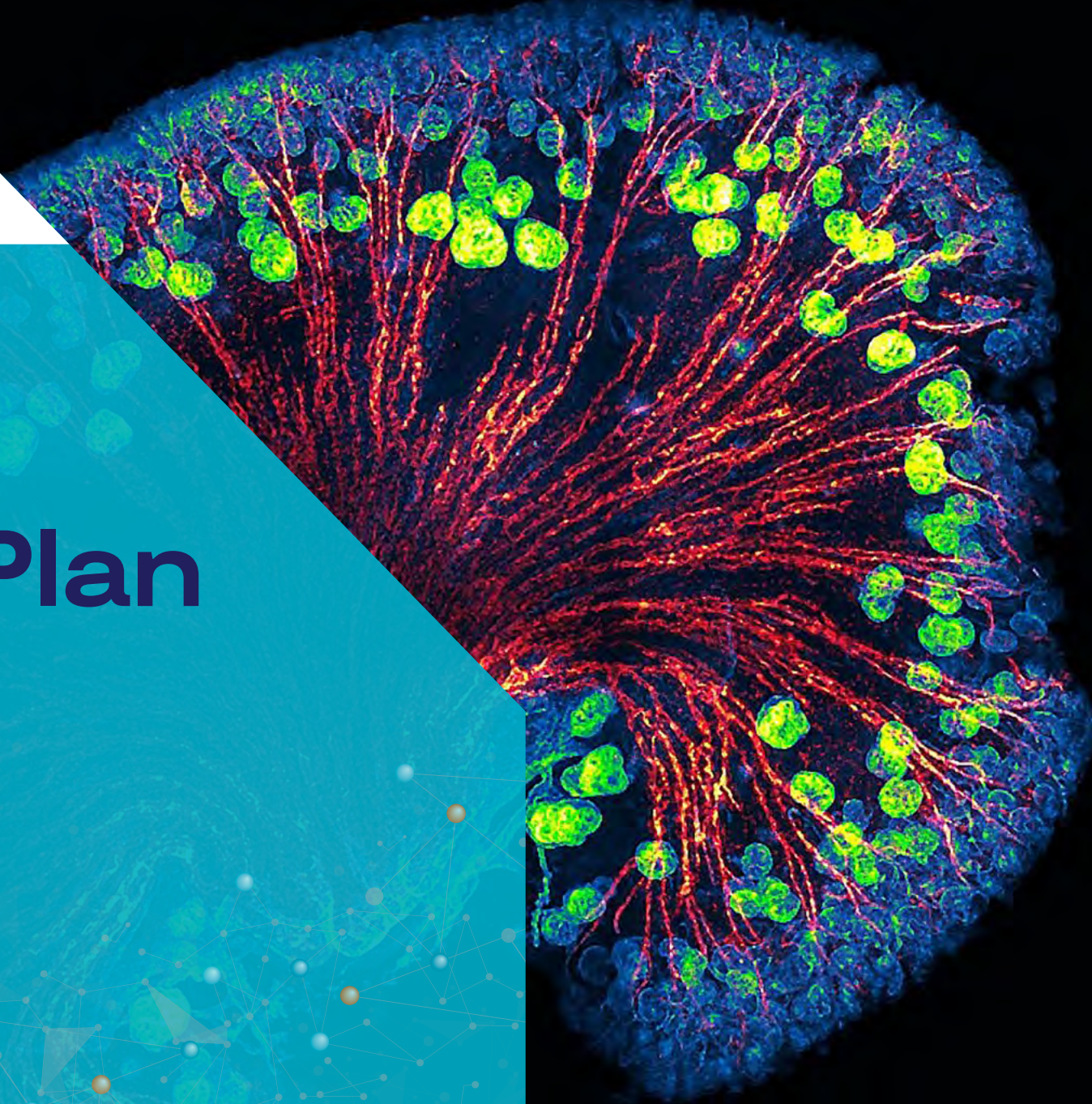




Medical
Research
Council

Strategic Delivery Plan

2022–2025





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Strategic Delivery Plan 2022–2025

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Professor John Iredale (*Interim Executive Chair, MRC*)

Foreword

Living healthily for longer concerns every one of us, no matter our background, place or upbringing, and is central to the Medical Research Council (MRC)'s mission and research.

There is unprecedented potential to transform lives and populations by harnessing huge data rich resources, fusing technologies across biological, digital and physical domains, and utilizing insights from social sciences to humanities. Unravelling the complexity of human health and disease across scales, from molecules to tissues and individuals to populations, will enhance the prevention, early detection, diagnosis and treatment of disease, improving health and wellbeing for all.

The publication of UKRI's first strategy marks an unparalleled opportunity to work with our colleagues across UKRI, adopting a collective approach to people, culture and talent, fostering interdisciplinary research approaches, and addressing the challenges set out in the UKRI strategic themes, from Securing Better Health, Ageing and Wellbeing to Tackling Infections.

Our success in transforming health and creating the healthcare companies of tomorrow is dependent on supporting the best investigator-led discovery science. For example, the results of MRC-funded fundamental research in 2005 helped develop an entirely new way of sequencing DNA, which has led to the foundation of a multi-billion pound UK-based company – Oxford Nanopore Technologies – that has developed portable, real-time DNA sequencers with applications ranging from point-of-care monitoring of Zika and Ebola through to drug-resistant TB. Decades of work led by the MRC Laboratory of Molecular Biology culminated in transformative developments in cryo-electron microscopy, providing a step-change in understanding molecular structures and improving rational drug design for the treatment of a wide range of diseases. Our long-term support for genomics research enabled the rapid creation of the COVID-19 Genomics UK (COG-UK) Consortium, which delivered whole virus sequencing data to manage the COVID-19 outbreak in the UK.

Bringing the benefits of our research to people requires partnerships across the health and innovation system. We have seen the power of this approach in the UK's response to COVID-19, including, with MRC and National Institute for Health and Care Research (NIHR) support, the development of the Oxford/AstraZeneca vaccine and the establishment of dexamethasone as an effective treatment through the RECOVERY trial.

We will act as a convener across the health and innovation system to maintain a fertile, agile and adaptive ecosystem that links, people, populations

and researchers across UKRI, the UK and the world. Working with NIHR, the NHS, all nations in the UK and the wider health sector we will address barriers and opportunities in health research, including strengthening clinical and data capabilities. We will take a coordinated approach to supporting research that enables the ambitions of the [UK Government Life Sciences Vision](#) and to progressing the translation of our research into new policies and clinical practice. Increasing involvement and engagement of patients and the public will ensure that our research provides solutions for critical health challenges relevant to all populations of the UK. We will also diversify and deepen our engagement with the academic sector to develop and address shared agendas and strengthen dialogue and collaboration with charities.

To support the Government's 2.4% Research and Development (R&D) investment target and leverage private sector investment, we will enhance and broaden the range of our partnerships with Innovate UK and Industry and stimulate cross-sector knowledge exchange and novel collaborations. Further strengthening our international partnerships will contribute to making the UK a global science nation and a destination of choice for international talent, innovative companies and inward investment.

I look forward to working across UKRI, with our research community and partners to deliver the bold vision set out in this plan.

Professor John Iredale
Interim Executive Chair, MRC
September 2022



Our success in transforming health and creating the healthcare companies of tomorrow is dependent on supporting the best investigator-led discovery science.



What we will achieve

MRC's vision is to accelerate improvements in human health and economic prosperity by supporting world-class biomedical research and innovation, and strengthening partnerships within UKRI, across the UK and around the world.

At the heart of our vision is our commitment to supporting world class discovery science and the best investigator-led **ideas**. Our aim is to further understanding of human disease by catalysing research that develops and embraces new tools, technologies and models and integrates diverse experimental approaches and data from genomics and molecular mechanisms through to lifestyles and environmental exposure. Supporting the best ideas will enable us to address the most challenging research questions and provide tractable interventions for debilitating disease such as cancer, cardiometabolic disease, neurodegenerative disease, mental illness, and infections.

To support the [UK Innovation Strategy](#) and bring the benefits of our research to people, we will link across the research and **innovation** ecosystem and enhance our translational support to accelerate the progression of discovery science through to clinical and public health assessment and commercialisation. In particular, we will drive advanced therapies and innovative technologies, working with Innovate UK and across UKRI, and strengthen and broaden

partnerships with the commercial sector, including pharma, diagnostics, digital and technology companies. Over the last decade, our translation programme has catalysed the creation of spin-out companies with a market value of £2.7 billion, accounting for over 40% of UK health and biotechnology venture capital investment in 2018¹.

To deliver **impacts** we will work in partnership across UKRI, with government departments, international partners and the wider health sector to develop solutions for national and global challenges. We will support research that promotes healthy ageing and reduces the burden of mental and physical disease over a lifetime. To do this, we will adopt an approach that focusses on prevention and early treatment of disease and addresses the health inequalities that are entrenched in society. We will also protect our health by tackling the impact of environmental change and the emergence and spread of infections. This will rely on harnessing the opportunities from transformative technologies ranging from artificial intelligence and advanced data science through to genomics and bioinformatics.

People and careers are central to our vision. We will support the breadth and diversity of skilled people needed to conduct the best science, increase support to attract, develop and retain talent, and foster porosity and interdisciplinarity across sectors. We will also advance an open and collaborative research culture that is strengthened through diversity and team-based approaches.

Excellent research is conducted in a variety of different **places** across the UK and the globe. We will connect across the system encompassing our world class Institutes, Units (in the UK and Africa) and research constituency to bring the benefits of our research to all citizens, particularly the most deprived, in support of the Government's levelling up agenda. This will include developing and leveraging local and regional research and innovation capabilities – including through our new Unit funding model, distributed Institutes, and new infrastructure investments – and involving academia, businesses, local communities, and patients to prioritise, co-develop, and participate in research that matters to people from a range of backgrounds.

Our ambitions need a **world-class organisation** that is efficient, effective, agile and diverse. We will be at the vanguard of initiatives to promote equality, diversity, inclusion and research integrity, and set, own and deliver ambitious targets for MRC and our research community. We will work with colleagues across UKRI to deliver a transformative efficiency plan and simplify our grant and review processes to reduce bureaucracy, and we will critically evaluate our work to improve the delivery of our strategy. We will also set and deliver ambitious targets to achieve Net Zero for our estate and operations before 2040 and work with partners including within UKRI, NIHR, the NHS, Wellcome and others to incentivise best practice and assist the greater research community to reach this goal.

Our purpose

Accelerating improvements in human health and economic prosperity by supporting world-class biomedical research and innovation, and strengthening partnerships within UKRI, across the UK and around the world.

Our principles for change – we will embed the principles of diversity, resilience, connectivity and engagement across all our work, to drive change and create the conditions for an outstanding research and innovation system

Our strategic objectives provide the framework for how we will achieve our vision and realise our principles, through world-class:

People and careers	Places	Ideas	Innovation	Impacts
Supporting the breadth and diversity of skilled people needed for the future R&D workforce; and advancing an open and collaborative research and innovation culture.	Fostering local, national, and international partnerships; access to infrastructure, equipment and digital capabilities; and the sustainability and agility of our major investments portfolio.	Funding world-class discovery science and driving an integrated understanding of human disease.	Strengthening the translation of discovery science and experimental medicine; driving advanced therapies and innovative technologies; and broadening partnerships with industry.	Promoting healthy ageing and reducing the burden of mental and physical illness; strengthening health equity and prevention; tackling infections; protecting human health in the face of environmental change; and progressing transformative technologies.

Supported by a world-class organisation

Strengthening equality, diversity and inclusion and enabling talented people to thrive; being an efficient, effective and agile organisation; and catalysing change and improving environmental sustainability through partnerships and leadership.



Objective 1: World-class people and careers

We will foster an environment, culture, and career paths that attract, support and retain talented people.

1.1: Support the breadth and diversity of skilled people needed for the future Research and Development workforce

Our aim is to develop a diverse research and technical workforce with the skills to address research and innovation challenges. This workforce needs to be open to all, equipped to move between sectors, trained for interdisciplinarity and team science, supported to be flexible in career choices, and embedded in an inclusive environment.

We will increase our support for people and careers, investing close to £80 million per annum through our fellowship panels and other support, and work across UKRI to support a cadre of scientists who can bridge scientific disciplines, cultures and sectors, and create novel approaches to currently intractable problems. We aim to embed digital and data science approaches and quantitative skills across the range of biomedical research and increase incentives and opportunities for team science and technology specialists. In partnership with key stakeholders, we aim to develop a cadre of clinical researchers skilled in the integration of innovative technologies such as advanced diagnostics and data science in medical research.

We will:

- support people flexibly at key career stages through our prestigious fellowship schemes, grants, institutes, units and centres, improving career stability and addressing barriers to attraction, retention and progression.
- work across UKRI on a collective approach to people, culture and talent, in support of the Government's Research and Development (R&D) people and culture strategy.
- promote sector porosity through a new pilot fellowship scheme with AstraZeneca, with the aim to expand this to other industry partners; our flagship Clinical Academic Research Partnership initiative, which re-engages healthcare professionals in research; and the MRC/ Academy of Medical Sciences policy internship scheme, which offers PhD students an insight into science policy.
- develop and pilot interventions to promote diversity across career stages and job roles, including within new Doctoral Training Partnerships, through sharing of best practice and trialling new approaches; and supporting a Black internship programme through Health Data Research UK.
- refresh skills priority areas in partnership across UKRI and launch an initiative to maximise the opportunities from data science for innovative biomedical research.

Inclusive research design

A new MRC policy requiring the use of both sexes in the design of preclinical scientific experiments will tackle the female research data gap to improve medicine for women. Historical gender bias in research has led to some drugs being inadequate and potentially dangerous for women. Following the thalidomide tragedy in the 1950s, it was not until 1993 that women were included in clinical trials in the US, with other countries following suit. By 2001 eight drugs had been withdrawn from the US market due to the harm they cause women. This is partly driven by experiments that overlook sex as a variable, using only one sex of animals, tissues and cells in underlying biomedical research. Currently, less than half of MRC grant applications proposing to use animals specify their sex – a data gap which will be addressed through the new policy. A further policy on inclusive research design for studies involving human participation, which will consider sex and gender as well as other characteristics such as ethnicity and socio-economic position, is in development and expected to launch in 2023.

Career mobility between academia and industry

Over a quarter of the c. 1500 PhD students supported by MRC each year move into industry immediately following their doctoral studies, rising to around 40% in the decade following completion of their PhD. Former MRC students who go into industry work for Biotech/ Small to Medium-sized Enterprises (25%), in the pharma industry (17%) or in scientific consultancy (13%).

A £4m postdoctoral fellowship scheme, co-funded with AstraZeneca, is the first MRC fellowship scheme in partnership with industry and will foster cross-sector working and industry training and mentoring in the field of advanced therapeutics. It will support up to 10 postdoctoral fellows to undertake academically-led, independent research projects related to cell and oligonucleotide therapies, equipping them to progress their careers in either academia or industry.

1.2: Advance an open and collaborative research and innovation culture

Our ambitions can only be realised with a research culture that drives reproducible, ethical, and high-quality research and innovation, and involves and benefits people from diverse backgrounds. We will strengthen our efforts to build a culture within MRC and its research community where equitable and inclusive public and patient involvement and engagement is an integral part of research. We aim to embed diversity and inclusivity in research design, strengthen open science practices, and ensure the highest ethical standards. In all of these, we will build on and inform UKRI-wide research culture frameworks and strategies, in the context of biomedical health research, and work with a range of partners and research communities.

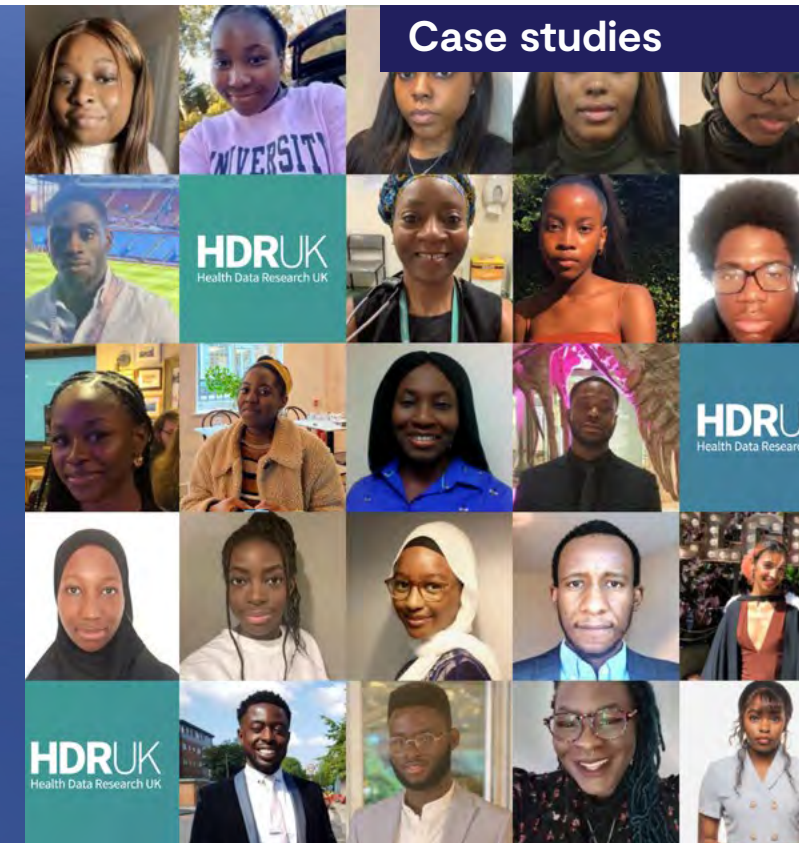
We will:

- review current MRC and wider public involvement and engagement activities and use the outcomes to develop an MRC strategy that sets out clear principles, expectations, and good practice for public involvement and engagement in biomedical research, within the wider framework of the forthcoming UKRI Public Engagement Strategy.
- evolve our existing policies and incentives to promote all aspects of open science, initially focussing on Data Management Plans to support the implementation of FAIR (Findable, Accessible, Interoperable and Re-usable) data principles, and Data Access Statements in publications.

Achieving diversity in data science careers

The Health Data Science Black Internship Programme has increased opportunities for Black early career data scientists, with many of the interns from the original intake in 2021 securing short-term or permanent jobs, or joining doctoral programmes across the UK. It has also positively impacted gender diversity: 30 of the 48 interns in 2021 were women, and this trend has been echoed in 2022. Led and delivered by Health Data Research UK and the UK Health Data Research alliance, in partnership with the 10,000 Black Interns initiative, the programme used a short questionnaire, rather than a traditional CV, to screen the candidates in a blind manner. This skills-based approach has now been rolled out to wider recruitment within Health Data Research UK to increase ethnic and gender diversity in data science.

- consult with the research community, and work in partnership across funders and other stakeholders to develop new policy and guidance on increasing diversity in research design involving human participants and embedding greater consideration of sex in experimental design of animal and in vitro studies.
- work with partners to horizon-scan the ethical challenges of tomorrow. Expand our work with regulators and continue to review and evolve



our ethical policies, guidance, and support for researchers, including the work of the MRC Regulatory Support Centre, and contributing to the development of a multi-disciplinary UKRI Good Research Resource Hub.

- recognise the impacts of those who are leading advancements in open science, team science and early career researchers who are pioneering approaches to improve research culture, through new annual prizes.



Objective 2: World-class places

We will support the institutions, infrastructures, and partnerships needed to push the boundaries of knowledge and advance health and economic benefits.

2.1: Foster Capability and Partnerships – locally, nationally, internationally

National, regional and local partnerships: We will continue to work closely with the health sector, including NIHR, the NHS, devolved nations and medical charities to address key research needs. Medical and health research lends itself to building on the strengths of regions, developing partnerships and collaborations across the UK, and linking established centres of excellence to build capacity in regions with emerging strengths. Tackling health inequalities requires working with at-risk and underserved populations and local communities to support and leverage place-based research addressing local health challenges. There are opportunities for new, highly skilled jobs in the life sciences across the UK and leverage of private sector investment.

We aim to use our convening power to stimulate new partnerships to enhance the impact our research and work with the devolved nations, regions, industry, and a diversity of research institutions and medical schools to build and leverage research capability in support of the Government's levelling up agenda.

We will:

- implement UKRI's 'Places Toolkit' to embed place considerations across a wider range of our work.
- through the UK Prevention Research Partnership and new activities in population health improvement, work with national policy makers, local authorities and communities to promote the adoption of research evidence into policy and practice and improve health equity.
- develop and harness distributed national capabilities, for example through our new Unit funding model which provides opportunities for connections across the UK, continued investment in partnership institutes such as Health Data Research UK and the UK Dementia Research Institute, and factoring levelling up into investment decisions including for infrastructure and capital.

International partnerships: Our aim is to maintain the UK as a partner of choice for biomedical research, ensuring that UK scientists can engage with the international science community, access global networks and resources, and participate in global research opportunities. MRC has a broad portfolio of global health investments, spanning fundamental science, intervention development, clinical trials and implementation science, delivered through our MRC Units in The Gambia and Uganda and programmes such as the Global Alliance for Chronic Diseases. We will build on our historical portfolio of global infections research whilst strengthening other areas such as chronic non-communicable diseases, mental health and maternal, neonatal, child and adolescent health, ensuring contextual relevance and sustainable partnerships.

We will:

- develop the role of MRC's new Applied Global Health Research Board: establishing a portfolio of high priority investments, delivering best global health practice by prioritising equitable working and investing in research capacity strengthening globally.

- enhance our engagement with partners in established and trusted emerging science nations, including in North America, Europe and Asia. We will shape the strategic agenda, implement reciprocal funding agreements and collaborate on strategic programmes in areas of mutual importance, such as pandemic preparedness, environmental change, cancer and healthy ageing.
- maintain active participation in multilateral and intergovernmental partnerships, for example through the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) and with European partners through Joint Programming Initiatives in neurodegeneration, nutrition, and antimicrobial resistance.

2.2: Ensure the UK has the infrastructure & digital capabilities needed for world-class research and innovation

Maintaining the UK's position as a global leader in biomedical research requires access to cutting-edge equipment, more environmentally sustainable facilities, new technologies, and a digital research infrastructure that implements the FAIR data principles to address the ever-growing demand for access and sharing of data.

We aim to maintain and develop cutting-edge research infrastructures in areas ranging from bioimaging to longitudinal population studies incentivising a culture of access and sharing. We will also make provision for replacement of equipment and small-scale capital (World Class Labs) funding to ensure MRC can adequately support its world-class research base. Working across UKRI we aim to deliver an interoperable and secure digital research infrastructure that will enable UK biomedical researchers to harness the vast resources of biological, clinical, population, environmental, administrative and other data to advance scientific discovery and health, working with partners to champion clear and consistent data standards.

We will:

- ensure effective delivery of new large UKRI Infrastructure Fund investments such as Population Research UK (£9 million joint with the Economic and Social Research Council, ESRC), the Adolescent Health Study (£62 million), 11.7 Tesla Magnetic Resonance Imaging (£29 million joint with the Engineering and Physical Sciences Research Council, EPSRC), Total Body Positron Emission Tomography (£32 million joint with Innovate UK) as well as relocation and enhancement of UK Biobank (£128 million).
- roll out an annual equipment call, open to all eligible UK Research Organisations, incorporating environmental sustainability as a key criterion.
- deliver UKRI Infrastructure Fund investment in novel Data and Analytics Research Environments capability (DARE UK) for storing, connecting, and analysing complex and sensitive data. Continue support for digital research infrastructure, building on MRC investments in data-intensive research institutes (Francis Crick Institute, MRC Laboratory of Molecular Biology, Health Data Research UK) and increase cohesion and links with other capabilities (such as Administrative Data Research UK, ELIXIR and EMBL's European Bioinformatics Institute).
- work collaboratively with the NHS England Transformation Directorate, across the Department of Health and Social Care (DHSC) and with the devolved nations to build an ecosystem that enables data-driven research to thrive.
- establish human central nervous tissue resources, through a £5 million investment, to provide researchers with access to well-characterised nervous tissue and investigate extending this activity to resources for other organs to help improve our integrated understanding of disease over a lifetime.

MRC translational funding leverages regional strengths

MRC's translational funding is geographically diverse, building on regional strengths in fields such as medical devices and small molecular drugs. 65% of this funding has been awarded to scientists outside the greater southeast of England and 59% of spin-outs emerged outside the Golden Triangle¹.

Tackling place-based health inequalities

The TRUUD (Tackling the Root Causes Upstream of Unhealthy Urban Development) consortium explores what would be required to incorporate health into the levelling up agenda, looking specifically at devolved governance arrangements in Greater Manchester and Bristol. TRUUD is supported through the MRC-convened UK Prevention Research Partnership with a key aim to tackle health inequalities across the UK.

2.3: Increase financial sustainability and agility of our major investments portfolio

The MRC's institute, unit and centre portfolio includes outstanding investments that deliver major cross-disciplinary scientific, health and economic impacts. The [2020 MRC unit and centre portfolio review](#) highlighted the opportunity for a more strategic approach to our major investments and the need for a more flexible funding model that can nurture new and high-risk approaches and has greater agility to deliver against key challenges, including through partnership with other funders and industry.

Through our new Major Investments Board we aim to provide horizon-scanning, review, and oversight of MRC's major investments portfolio, including institutes, units, centres and strategic grant awards, where these operate at the national level with an expectancy of funding for 10 years or more. Working in partnership with one or more university host institutions and seeking out opportunities to work across UKRI and with other public or private sector partners, we will establish a new unit funding model to support bold, interdisciplinary approaches that address major health challenges and require long-term funding of up to 14 years.

We will:

- work through the Major Investments Board to actively manage our portfolio through a rolling review of existing investments and identification of new funding opportunities.

- launch an annual call for units under the new funding model, working with the Board to finalise structure and expectations, from establishing new investments to transitioning existing investments into the new model.
- drive a culture of outward engagement, resource-sharing and open science within our major investment portfolio and consider opportunities for targeted investment to support this agenda, further building on recent networking awards.

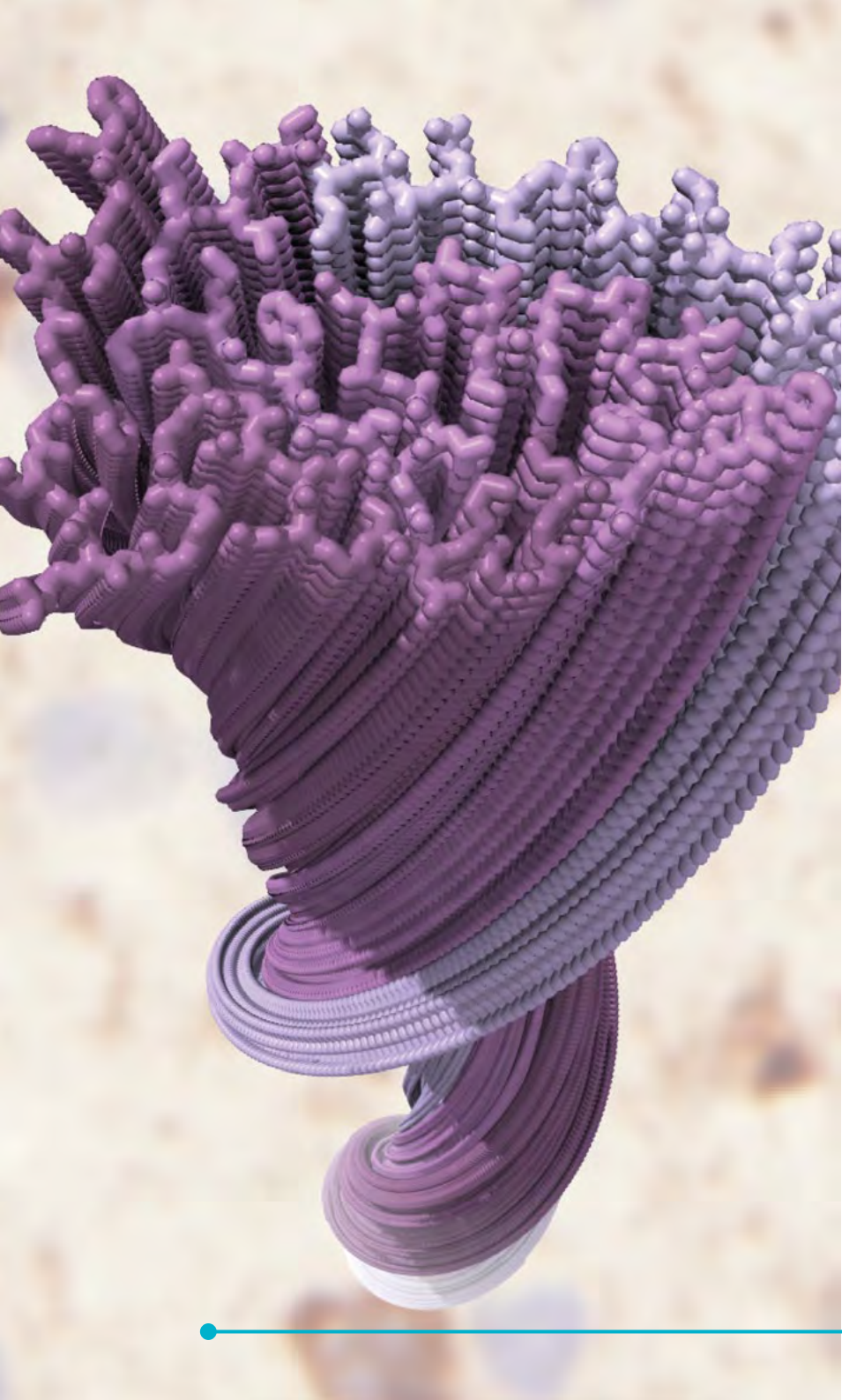


Case studies

Nationwide tracking of new COVID-19 variants

Professor Sharon Peacock took rapid action in early March 2020 to initiate and direct the COVID-19 Genomics Consortium (COG-UK), a network of scientists and labs across the country supported by MRC and other UK funders. The nationwide approach and early involvement of the devolved administrations enabled COG-UK to sequence over a million SARS-CoV-2 genomes to date, help the four UK Public Health Agencies manage the COVID-19 outbreak, and play a key role in the detection and characterisation of global variants of concern. It demonstrated for the first time that real-time pathogen sequencing at scale can directly inform a public health response. Professor Peacock actively promoted a team-based approach to research and an open science culture, which has also been instrumental in providing less-equipped countries with the tools to manage the pandemic.





Objective 3: World-class ideas

We will continue our commitment to supporting excellent fundamental discovery science to advance the frontiers of knowledge and maintain the breadth of expertise that allows us to respond rapidly to current and future challenges.

3.1: Fund world class discovery science

MRC is committed to supporting great ideas wherever they are found. We understand the importance of discovery science and the value of knowledge generation. Flexible and responsive funding that is not driven by top-down goals, that allows knowledge to be built up in the long term and provides talented people with the flexibility to pursue new directions, will drive the industries of tomorrow and maintain the UK's position as an international partner of choice.

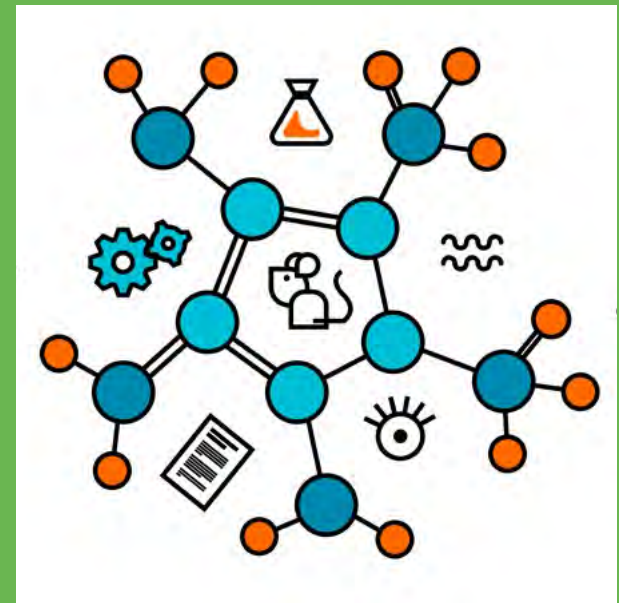
By expanding the diversity of those making decisions through our boards and panels, we will be able to better support the breadth of interdisciplinary science needed to address important research questions, researchers from underrepresented groups and those following diverse career paths.

We will:

- invest close to £200 million per annum to support the best discovery research through our boards and panels with the aim to improve our understanding of human health and disease, ranging from molecular and cellular mechanisms, to the physiology and pathophysiology of organs and systems, early clinical trials and population-level studies.
- support innovative life science research conducted by our world-leading Institutes² and their work pioneering cutting-edge tools, technologies and techniques that push boundaries at the edge of current knowledge.

National Mouse Genetics Network

The MRC National Mouse Genetics Network, a new £20 million investment led by Professor Owen Sansom, will capitalise on the UK's international excellence in mouse and human genetics and the wider biomedical sciences to tackle challenges ranging from cancer to the influence of the microbiome on disease. Within the challenge-led clusters in the network, experts in developing mouse genetic models and translational and clinical scientists will work together to provide a clear path to translation. The Network will openly share mouse models, data and access to training courses through the Mary Lyon Centre at MRC Harwell. This will ensure that many areas of science benefit from the initiative and will reduce unnecessary duplicative animal experiments through 3R (replacement, reduction, refinement) approaches.



3.2: Drive an integrated understanding of human disease

Collaborative and cross-disciplinary approaches are needed to gain an integrated understanding of human physiology and disease across scales and time, from molecules and cells through to tissues, organisms and the environment. The knowledge gained will be relevant to many biological processes, including ageing and the function of our immune system, and will help us improve the targeting of therapies for diseases such as cancer, neurodegenerative conditions, cardiometabolic, and respiratory disease, supporting the [Government's Life Sciences Vision](#).

Our ambition is to achieve a radical shift in our knowledge of how physiological processes function in context, building on dynamic and predictive models, new technologies, targeted perturbations, and rich multimodal datasets.

We will:

- strengthen collaborative networking and encourage ambitious investigator-led research proposals that combine disciplines and work across biological scales to push the boundaries of our understanding of human disease and dysfunction.
- fund basic technology development with the Arts and Humanities Research Council (AHRC), Biotechnology and Biological Sciences Research Council (BBSRC), Engineering and Physical Sciences Research Council (EPSRC) and Science and Technology Facilities Council (STFC), to accelerate the development of next generation sensing and imaging technologies.
- continue to invest in outstanding UK facilities and resources, patient cohorts, tissue banks and data collections, encouraging linkage to further develop integrative approaches to tackling major health challenges.
- through the MRC National Mouse Genetics Network, bring together research clusters across the UK to integrate mouse models with human genetics and accelerate understanding, diagnosis, and treatment development. Strengthen the network with an approximately £5 million investment for a new data platform.
- work across UKRI to pilot a new interdisciplinary responsive mode programme to fund excellent ideas spanning traditional disciplinary boundaries.

Research across biological scales

A pioneering multidisciplinary project led by Cardiff University aims to identify neural patterns in patients with severe epilepsy to uncover disease mechanisms that have previously been hidden from view when using conventional magnetic resonance imaging (MRI) scanning. One of seven ground-breaking projects supported by a recent MRC multimodal science initiative, the project will allow analysis of brain pathology, for the first time across different scales within the same individuals, using in situ clinical MRI and subsequent experimental MRI of surgically extracted tissue, followed by histopathology. Using artificial intelligence (AI), the project team will track back from a cellular level to whole organ level, improving mechanistic understanding and detection of epilepsy.



Objective 4: World-class innovation

We will support the Government's 2.4% target, the delivery of the [UK Innovation Strategy](#) and UKRI's Research Commercialisation Funding Framework by interconnecting the health research and innovation ecosystem. By expanding the diversity and ambition of our translational funding, we will accelerate the progression of discovery science through to clinical research, commercialisation, and policies and practice.

4.1: Maximise translation of discovery science and strengthen experimental medicine

MRC's translation funding model¹ provides a continuum of support for translational research and early clinical development, enhancing capability across the UK. We aim to strengthen our translational pipeline and pull-through of innovative technologies, such as bioengineering, nucleic acid and engineering biology, advanced imaging, diagnostics, and digital health, working in partnership across disciplines and sectors. By building on the lessons learnt during the COVID-19 pandemic, embracing regulatory agility, adaptive and data-enabled trialling, and coordination of translational infrastructure, we aim to maximise the translational value of UK discovery science and de-risk disruptive technologies.

We will:

- invest more than £60 million per annum to support a diverse portfolio of translational research through our Developmental Pathway Funding Scheme and Impact Acceleration Accounts, building on the specific research strengths of different regions of the UK.
- develop challenge-led Translational Co-development Centres, working in partnership across UKRI, NIHR, the NHS, the devolved nations and industry and work with EPSRC on transformative technologies to enhance treatment, homecare, prevention, and wellbeing.
- continue and enhance long-term strategic partnerships with industry, stimulating porosity and knowledge exchange, for example through the MRC/AstraZeneca Centre for Lead Discovery and partnerships through our institutes and platforms³.
- grow our sustained support for ambitious experimental medicine research that has a clear path to produce mechanistic insights and clinical impact through the recently established Experimental Medicine Panel.

4.2: Drive advanced therapies and innovative technologies

Advanced therapies, including cell, genetic and regenerative therapies, can provide treatments for unmet clinical needs. UKRI has established an advanced therapy research and innovation ecosystem through investments such as the Cell

and Gene Therapy Catapult, UK Regenerative Medicine Platform, and more recently the Advanced Therapy Treatment Centre network, the Nucleic Acid Therapy Accelerator (NATA) and Innovation Hubs for Gene Therapies. By further building on and leveraging these investments, we will support growth in areas where significant challenges remain in the development, scale-up and delivery of advanced therapies to patients, working across UKRI and with other partners.

We will:

- invest in emerging advanced therapies supporting the de-risking of innovative technologies and pull-through of discovery science through our translational funding schemes.
- link collaborative R&D with clinical and regulatory expertise and commercial partnerships and develop capabilities in conducting early-phase advanced therapy clinical studies, working closely with the Medicines and Healthcare products Regulatory Agency (MHRA) to streamline patient access to novel treatments.
- develop models for the future sustainability of the NATA and Innovation Hubs for Gene Therapies initiatives and maximise their outputs and impacts.
- work with international partners such as the Canadian Stem Cell network, and the Bespoke Gene Therapy Consortium (US) for a global approach to research and capacity development.

Gene therapy innovation hubs

A network of cutting-edge gene therapy innovation hubs has been launched by MRC in partnership with LifeArc and BBSRC, laying the foundations for transforming the care for millions of patients. The hubs are distributed across the UK (Bristol, London and Sheffield) and will take advantage of local pockets of expertise to build critical mass and support later innovation to advance the clinical development of new genetic treatments.

- establish a £12 million UK Rare Disease Research Platform in partnership with NIHR to support the diverse UK strengths in rare disease research whilst developing new approaches, such as advanced therapy development or platform technologies with broad applicability across different rare diseases.
- work with partners (EPSRC, BBSRC, ESRC, Ministry of Defence, and DHSC) to progress neuro-technologies, facilitating co-creation between disciplines and ties to policy and regulatory experts; and across government departments to grow our portfolio of research in traumatic brain injury.

4.3: Enhance and broaden partnerships with industry

Academic-industry collaboration is a valuable route to innovation and over the last decade our grant portfolio has supported collaborations with over 200 companies. We support engagement with industry through direct strategic partnerships, commercialisation of our intellectual property and by funding collaborative research. Through proactive engagement with businesses and other partners in the innovation ecosystem, we aim to build on this strong foundation to further increase cross-sector movement and knowledge exchange, attract private investment, and support advances in our research to benefit the health and wealth of the nation.

We will:

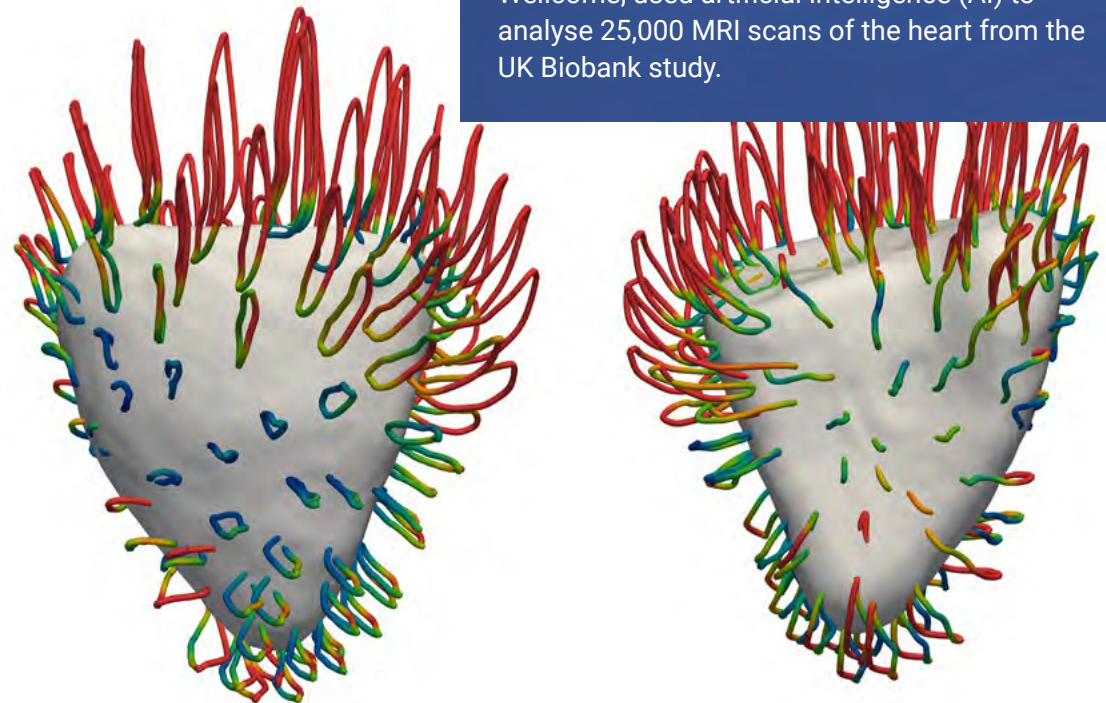
- broaden engagement with industry beyond biopharma and in particular with Small to Medium-sized Enterprises, diagnostics and digital companies, and private investors to identify mutual interests and explore models for partnering to co-create solutions for societal challenges.
- identify areas that would benefit from large joint investments, such as mental health, neurodegeneration, digital health, imaging, medical technologies and functional genomics, in partnership with industry, across UKRI and other funders.

- further develop our industry partnerships to enable academic access to industry resources and assets for mechanistic, preclinical and clinical research, and capitalise on the evolving post-COVID-19 advanced diagnostics/theragnostics industry.
- work with Innovate UK and other research councils to provide broader support to the research and innovation ecosystem, including for entrepreneurship and the development of spin-outs.

Case studies

Innovating with AI to identify heart failure risk

An international team of researchers, led by the MRC London Institute of Medical Sciences, was the first to show how a complex mesh of muscle fibres that line the inner surface of the heart plays a vital role in increasing blood flow through the organ. The team hopes the findings will help to identify those most at risk of heart failure and inform research into new treatments for the disease. The study, funded by MRC with support from the British Heart Foundation and Wellcome, used artificial intelligence (AI) to analyse 25,000 MRI scans of the heart from the UK Biobank study.



A microscopic image showing two large, red, textured biological structures, possibly cells or tissues, against a blue background of branching, tubular structures. The red structures have a bumpy, porous appearance. The blue structures are more elongated and have a smoother, slightly ribbed texture.

Objective 5: World-class impacts

We will work across UKRI and with national and international partners to address health and societal challenges aligned with the UK Sustainable Development Goals⁴, government and National Science and Technology Council (NSTC) priorities. This will include targeted support for challenges set out in the strategic themes of the [UKRI Strategy](#), focusing on Securing Better Health, Ageing and Wellbeing and Tackling Infections, and in the Government's [Life Sciences Vision](#).

5.1: Promote healthy ageing and reduce the burden of mental and physical illness throughout life

Healthy life expectancy has not kept pace with longevity and there are stark differences linked to deprivation and inequalities. Working across UKRI and with government departments, we will address the challenges of demographic change and an ageing society, prioritising prevention and early treatment to reduce disease burdens and improve health equity. This will include characterising the precursors of illness throughout life and investigating influences across the social, environmental and biological spectrum, which is particularly pertinent for mental ill health where, despite the burden and unmet clinical need, the development of new and more effective interventions remains slow.

Improving prevention and treatment demands an interdisciplinary approach that cuts across diagnostic categories and embraces research that looks across mind and body.

We will:

- stimulate interdisciplinary approaches to identify intrinsic and extrinsic influences on ageing, novel biological pathways and tractable targets for intervention, including linking established ageing networks and Multimorbidity Research Collaboratives.
- support cross-council investment in new ageing research models.
- convene a sandpit focused on technical challenges in cancer to develop novel research partnerships across the life and physical sciences interface to address currently intractable problems.
- invest a minimum of £15 million to develop a new mental health research platform that will harness a wide range of data from patients, cohorts, schools and other relevant groups to identify novel markers and targets to inform detection and treatments. The platform will build on DATAMIND, the mental health data research hub and support networked multidisciplinary academic/clinical/industry consortia.

5.2: Strengthen health equity and prevention of disease

Building and maintaining prosperous, productive and resilient communities requires promotion of health and wellbeing and closing the gap between the richest and the poorest. MRC will work within UKRI and with external partners to promote interdisciplinary research into prevention and population health improvement, aimed at identifying sustainable ways of preventing non-communicable diseases by taking account of the wider socio-economic, behavioural, cultural and environmental determinants of health. Interventions will be developed and evaluated to improve population health and reduce health inequalities.

Our approach will harness population-associated data, and we will work with local and national policy makers, health and social care and other relevant sectors to drive increased co-development and evaluation of interventions and ensure that evidence can be readily adopted into policy and practice. This will include improving understanding of the multiple factors that contribute to the development of complex conditions like obesity and developing effective evidence-based prevention and intervention strategies to tackle conditions in real-life settings.

We will:

- strengthen population health and health equity as part of the UKRI Securing Better Health, Ageing and Wellbeing strategic theme by:
 - incentivising challenge-led networks of major UKRI investments to address common goals for interdisciplinary research in population health improvement, including the development of methods to enhance and integrate health-related data, drawing on fields outside the traditional public health sector as well as biological understanding.
 - foster growth of the population health research community by bringing together a transdisciplinary cadre of researchers, supported by networking events and mentorship.
- develop plans in partnership with other funders for further targeted investment in prevention research to sustain the impetus of the ground-breaking UK Prevention Research Partnership.

5.3: Tackle infections

The ongoing COVID-19 pandemic has demonstrated the critical need for strengthened national research and innovation capabilities that can effectively connect into global initiatives. Epidemic threats are becoming more acute, with biodiversity loss, changing climate, and human demographics and behaviours driving the emergence of new diseases and increasing the speed and range of their spread. This is set against a backdrop of endemic infectious diseases, compounded by the global rise of resistant pathogens (collectively termed antimicrobial resistance; AMR).

Our aim is to build knowledge and capability to better detect and disrupt the emergence and spread of infectious diseases and accelerate development of new vaccines and therapeutics to manage the on-going COVID-19 pandemic, the risk of new pandemics, the impact of neglected endemic diseases and halt the ‘slow motion pandemic’ of AMR. A comprehensive response spanning disciplines and geographies is needed to strengthen identification, prevention and mitigation of infectious disease threats, through the adoption of a ‘One Health’ approach to create barriers to disease transmission and deliver effective responses.

We will:

- work with government and policy partners to secure the research legacy of COVID-19 investments, to provide sustainable ongoing pandemic response and preparedness and ensure a joined-up research, innovation and public health ecosystem to tackle endemic infections.

- work across UKRI through the Tackling Infections strategic theme to:
 - build new inter-disciplinary, challenge-led programmes and capacity strengthening investments addressing epidemic preparedness and AMR, with an initial focus on zoonotic disease.
 - increase support for UK vaccinology and virology, addressing the pressing need to underpin development of better, more durable vaccines against SARS-CoV-2 and other pathogens through a new minimum £16 million investment.
 - build and strengthen strategic international partnerships and support UK leadership and participation in international research and innovation programmes to define priorities and address challenges on a global scale.

5.4: Protect human health in the face of environmental change

The impact of human-driven change, including changes to climate, food systems, urbanisation and pollution are affecting health and wellbeing. Learning more about how environmental change affects health will help individuals, industry and policy makers to manage risks, and aid the development of strategies for the prevention of adverse impacts on health.

Boosting the Life Sciences Vision

Working in partnership with the Office for Life Sciences (OLS), NIHR and across the four UK nations, we will support the Government’s [Life Sciences Vision](#), drawing on the UK’s world-leading expertise and infrastructures to provide compelling opportunities for collaborative academic and industrial research, and securing industrial co-funding in support of the Government’s 2.4% R&D investment target. This will include:

- a £20 million investment, as part of a wider cross-government commitment, to a Neurodegeneration Initiative to support the development of novel therapies including for dementia.
- an up to £10 million investment, in partnership with OLS, to establish a pan-UK Immuno-Phenotyping network, to better target and develop therapies and vaccines for cancer. This network will build on our COVID-19 investments and a parallel minimum £16 million investment in underpinning immunology and virology.
- a minimum £15 million investment in a Mental Health Research Platform, co-designed and supportive of an OLS-funded mental health trials platform.

We aim to strengthen integration of research and data across environmental, health and biomedical domains to better understand health impacts of environmental change and develop interventions to promote human health. We wish to improve knowledge of how environmental factors interact with genes, physiology and the biological mechanisms through which they cause and influence disease. As a global challenge, we will work with domestic and international partners to understand and address the disproportionate impact of environmental change on the most vulnerable, both geographically and socioeconomically.

We will:

- support research into the health effects of environmental hazards and pollutants through major investments such as the MRC Centre for Environment and Health and MRC Toxicology Unit and our partnership in the SPF Clean Air initiatives.
- work across UKRI to develop planetary health priorities and strengthen research on the environmental impact on health, including the feedback loop between a healthy environment and healthy people and the impact of environmental change on infectious disease.

5.5: Progress transformative technologies

The technologies identified in the Government's [Innovation Strategy](#) such as artificial intelligence (AI) and digital, bioinformatics and genomics, engineering biology and quantum technologies have the potential to unlock fundamental discovery science and transform healthcare by supporting early diagnosis, clinical decision making, digital therapeutics and precision medicine. MRC has an important role in convening wider stakeholder interests, supporting team science across disciplines and sectors to accelerate progress in advanced data science and technology-driven biomedical and health-related research.

We will:

- partner with fellow research councils through the UKRI AI programme, and with academia, industry, the NHS and other public and private sector organisations to realise the transformative potential of AI for the delivery of fundamental insights and translation.
- ensure MRC schemes enable researchers and innovators across academia, industry and other sectors to work together on ambitious AI-driven biomedical and health-related research and publish our expectations for ethical and responsible AI approaches.
- build on major strategic investments to support and coordinate innovative functional genomics research, identifying opportunities across UKRI and with industry to facilitate the co-creation of solutions to national healthcare challenges.



- work across UKRI and with the Defence Science and Technology Laboratory (Dstl) towards establishing the National Engineering Biology Programme, including development of tools and technologies for use in biomedicine and health. Continue to support world-class research at the MRC Laboratory of Molecular Biology, where recent advances in artificial biology have the potential to increase the efficiency of pharmaceutical production.
- further develop our understanding of the opportunities quantum technologies can bring to the biomedical community, working closely with BBSRC and EPSRC.

Case studies

Preventing spina bifida

Since 2021 UK manufacturers are mandated to fortify all non-wholemeal wheat flour with folic acid in the wake of work by the MRC Vitamin Study Research Group. In 1991 the group found that folic acid supplementation for women around the time of conception reduced the risk of spina bifida and other serious neural tube defects. The ground-breaking study has led to the addition of folic acid to staples in more than 80 countries.

Protecting human health from air pollution

Following the introduction of London's ultra-low emission zone (uLEZ) in April 2019, research conducted by the MRC Centre for Environment and Health showed that by 2020 the number of Londoners living in areas with illegally high levels of nitrogen dioxide had fallen by 94%. This research influenced the expansion of the uLEZ in 2021, thus improving air quality and respiratory health for more Londoners. The Centre is now researching the health benefits of the uLEZ to help other UK cities developing plans for clean air zones.

Tackling antimicrobial resistance worldwide

Integrating animal and human health research has led to improved outcomes for both when it comes to antimicrobial resistance. In 2017, MRC-funded scientists discovered a new gene, *mcr-1*, in China that allowed bacteria to survive the 'last-resort' antibiotic colistin. This led to China banning colistin use in animals in 2018. In 2020, a Lancet article showed that the ban has already led to a drop in the transmission of the colistin-resistance gene in animals and humans in China, helping to safeguard the antibiotic for future human use.





Objective 6: A world-class organisation

We will make it easier for people to interact with us and increase our diversity, efficiency and effectiveness.

6.1: Strengthen equality, diversity and inclusion and enable talented people to thrive

We are committed to advancing equality, diversity, and inclusion (EDI) within our workforce and across the biomedical research and innovation system. We strive to ensure that our peer review, decision-making processes, policies, and practices are conducted consistently, equitably, and transparently. Working in partnership across UKRI and externally, we will deliver on [UKRI's EDI Strategy](#) and through our EDI Action Plan we will tackle barriers specific to our communities to help build an inclusive environment that attracts and retains the best scientists and staff from all backgrounds.

We will:

- develop positive action initiatives to increase applications from and participation by people from under-represented groups for job roles, funding and peer review, and achieve a greater representation of researchers from ethnic minority groups and those who identify as women on our standing boards and panels, in line with our stretching diversity targets.
- foster a culture of active bystander intervention and psychological safety by rolling out and evaluating a three-year Active Bystander Scheme pilot within MRC boards and panels and across Head Office to further raise awareness of bias and how to address it.
- empower our staff to embed EDI into everything they do, and strengthen opportunities for mentoring, mobility and flexible working across MRC Head Office to support career development and progression, particularly for those from under-represented groups.

6.2: Be an efficient, effective and agile organisation

We are working as part of UKRI to simplify processes and reduce bureaucracy to ensure that together we are an outstanding organisation. This includes implementing a new UKRI operating model to enhance agile decision making, a new funding service to make our application process more streamlined, harmonised and supportive for applicants, assessors and staff, and strengthened data governance to re-imagine the way we use data.

To take the best evidence-based decisions we need to know what works and doesn't work in health research and be able to measure and communicate the benefits of our research. Our aim is to engage MRC and UKRI leaders, external stakeholders and expert evaluators, in shaping and delivering an innovative evaluation programme that provides robust evidence for decision making, accountability and advocacy. This will include developing an outcomes framework to assess our progress against the priorities laid out in the Strategic Delivery Plan.

We will:

- complete piloting of the new UKRI Funding Service, engage with and support our academic communities, and create a schedule to transition all MRC funding opportunities into the new service before the end of 2023.
- respond to the relevant Grant Review recommendations through our wider Reforming our Business and Operating Model organisational change programmes and support delivery of a new Enterprise Resource Management system through the SHARP programme.
- enhance our effectiveness through strengthened prioritisation and coordination aligned with this Strategic Delivery Plan and define success criteria for our key strategic priorities, including the development of responsible quantitative measures.
- deliver a rolling programme of analytical projects that covers aspects of MRC's whole portfolio and publish results of current work on studentships, early career researchers and MRC institutes.
- develop reports and case studies to provide information about MRC's operational effectiveness, research outputs and impact. For example, a joint MRC/EPSRC study to "understand the benefits and burdens of the funding process from idea to award"⁵ will complete in 2023–24.

6.3: Catalyse change and improve environmental sustainability through partnerships and leadership

Working in a complex landscape, the MRC has a critical role to play in convening and catalysing across all parts of the life sciences sector to deliver impact. This will include collaboration to deliver on the ambitious Net Zero targets set out in the [UKRI Environmental Sustainability Strategy](#), including transforming our science estate and operations to zero-carbon by 2040 and challenging unsustainable research practices.

We will:

- provide increased opportunities to hear from the research community through meetings with an expanded range of university partners, targeted regional engagement, and dialogue with our MRC Directors and Investigators, and early career researchers.
- support continual engagement with key partners across the sector and establish new relationships to better connect our research and ensure MRC priorities are aligned and complementary within a complex landscape.
- challenge researchers to find practical applications to reduce the environmental impact of life science research and medical practice in collaboration with NERC, DHSC and NHS England through a £1 million investment.
- undertake a feasibility study to establish a clear strategy for the Net Zero transformation of our estate and secure sufficient power provision to phase out gas supply in operating our Institutes. We are working with our supply chain to reduce our scope 3 emissions and target “gold” status for our organisations in the [LEAF scheme](#).



Net Zero by 2040

MRC has committed to achieving Net Zero by 2040 and halving carbon emissions by 2030. We will assist our Institutes to reduce their carbon emissions and overall impact of their operations on the environment, including by replacing single-use plastic wherever possible. Recently implemented initiatives at the MRC Laboratory of Molecular Biology that include switching to LED microscope bulbs, installing automatic sash closers for fume hoods and changes to Heating, Ventilation and Air Conditioning controls are expected to result in energy savings of up to 2000MWh per year. Significant focus is now being given to reducing direct carbon emissions from gas fired plants within the estate through alternative, viable technologies. MRC has also committed to working in partnership across the public and higher education sector to target its supply chain impacts on the environment.

Our budget

Budget category ^{i ii}	2022–23 (£m)	2023–24 (£m)	2024–25 (£m)
Core R&I Budgets	548.07	587.36	615.06
Existing cross-UKRI Strategic Programmes	23.80	24.26	19.70
Fund for International Collaboration	5.13	1.86	0.00
Strategic Priorities Fund	18.67	22.40	19.70
Infrastructure*	42.81	40.82	39.08
World Class Labs	30.75	37.32	39.08
Digital Research Infrastructure Programme – phase 1b pilot projects (2022–23 – 2023–24)	3.00	1.50	0.00
Carbon Zero Fund	0.95	0.00	0.00
Existing infrastructure investments	8.11	2.00	0.00
R&I Budgets – existing time-limited commitments	21.01	3.97	0.00
COVID interventions	21.01	3.97	0.00
Grand Total	635.69	656.41	673.84

Notes

- i. The figures provided in this document are in line with the 2022–23 – 2024–25 budget allocations for UK Research and Innovation. These are broken down by our budgeting and reporting categories, and exclude funding for ODA, Financial Transactions, and BEIS Managed Programmes. Figures are indicative and may vary over the course of the three-year period due to budget adjustments made as a part of on-going financial management and planning processes to maximise the use of our total funding.
- ii. From 2022–23 UKRI talent investments are managed collectively across the Research Councils. The funding for collective talent activities outlined in this delivery plan are accounted for in the broader collective talent funding line included in our Corporate Plan.

* Infrastructure projects are detailed separately below. Note that further infrastructure allocations to Councils may be made during the Spending Review period from the Infrastructure Fund, Digital Research Infrastructure Programme and Carbon Zero Fund Programme.

Infrastructure Fund projects include:*	Total lifetime allocation (some in future SR periods)
Infrastructure Fund: Wave 1 – Full project – Population Research UK (PRUK) <i>Joint project with ESRC</i>	9.00
Infrastructure Fund: Wave 1 – Full project – Adolescent Health Study <i>Subject to business case approval</i>	61.94
Infrastructure Fund: Wave 2 – Full project – Total body PET platform <i>Subject to business case approval, joint project with Innovate UK</i>	32.10
Infrastructure Fund: Wave 2 – Full project – UK Biobank <i>Subject to business case approval, joint project with ESRC</i>	127.60

* Further allocations may be made during the Spending Review period. Excludes wave 1 preliminary activities where spend was in 21–22 only. Allocations include contingency, which may be returned if unused.

References

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3. Examples include: MRC Laboratory of Molecular Biology – AstraZeneca; The Francis Crick Institute – MSD; UK Dementia Research Institute – Eisai; UK Regenerative Medicine Platform – AstraZeneca; Dementias Platforms UK – Araclon Biotech, AstraZeneca, Autifony, BrainDTech, Cambridge Cognition, Cognetivity, CytOx, IXICO, Janssen
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5. Understanding the benefits and burdens of funding processes, from idea to award, Kings College London, 2021: <https://gtr.ukri.org/projects?ref=MR%2FV049437%2F1>

Image references

- Cover A confocal microscopy image of the urinary filtration apparatus of the developing kidney. Research partially supported through MRC funding
Credit: Dr Daniyal Jafree and Professor David Long, Kidney Development and Disease Group, UCL Great Ormond Street Institute of Child Health
- Page 4 MRC-funded ZIBRA (Zika in Brazil real-time analysis) project
Credit: Ricardo Funari
- Page 8 Dr Emilie Pondeville, Molecular Entomologist at the MRC Centre for Virus Research
- Page 10 The class of the 2022 Health Data Science Black Internship Programme. Credit: Health Data Research UK.
- Page 11 The Sir Michael Stoker Building, home to the MRC Centre for Virus Research
Credit: University of Glasgow
- Page 14 A technician validates genetic variants identified through whole-exome sequencing
Credit: Daniel Sone (photographer), US National Cancer Institute
- Page 14 COG UK Scientist looking at genome sequencing samples (insert)
Credit: Image courtesy of the COVID-19 Genomics UK Consortium and the University of Glasgow
- Page 15 Structure of abnormal human protein aggregation that characterises the most common adult-onset motor neuron disease
Credit: MRC Laboratory of Molecular Biology
- Page 16 Diagram representing the National Mouse Genetics Network clusters
Credit: MRC National Mouse Genetics Network
- Page 18 Dr Sinead Lambe from Professor Daniel Freeman’s team at the Department of Psychiatry, University of Oxford, demonstrating the use of virtual reality to treat patients with persecutory delusions (paranoia) and other severe mental health problems
- Page 20: Computer vision analysis of 3D cardiac motion in heart failure is used to make automated predictions of future outcomes to help guide treatment
Credit: Professor Declan O’Regan, MRC London Institute of Medical Sciences
- Page 21 Produced by the National Institute of Allergy and Infectious Diseases, this scanning electron microscopic image depicts a human white blood cells, interacting with multidrug-resistant *Klebsiella pneumoniae* bacteria
Copyright: David Dorward Ph.D, National Institute of Allergy and Infectious Diseases
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- Page 24: Scientist from NATA working on industry and academic collaborations in the new and emerging field of nucleic acid therapeutics at the Research Complex at Harwell
Credit: Nucleic Acid Therapy Accelerator (NATA)
- Page 26 Wildflower beds at the MRC Laboratory of Molecular Biology
Credit: MRC Laboratory of Molecular Biology
- Page 28 Credit: Dr Stephen Holmes, MRC Laboratory of Molecular Biology



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