triggers it, how it progresses and how to prevent, treat and even cure it. The UK must continue to lead in the understanding of disease biology through discovery science if it also wants to lead in developing the new therapeutics for dementia.

## Fewer than 2,400

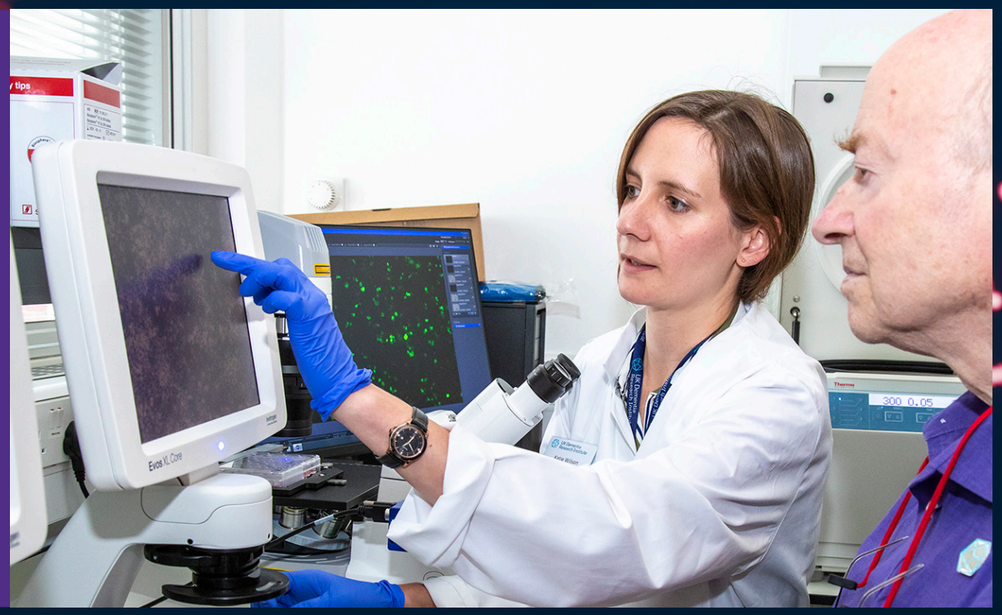
**Since 2000, nearly 74,000 clinical trials have been run in cancer compared with fewer than 2,400 in Alzheimer's disease.**

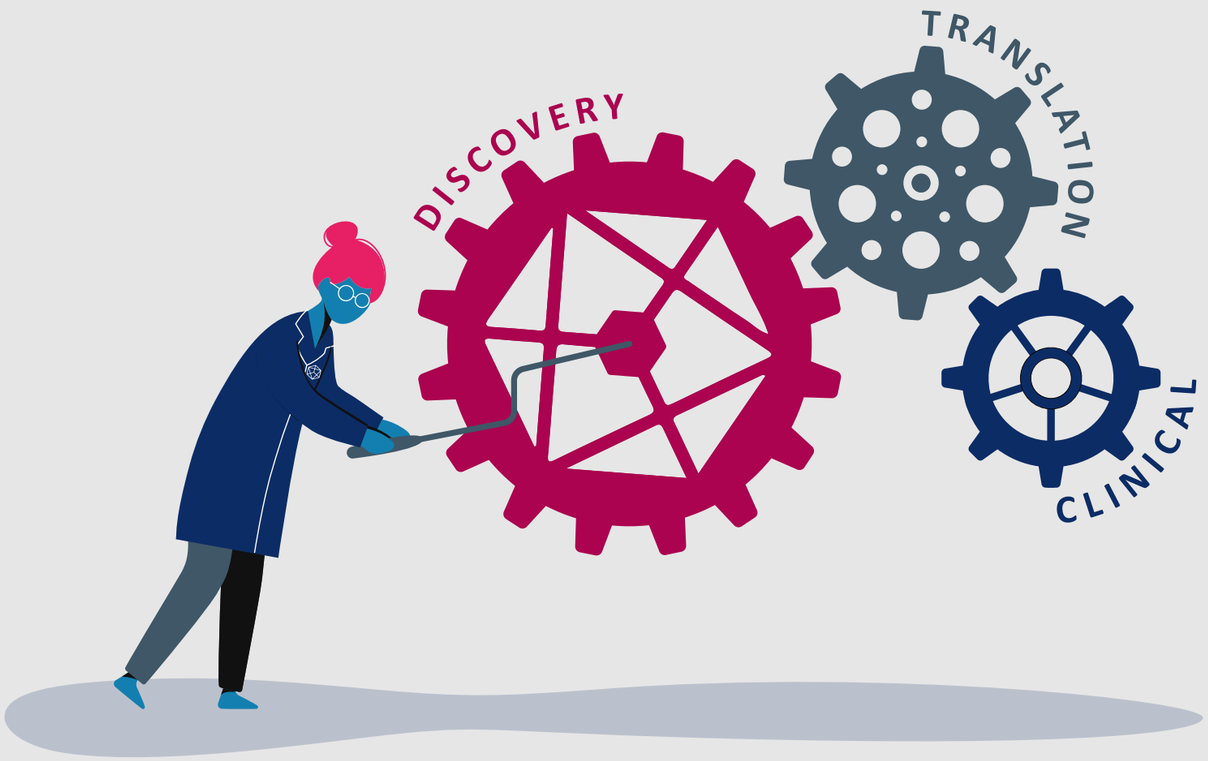
## Just 6

**In the same timeframe, this has led to 553 drugs approved by the FDA for cancer, compared with just six for Alzheimer's[3].**

# Discovery science: The crucial first step towards treatment and cures

**Cancer is much better understood as a set of diseases than dementia, yet 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 research[5].**

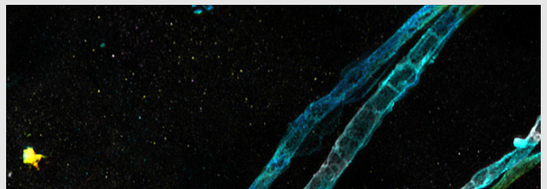





## Today, we're much closer to new treatments for dementia than we were even five years ago, but we're not there yet.

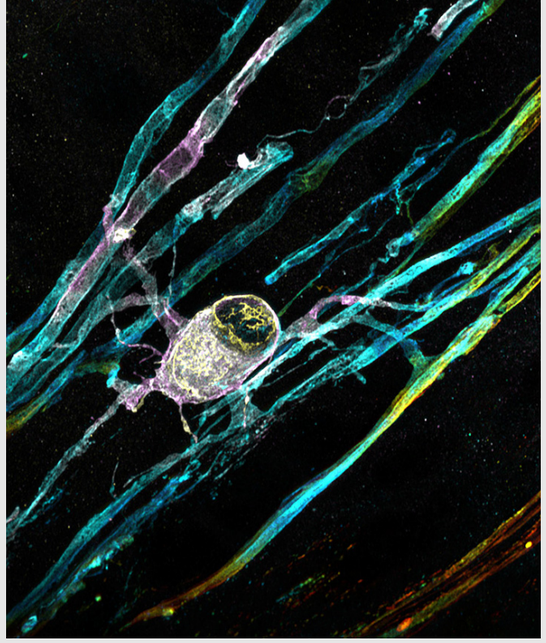
To get treatments and potential cures to a clinical trial, or even to the stage where a molecule can be developed into a drug, we need to fill the dementia knowledge gap and understand more of the fundamental mechanisms of the disease. Without more of this basic discovery research, drugs cannot be developed.

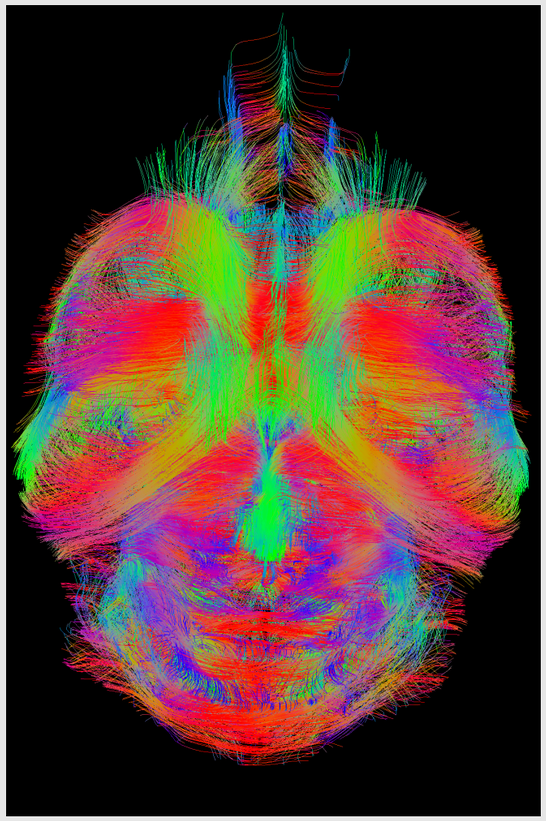
In the race to find cures, the UK Dementia Research Institute has brought together and funded world-leading research on how our body's cells, circuits and systems work. The UK Dementia Research Institute has boosted the UK's capacity to investigate the causes of dementia, driving the UK into the position of world leader in dementia research. And thanks to its unique 'hub and spoke' model, this has been done at a pace previously unimaginable, through collaboration among the UK's top experts within and outside of dementia research.



The past four years have brought about significant breakthroughs in dementia research. 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. Our breakthroughs have shown how we can correct electrical signals in the brain to treat brain conditions in a non-invasive way, which opens up a whole new area of treatment to explore that has been left untouched for decades because it was deemed too invasive. We've discovered a novel gene that seems to play an important role in how fast Huntington's disease progresses has been identified, giving us much more focus on research for treatments. And animal studies looking at using existing drugs to slow the degeneration of the brain could pave the way for a shortcut to cures for dementia.

**Behind each of these breakthrough studies stands the UK Dementia Research Institute.**





**The best way to improve this situation is to identify and treat problems before hospitalisation becomes necessary. 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.**

## 50%

Around half of patients living with dementia will have at least one hospital admission each year

## 1/4

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

## 1/5

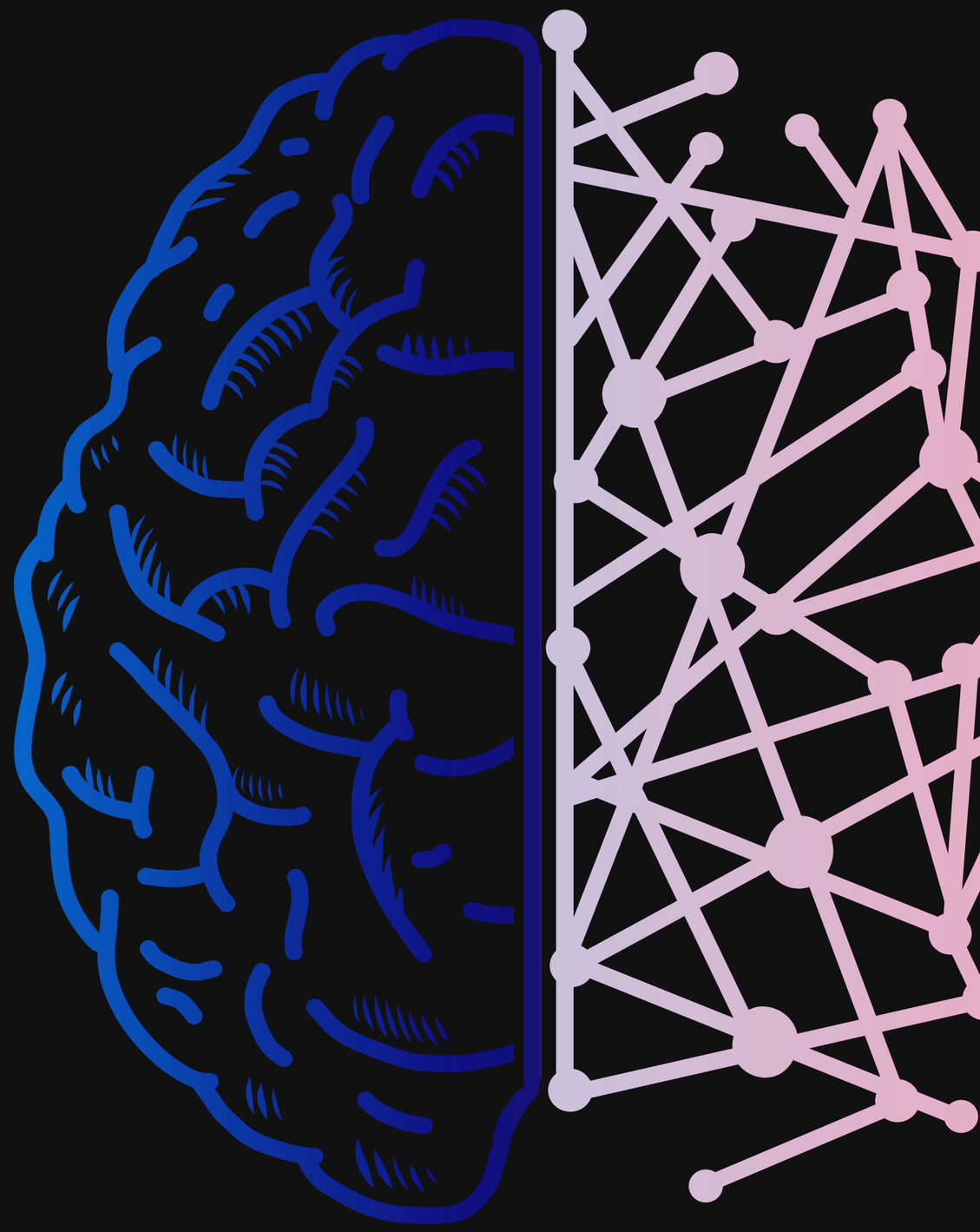
One in five of these admissions are due to potentially preventable causes such as falls, neuropsychiatric problems or infection.

*(Alzheimer's Research UK 2018. Alzheimer's Societv 2009)*

# 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.

UK Dementia Research Institute 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 within translational research as study progression markers to indicate whether potential drugs could be useful.



# Culture of collaboration

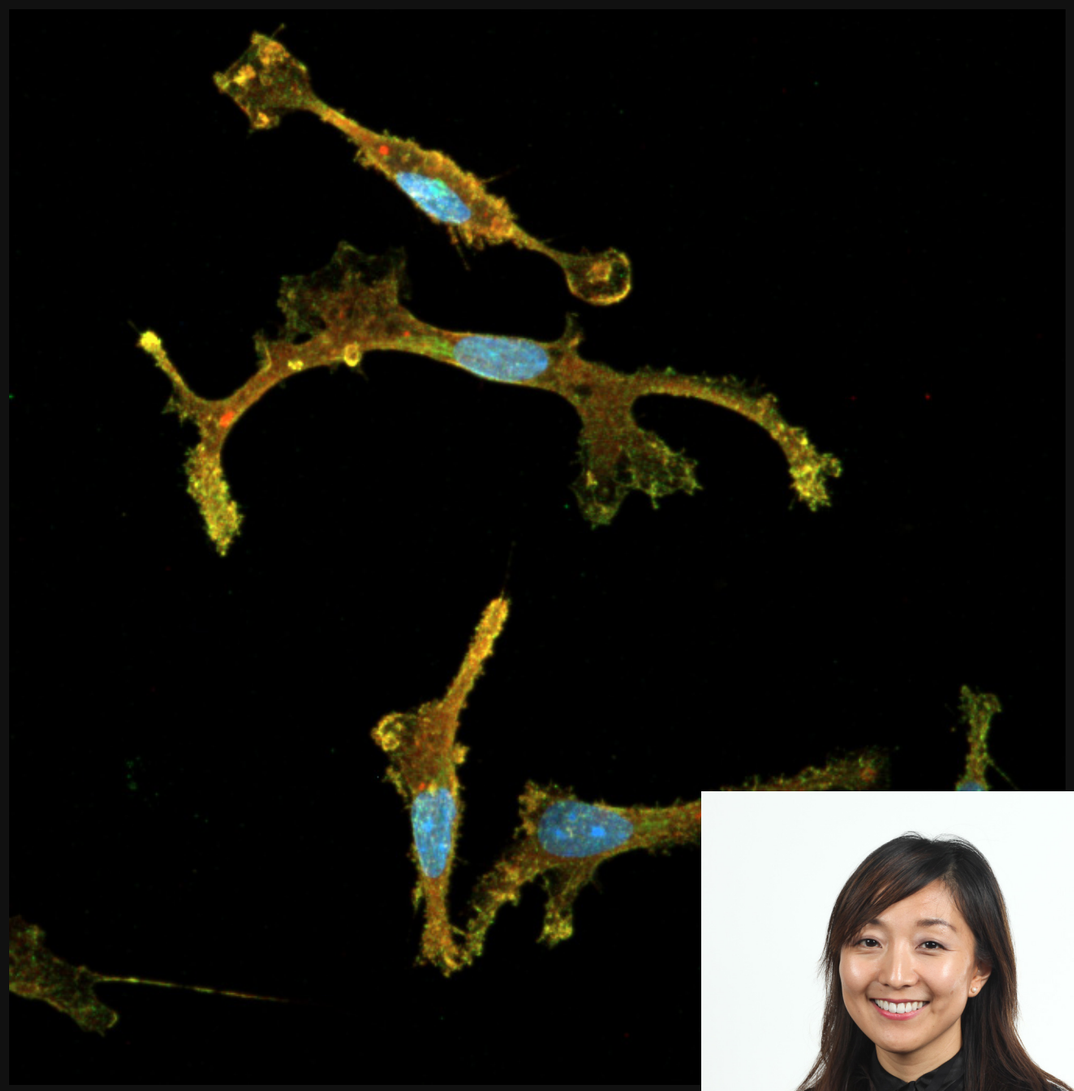
**It’s tempting to see the search for a dementia cure as a relay race, with discovery science handing the baton to translational who hand over to industry to develop treatments, trial them and bring them to market. However, it’s more multi-directional than that.**

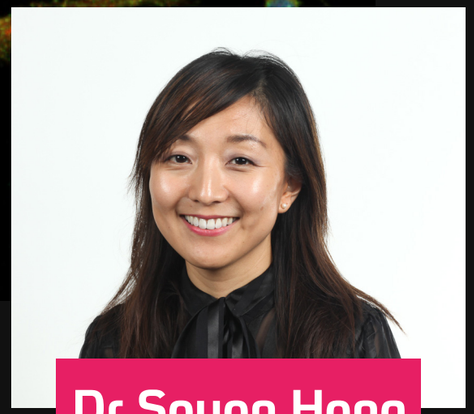
Clinical trials can’t succeed without the ability to identify patients with the right profiles, and targets often need biomarkers before they can be validated.

We've seen a staggering acceleration in breakthroughs in the past four year, 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. From a previously fragmented research ecosystem, we have created a more unified and collaborative community to drive forwards as one. But there's still work to be done to ensure progress is happening as fast as possible. Silos have slowed progress in the past and they must be further broken down.

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.





Dr Soyon Hong

# 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) are 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 forced 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.

# 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 gave 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.

Dr Gabriel Balmus

# 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, 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.

# 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 has always punched above its weight when it comes to science. The UK Dementia Research Institute is already recognised as a key player in the global race to find cures for dementia. While our investment in dementia research was much needed and impressive, we lag far behind comparable countries globally.

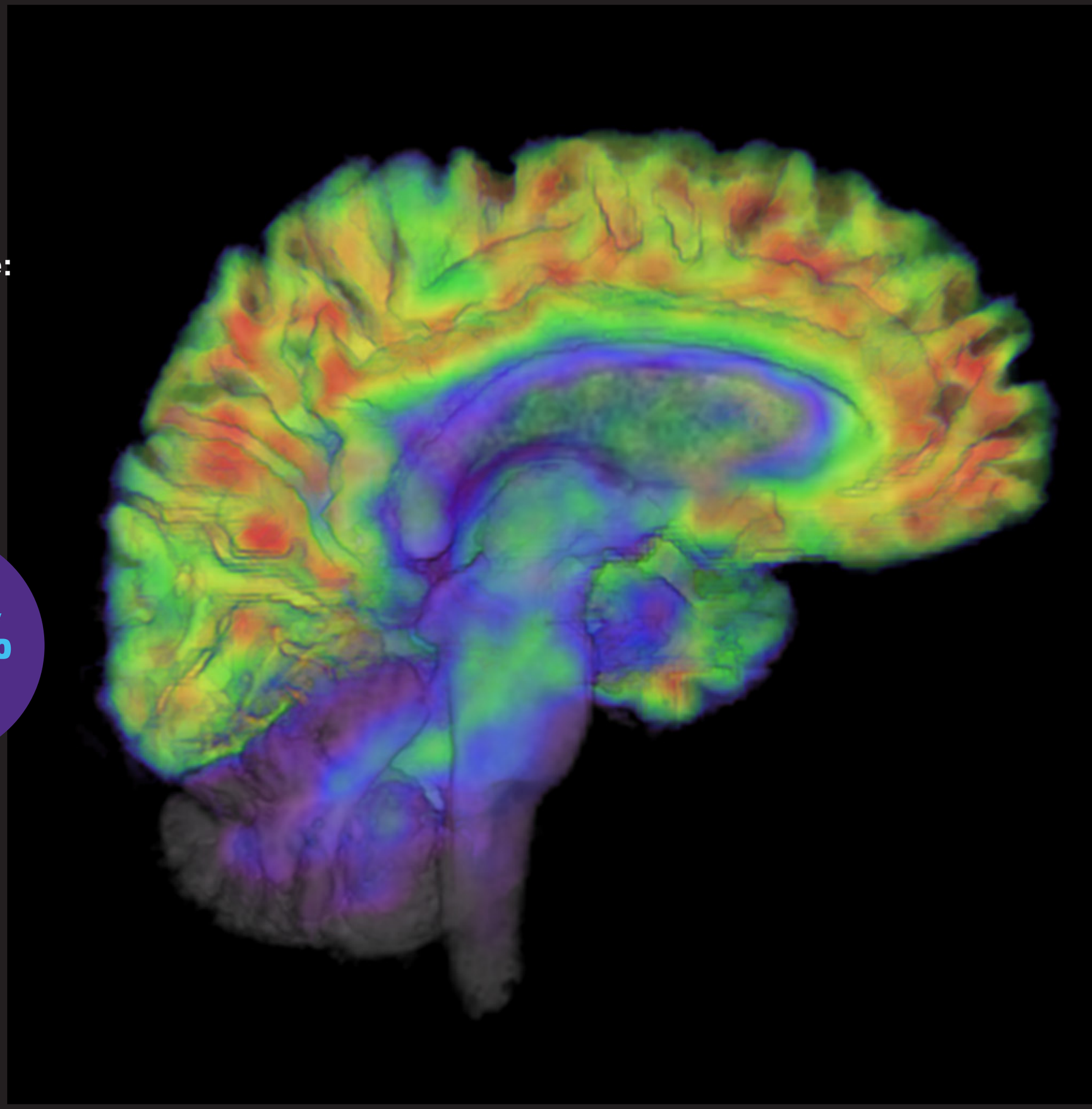
**Spend on dementia research as a percentage of the cost to the economy of treating the disease:**

**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.**

This includes internationally-renowned researcher, Professor Joanna Wardlaw, 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's work is pinpointing 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.

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. Harnessing these insights is enabling the development of new and targeted therapeutic interventions to slow disease progression.

Prof Joanna Wardlaw

Prof Sarah Tabrizi

# Funding the future

Further investment in research can’t, and shouldn’t, wait. A survey of our UK Dementia Research Institute researchers shows we’re right to be optimistic, but only if sustainable funding continues.

**In a survey of over 200 UK DRI researchers:**

**90%**

think new treatments will be found in the next ten years

**72%**

think the pace of discoveries and 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. Without increased funding, the UK Dementia Research Institute will be unable to supercharge the pace of discoveries across the field. Translational opportunities will be few and far apart and therefore the investment risk too high for industry. With the right funding, the UK Dementia Research Institute is however in an excellent position to feed an expanding pipeline.

For example, head trauma is a significantly 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 rich 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 under-funded areas of research like head trauma and Parkinson's disease, we will be helping patients with those conditions, as well 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

To support translational science, building has begun on a new 17,500m$^2$ 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, providing our researchers with the optimum environment for getting the job done. It will be home to 500+ neuroscientists and will become an internationally recognised symbol of the UK's commitment to conquering dementia.

Prof Chris Shaw

# Translation leading to new companies and new jobs, today

Professor Chris Shaw (UK Dementia Research Institute, King's College London) has already translated his UK DRI discoveries into a new company that is designing and testing a new generation of gene therapy for treating Amyotrophic Lateral Sclerosis (ALS) and other neurodegenerative diseases. With an initial investment creating 18 jobs, the research community is excited to see the results this company will be producing soon.

# 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.


**Prof Valentina Escott-Price**

UK Dementia Research Institute

# Race to Cures: How discovery research will fast-track dementia treatments


*Refrences:*

*1. https://pmj.bmj.com/content/97/1151/598*

*2. Data on file – UK DR*

*3. Data on file – UK DR*

*4. https://bmjopen.bmj.com/conctent/7/4/e013936*

*5. Funding across the research pipeline. Cancer Research UK. https://www.cancerresearchuk.org/funding-for-researchers/ facts-and-figures-about-our-research-funding-0*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