Forward Look for UK Bioscience

UK Research and Innovation

About BBSRC

The Biotechnology and Biological Sciences Research Council (BBSRC) is part of UK Research and Innovation (UKRI), a non-departmental public body funded by a grant-in-aid from the UK government.

BBSRC invests in world-class bioscience research and training on behalf of the UK public. Our aim is to further scientific knowledge, to promote economic growth, wealth and job creation and to improve quality of life in the UK and beyond.

Funded by government, BBSRC invested £498 million in world-class bioscience in 2017-18. We support research and training in universities and strategically funded institutes. BBSRC research and the people we fund are helping society to meet major challenges, including food security, green energy and healthier, longer lives. Our investments underpin important UK economic sectors, such as farming, food, industrial biotechnology and pharmaceuticals.

Foreword

Pushing back the frontiers of biology to deliver a healthy, prosperous and sustainable future

The 21st Century is the age of bioscience. New technologies, tools, and approaches, often spanning several disciplines, are revolutionising biology and providing unprecedented opportunities to advance the frontiers of bioscience knowledge. Our understanding of the complex and dynamic processes that govern life will be transformed, and with this will come exciting opportunities to apply new knowledge for the benefit of society and the economy. The power of biology impacts all of our lives, from sustainable and resilient agriculture, safe nutritious food, new pharmaceuticals and better health to new low-carbon 'greener' energy, materials and everyday products.

This Forward Look for UK Bioscience has been developed by UKRI-BBSRC drawing on the advice and expertise of the research community and our diverse range of stakeholders. It identifies the direction of travel for bioscience and the high-level priorities that will ensure the continued health of the discipline, while also setting out where biotechnology and the biological sciences can have the most impact in addressing some of the 21st Century's greatest challenges around ensuring food security, clean growth and healthy ageing. Working within UKRI, the priorities identified will guide BBSRC's actions and investments in the coming years to help deliver UKRI's overarching strategy and ambition. UKRI-BBSRC will draw on the Forward Look to provide the context and framework for our own Strategic Delivery Plan, where we will set out our intended actions in more detail.

As a strategic and forward-looking council, UKRI-BBSRC will invest wisely not only in the best bioscience, technologies and infrastructure but also in the incredible range of talent across the diverse career paths necessary to generate new knowledge and for its application. We recognise that UKRI-BBSRC is not the only funder of bioscience and there are other significant public, private and third-sector players where forging strong collaborative partnerships will be vital to deliver our shared ambitions. Bioscience is truly interdisciplinary, and the creation of UKRI provides new opportunities for working across traditional boundaries. Indeed, breakthrough discoveries in bioscience often occur at the interfaces with other disciplines and provide the foundations for impacts across the remits of other funders. This is the underpinning and pervasive nature of biotechnology and the biological sciences.

The Forward Look covers a period when the research landscape is changing rapidly. Whilst acknowledging the current uncertainty over our future relationship with research in the European Union, there is significant new government funding for R&D and an ambition to raise overall spend to 2.4% GDP by 2027. With this comes a clear commitment to raising national productivity and an associated Industrial Strategy. Those parts of the UK economy that depend on bioscience - the bioeconomy - contribute around £220 billion per year and support 5.2 million jobs. There are significant opportunities for UK bioscience to drive growth in the bioeconomy, acting as a focus for private sector investments and by inspiring new companies around potentially disruptive bio-based solutions in exciting areas of agri-tech, industrial biotechnology and synthetic biology to name but a few. The opportunity for BBSRC as part of UKRI is to ensure that the strength of our biotechnology and biological research and skills base continues to pick out the UK as a partner of choice globally and that the transformative power of biology is realised to help drive a more healthy, prosperous and sustainable future.

Overview

This Forward Look for UK Bioscience is structured around three, interrelated high-level themes:

Theme: 1

Advancing the frontiers of bioscience discovery

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- Understanding the rules of life
- Transformative technologies

Theme: 2

Tackling strategic challenges

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- Bioscience for sustainable agriculture and food
- Bioscience for renewable resources and clean growth
- Bioscience for an integrated understanding of health

Theme: 3

Building strong foundations

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- People and talent
- Infrastructure
- Collaboration, partnerships and knowledge exchange

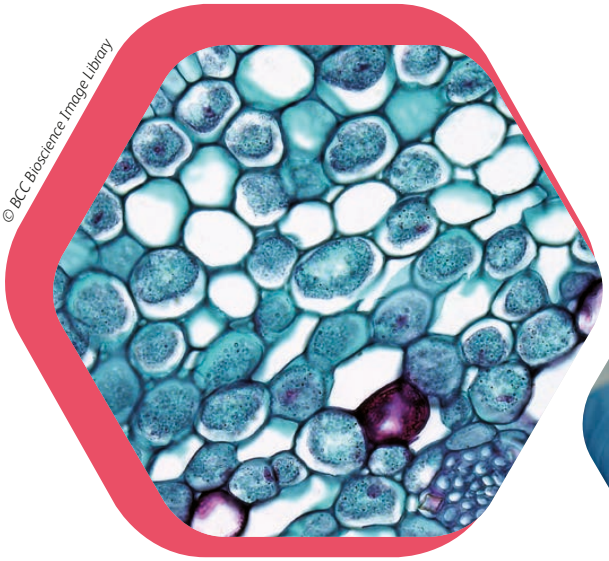
Theme 1: **Advancing the frontiers of bioscience discovery**

New tools, technologies and ways of working are driving a revolution in bioscience that is advancing the frontiers of discovery about living systems and how they function. At the same time, tackling both curiosity-driven and strategically motivated questions in bioscience often leads in turn to new breakthrough technologies that find wide-spread applications.

For the UK to remain at the forefront of this revolution in bioscience research and innovation, we must nurture both elements of this synergistic relationship:

- **Understanding the rules of life** - promoting creative, curiosity-driven frontier bioscience to address fundamental questions in biology
- **Transformative technologies** - developing the tools, technologies and approaches that enable researchers to push the boundaries of scientific discovery and stimulate innovation

As well as being important areas of focus in their own right, these two areas are also highly relevant to the strategic challenge areas identified under Theme 2, where advances in our understanding of fundamental biology, together with transformative technologies and approaches to research, are key to addressing some of society's greatest challenges.



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Understanding the rules of life

Promoting creative, curiosity-driven frontier bioscience to address fundamental questions in biology

Why is this important and what are the challenges and opportunities?

Understanding living systems and how they function is at the very heart of bioscience research and innovation. From the structure of DNA, to the processes by which cells divide and replicate, the UK has a rich history of contributing ground-breaking discoveries in bioscience that have begun to reveal the basic operating 'rules of life'.

However, for all that is already known about biological systems, there is much still to learn and tremendous excitement about the opportunities that future discoveries in bioscience will unlock. For example, understanding how cells communicate with one another, or being able to predict how the interplay between an organism's genetic make-up and its environment will affect its physical characteristics.

A long-standing commitment to excellence in discovery research - supporting the best ideas wherever they are found - has positioned the UK as a leading nation in bioscience. To maintain this global leadership and ensure the future health of the discipline, it is essential that the UK continues to promote creative, 'frontier bioscience' research that advances the boundaries of knowledge and delivers high-impact discoveries with a wide range of potential applications.

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Fundamental bioscience discoveries can be transformative for both science and society in the long term. However, for researchers working at the frontiers of biology, the line of sight to a practical outcome might seem indirect or far off from the outset. The UK's funding environment for bioscience must recognise this, and enable the build-up and synthesis of knowledge over longer time-periods that culminates in high-impact breakthroughs, as well as providing opportunities for researchers to pursue new avenues and 'high-risk, high reward' ideas.

Key objectives

- Actively promote creative, **curiosity-driven discovery research** that advances our understanding of the rules of life
- Create an environment in which frontier bioscience thrives, through an **emphasis on scientific excellence and transformative potential** in funding decisions
- Maintain UK **strengths in core disciplines** that underpin fundamental research into microbes, plants and animals, spanning scales from molecules to populations
- Enable industry and other users, as well as researchers in other disciplines, to **access, use and benefit from the knowledge and discoveries** arising from frontier bioscience research
- Ensure that the importance of fundamental discovery research is widely recognised, valued, and championed as a key principle **for UK bioscience**

Transformative technologies

Developing the tools, technologies and approaches that enable researchers to push the boundaries of bioscience discovery and stimulate innovation

Why is this important and what are the challenges and opportunities?

Advances in research often involve the development or application of new tools and technologies and, increasingly, data-intensive and predictive approaches to biological discovery. To understand biological processes and organisms better, researchers need to measure many different parameters across multiple scales (e.g. molecules, cells, organs), ideally under physiologically relevant conditions. Greater integration of bioscience with innovation in the engineering and physical sciences is a huge opportunity to improve on existing technologies and create new ones.

The increasing complexity and scale of biological data arising from technologies such as next-generation sequencing and high-resolution imaging present both a challenge and an opportunity. The use of artificial intelligence (e.g. machine learning) and other innovative data science approaches is key to unlocking new understanding, value and scientific leads from the enormous quantities and diversity of data available.

The broader availability of, or access to, advanced tools and technologies supports the embedding of advanced methodologies across the research community and the wider democratisation of science through, for example, citizen science and crowd-sourcing approaches.

The emergence and exploitation of disruptive technologies can open up transformative new opportunities for research and business innovation. For example, major developments in genome-editing tools (e.g. CRISPR/Cas9) mean that it is now possible to make precise, targeted changes to the genomes of cells and organisms. Alongside the tools of synthetic biology, this enhances our ability to design and engineer biological systems, fuelling major advances in both fundamental bioscience research and its applications in areas such as agriculture, materials, chemicals, and bio-medicine.

Key objectives

- Drive convergence and integration across disciplines, **particularly between the physical and life sciences**, to support the development and application of new technologies to drive bioscience discovery
- Support **mathematical and computational approaches** to generate new knowledge from the huge volume and diversity of biological data available, including integration of **knowledge and data across multiple scales and the development of predictive and dynamic models**
- Build capacity in academia and industry to **identify and utilise disruptive bioscience technologies**, wherever they originate
- Increase the sensitivity, speed, resolution, and non-invasive methods of **analytical measuring technologies**, opening new avenues for research on living systems
- Enable the development of new models and approaches to **reduce the use of animals in research** and provide more effective and representative tools for studying animal and human biology
- Ensure that bioscience research benefits from the early application of new technologies

Courtesy of University of Nottingham

New frontiers in protein dynamic imaging reveal secrets of photosynthesis

Using ultrafast imaging of energy movement in photosynthesis, scientists have been able to answer fundamental questions about the main 'bottlenecks' in the photosynthetic process. In order to address these questions, researchers at Imperial College London developed a unique ultrafast imaging system, built and developed over more than seven years, together with necessary new theory, to realise real-time dynamic images of energy transfer in photosynthesis. Their findings have replaced what used to be a textbook description of photosynthesis, and could inform applications in areas from materials science to green energy research.

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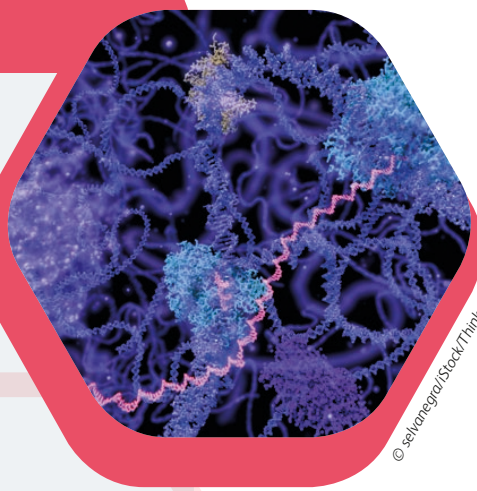
From visual ecology to human health

Fundamental research at the University of Bristol on how different species of animals see the polarization of light has led to the development of a device that can be used to test people for one of the risk factors for age-related macular degeneration (AMD) – the leading cause of incurable blindness in developed countries. The technology is now being commercialised through a company, Azul Optics.

Fundamentals of gene control

Researchers at the University of Edinburgh are studying the control of gene expression in multicellular organisms – with a particular focus on furthering our knowledge of how post-transcriptional control of gene expression is regulated by multifunctional mRNA-binding proteins. Current understanding of what endows these proteins with multiple functions and how each function is coordinated is limited. The research team are seeking to shed light on this by understanding how post-translational modifications impact mRNA-binding protein function. This understanding will provide important fundamental insight into an important facet of gene regulation.



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Theme 2: **Tackling strategic challenges**

Bioscience offers significant opportunities to provide solutions to major challenges facing society in the 21st Century, while simultaneously driving innovation and growth in the bioeconomy by transforming traditional industries and creating new ones.

BBSRC has previously identified three challenge-led strategic priorities or 'grand challenges' where the UK's strengths in biotechnology and biological sciences can have particular impacts, nationally and internationally. Consultation and engagement with our stakeholders and user communities have confirmed that these remain highly relevant areas for focus:

- **Bioscience for sustainable agriculture and food** - delivering more productive, healthy, resilient and sustainable agriculture and food systems
- **Bioscience for renewable resources and clean growth** - transforming industries through bio-based processes and products in a new low-carbon bioeconomy
- **Bioscience for an integrated understanding of health** - improving animal and human health and wellbeing across the lifecourse

All three are complex and long-term socio-economic challenges requiring sustained and concerted effort across the research and innovation ecosystem. Tackling these challenges will rely on our fundamental understanding of biological processes and mechanisms and involve research that leverages knowledge, tools and expertise across multiple disciplines enabled by national and international funding partnerships. In this Forward Look we focus on what UK bioscience in particular can contribute to the challenges, whilst recognising these crucial interfaces. We also recognise the opportunity to enhance and exploit synergies between these three areas.

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Bioscience for sustainable agriculture and food

Delivering more productive, healthy, resilient and sustainable agriculture and food systems

Why is this important and what are the challenges and opportunities?

Predictions of population growth suggest that by 2050 the world's population will have expanded to over 9 billion and 60% more food will be required. Reducing the amount of food waste is part of the solution, but a huge, sustainable boost in agricultural productivity will also be needed to meet this demand. It is not simply about using more land for food production, but maximising efficiency of land use and resources. We must increase the resilience of food supply chains in the face of challenges such as climate change, growing threats from pests, pathogens, extreme weather and soil degradation, whilst also protecting the environment.

Advances in 'omics technologies, crop and livestock breeding, coupled with the convergence of sensor technologies, robotics and autonomous systems, big data, machine learning and artificial intelligence, offer an unprecedented opportunity to revolutionise food supply chains. Bioscience will contribute essential knowledge and evidence for farmers, food producers, processors, retailers, consumers and governments, to enable them to farm sustainably, producing healthy, nutritious and affordable food, while reducing impacts on the environment, protecting biodiversity and enhancing our natural capital.

For the UK's strengths in bioscience to have an impact on global food security and drive innovation and clean growth in the agri-food sector, effective user engagement and knowledge exchange will be essential, as will integration with other disciplines such as environmental and social sciences and engineering.

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Key objectives

- Improve the **sustainability and resilience of agriculture** using interdisciplinary, multi-scale and systems modelling approaches to agri-ecosystems
- Develop novel strategies to predict, detect and manage threats to **plant and animal health**, address the challenges of resistance, and improve the welfare of farmed animals
- Improve **food safety and nutrition** through integration of novel crop and nutritional research, and exploiting fundamental knowledge in microbiology to minimise pathogens and toxins in the food system
- **Reduce waste in the food system** by understanding and controlling fundamental biological processes involved in crop physiology, maturation and post-harvest spoilage
- **Understand and exploit genomics and genetic diversity** to develop the next generation of improved crops and farmed animals
- Support the emergence of **precision agriculture and smart technologies**, combining bioscience with novel engineering and technology solutions, including digital and predictive tools, to improve decision making in agriculture

Bioscience for renewable resources and clean growth

Transforming industries through bio-based processes and products in a new low-carbon bioeconomy

Why is this important and what are the challenges and opportunities?

Harnessing the power of biology through industrial biotechnology has the potential to transform a wide range of industries and supply chains, reducing reliance on chemical processes and fossil fuels, helping to meet international climate change targets and driving productivity and growth in the bioeconomy. The move to bio-based processes offers opportunities to generate materials, biopharmaceuticals, chemicals and energy with improved performance, lower operational costs and reduced carbon emissions, leading to more sustainable, cleaner manufacturing and greater use of residues or wastes in a more circular bioeconomy.

The industrial biotechnology sector is growing at a rate of 8-10% pa, which is predicted to continue beyond 2025. Recent investments have increased the UK's capacity for industrial biotechnology research and innovation in academic and business communities, encompassing engineering, physical, chemical and biological sciences. However, for UK industry to realise its full potential will require sustained support and specialist infrastructures to enable the translation of world-leading UK bioscience into innovative, bio-based products and processes at industrial scales.

Key objectives

- Generate new understanding of the **molecular and cellular basis of key bio-based processes** such as enzyme pathways and their regulation in a range of organisms
- **Develop and apply whole-cell and enzymatic systems and harness synthetic biology approaches**, to aid the production of high-value chemicals, biopharmaceuticals, antimicrobial compounds, industrial chemicals, fuels and platform chemicals in different manufacturing environments
- Develop and **improve the performance of bio-based processes** at larger scales appropriate for industrial processes
- Exploit the development and application of **biotechnologies that create valuable chemicals and materials from waste** (agricultural, food, municipal and industrial waste and contaminants), for economic and environmental benefit
- Encourage **whole-systems approaches** that consider the range, efficiency and cost-effectiveness of bio-based technologies, and facilitate the emergence **of new business models for bio-based manufacturing**

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Bioscience for an integrated understanding of health

Improving animal and human health and wellbeing across the lifecourse

Why is this important and what are the challenges and opportunities?

The UK has an ageing population, but, as our average lifespan increases, our healthspan is not extending as fast. Changing lifestyles are having significant impacts on health across the lifecourse, and declining health and wellbeing in later life are placing increasing pressure on health and social services. In addition, globalisation presents specific and urgent health challenges in zoonotic infections and antimicrobial resistance. There is a pressing need for integrated approaches across a range of disciplines, organisms and scales that generate new insights to improve animal and human health and wellbeing, inform strategies for the prevention of disease, and underpin innovation in health-related industrial sectors.

Bioscience has a crucial foundational role in health-related research and innovation, providing a deep, integrated understanding of the 'healthy system' across the lifecourse, and of the factors that maintain health and wellness under stress and biological or environmental challenge. However, its impact on health challenges depends on effective integration and translation across different areas of bioscience research, with other disciplines such as the medical, social, environmental and physical sciences, and between academia, industry and policy-makers.

Key objectives

- Promote **'one health'** approaches that combine biological, veterinary and medical research to improve the health and well being of animals and people
- Advance understanding of the mechanisms underlying **normal physiology and homeostatic control** during early development and **across the lifespan**
- Develop new knowledge about the relationships between **diet and health** through integration of nutrition, agriculture and food-processing research, and by understanding **gut function and the role of the gut microbiome**
- Encourage and support **systems-modelling approaches** that combine knowledge within and across disciplines to generate new understanding of the biological mechanisms underpinning mental and physical health
- Enable the development of tools and interventions to tackle **zoonotic and vector-borne diseases** of animals and humans, and **resistance to antimicrobial compounds**
- Support the **application of biological knowledge, models and tools in expanding market sectors** such as personalised health, regenerative medicine, biomarkers for health and new therapeutic, food and health-promoting products.

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Theme 3: **Building strong foundations**

For UK bioscience to remain world-leading, advancing the frontiers of knowledge and delivering economic and social benefits in the UK and beyond, it needs to be built on solid foundations.

Here we recognise three key cross-cutting capabilities that require long-term support and a joined-up approach across the bioscience research and innovation landscape, involving funders, research organisations, government and industry:

- **People and talent** - attracting and developing a flexible and diverse workforce for modern bioscience
- **Infrastructure** - ensuring that the UK bioscience community has access to the facilities, resources and services necessary to carry out ground-breaking research, and to support its translation into economic and societal impact
- **Collaboration, partnerships and knowledge exchange** - enabling collaborations across disciplines and sectors, with the users of research, nationally and internationally

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People and talent

Attracting and developing a flexible and diverse workforce for modern bioscience

Why is this important and what are the challenges and opportunities?

A highly skilled and productive workforce is fundamental to the UK's global leadership in biotechnology and biological sciences, and a driving force for growth and inward investment in the bioeconomy. However, bioscience is a rapidly evolving discipline. Game-changing advances in technology and data-driven approaches continue to revolutionise bioscience research, requiring researchers to continually develop new skills and ways of working. Additionally, as advances in bioscience increasingly drive innovation in key industrial sectors, demand for bioscience skills and expertise can be expected to increase.

Modern bioscience, more than ever, involves the drawing together and coordination of large, interdisciplinary research teams and interactions with a variety of project partners and stakeholders. The brokerage skills necessary to identify and bring together the best teams will be essential. A more holistic, inclusive approach to developing and maintaining skills is, therefore, required that reaches across the research and innovation system to support not just 'traditional' academic research careers but also, for example, postdocs, technicians, data scientists, and knowledge-exchange professionals. Attracting people into UK bioscience through non-traditional routes, and encouraging researcher mobility across disciplines, institutions, sectors and countries, are also key to securing the diversity of talent needed.

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Key objectives

- Take a more system-wide approach to talent, that recognises and values the **entire workforce** needed to deliver high-quality bioscience research and innovation
- Continue to train for **depth of expertise** as well as equipping researchers with a **breadth of professional, enterprise and transferable skills**
- Develop talent at all career stages, fostering a culture of **lifelong learning and development**
- Continue to champion a culture of **inclusion** within the biosciences, supporting **diversity** in all its forms
- Enable **flexible career structures** and **researcher mobility**, facilitating the flow of talent between different parts of the research and innovation system
- Actively monitor, horizon-scan and make strategic interventions to address **emerging skills needs** and / or vulnerabilities
- Attract and grow all **multidisciplinary expertise** required to advance UK bioscience, in particular to boost capacity and capability for **quantitative, integrative and data-intensive bioscience**

Infrastructure

Ensuring that the UK bioscience community has access to the facilities, resources and services necessary to carry out ground-breaking research, and to support its translation into economic and societal impact

Why is this important and what are the challenges and opportunities?

Cutting-edge bioscience depends on modern and sustainable research infrastructures, from essential bioinformatics and biological resources, such as databases and biological collections, to state-of-the-art instrumentation and facilities, such as high-throughput 'omics platforms, and advanced bioimaging technologies. Infrastructures that support innovation and research translation by linking researchers and users, are also crucial to the competitiveness of UK bioscience.

Looking ahead, bioscience is evolving more and more into big and connected science, which requires networks of small-scale shared facilities to come together to form integrated and distributed infrastructures. In addition, changes in the way bioscience research is undertaken, for example increased automation and use of machine learning, will prompt further changes in infrastructure needs. The creation and maintenance of well-found laboratories that keep pace with rapid developments in research technologies are integral to the UK's continued leadership in bioscience.

The development and implementation of the UK research and innovation infrastructure roadmap, led by UKRI, is an opportunity for funders, research organisations, private-sector providers and government to work together to develop a more coordinated, integrated approach to the sustainable provision and use of research and innovation infrastructures on which the UK's bioscience research base depends. This will need to encompass different types of infrastructures, at local, regional, national and international scales, and recognising the requirement for specialist technical staff to support their operation. Within this, the development and maintenance of reliable, interoperable and sustained data infrastructures is a high priority, as bioscience becomes an increasingly data-intensive discipline.

Key objectives

- Contribute to the development of the UKRI infrastructure roadmap to ensure that the UK bioscience research base has **access to essential research and innovation infrastructures**
- Work with UKRI partners to establish **data infrastructures** that meet the needs of UK bioscience as well as facilitating the sharing of data between disciplines
- Develop **approaches to support the sustainable operation** of equipment, facilities and resources, including associated specialist technical support
- Support the concept of the 'well-found laboratory' in UK bioscience, through the provision of **mid-range equipment**, particularly at local and regional levels
- Lead for the UK in the coordination, development and delivery of relevant research infrastructures in collaboration with partners in Europe and beyond
- Increase the **connectivity** of research and innovation infrastructures, across disciplines, nationally and internationally, and between academia and industry

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Examples of essential infrastructures for UK bioscience research and innovation

- e-infrastructures for data-driven biology, including integrated and interoperable data resources, and computational hardware and software for large-scale data analyses
- High-throughput platforms for genomic, transcriptomic, proteomic and metabolomic analyses, together with associated bioinformatics capability
- Infrastructures for biological imaging, from single-molecule studies to whole-organism and field-scale phenotyping
- Automated pipelines which combine processes and integrate data from different modalities
- Range of tools and facilities for biomolecular characterisation / study of biomolecules and the interactions between them
- Scale-up, demonstration and pilot facilities that support the progression of research through various stages of translation, and the testing of products and technologies
- Centres of excellence that support the emergence of new research areas or technologies and / or provide a critical mass of research expertise and specialist facilities
- Specialised / large-scale facilities, such as high-containment facilities for research on infectious diseases of plants, animals and humans, controlled-environment facilities and plot-, field- and farm-scale research facilities including multi-scale phenotyping
- Innovation infrastructures that support knowledge exchange and collaboration between researchers and users
- Biological resources such as genetic resources, longitudinal and cohort studies, biorepositories and culture collections

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Collaboration, partnerships and knowledge exchange

Enabling collaborations across disciplines and sectors, with the users of research, and nationally and internationally

Why is this important and what are the challenges and opportunities?

Science is increasingly a connected global endeavour where collaboration and partnerships are essential across disciplines, organisations and national boundaries.

Integration across disciplines

While ensuring the continued health of the discipline, this Forward Look for UK bioscience must promote and enable multi-, inter- and trans-disciplinary ways of working. Tackling complex economic and societal grand challenges requires the convergence and integration of research across multiple disciplines. Moreover, exciting breakthroughs in research often occur at the interfaces between disciplines, where the integration of diverse knowledge, tools and expertise can help stimulate innovation from discovery through to translation. The creation of UKRI is an exciting opportunity to further strengthen collaboration and coordination across the research and innovation landscape.

Working with the users of research

Bioscience underpins a wide range of established and emerging industry sectors that collectively contribute to the bioeconomy, and national and international policy areas. Partnerships with the users and recipients of research (e.g. industry, policy-makers, charities, civil society) are important in shaping research agendas through better understanding of users' needs, concerns and aspirations. Similarly, the realisation of economic and societal benefit from the ideas, knowledge, skills and technologies that arise from bioscience research relies on a deep, discipline-specific understanding of the diverse routes to application, effective knowledge exchange, and partnerships that bring together companies and other research users with academics in ways that are appropriate to the sector.

Openness and integrity

The UK has a supportive fiscal, regulatory and policy environment for bioscience research and innovation. This relies on stakeholder and public trust in the practice and regulation of bioscience, and confidence that bioscience universities, businesses, institutes and researchers act with integrity and openness. Furthermore, research that is informed by a wide range of perspectives is better able to articulate and respond to the challenges it seeks to address. It is, therefore, essential that bioscience is open to scrutiny and to inviting in diverse views and experiences, and that researchers give consideration to the broader societal consequences of their work. UK bioscience also contributes to, and benefits from, the open science agenda. Making research outputs, including data, more readily available reinforces open scientific enquiry and stimulates new investigations and analyses as well as contributing to enhanced reproducibility in bioscience research.

International collaboration

International partnerships help to sustain the vibrancy of UK bioscience, promoting the free flow of ideas and researchers, delivering 'best with best' scientific collaboration that advances the frontiers of knowledge by capitalising on complementary research and technology capabilities, and contributing to the development and delivery of international research priorities. As a global partner of choice, the UK leverages its strengths in bioscience to influence global science governance and standards, where other countries often look to the UK for leadership, and to support wider UK international policy and relationships.

Key objectives

- Ensure the UK remains a **partner of choice** for bioscience research and innovation, responding to changes in our **global partnerships** such as the increasing emphasis on official development assistance and the UK's changing relationship with the EU
- **Identify and build mutually beneficial partnerships** for UK bioscience, and opportunities for UK bioscience to help **address international research priorities**
- Foster approaches that **facilitate collaboration and the exchange of people and ideas**, whether between disciplines, institutions or countries
- Develop and sustain a range of models to support **industry / academic partnership, knowledge exchange and translation** that meet the needs of the diverse sectors underpinned by bioscience
- Maintain high standards of **research integrity** in UK bioscience, and promote and champion the UK's leadership in standards of research and technology governance
- Continue to promote **open access** to research outputs and data sharing
- Open up discussions about the direction of bioscience research and innovation to **diverse perspectives**, particularly for new and potentially disruptive areas

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