



HM Government

UK Biological Security Strategy

UK Biological Security Strategy

Presented to Parliament by the Deputy Prime
Minister and Chancellor of the Duchy of
Lancaster by Command of His Majesty

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FOREWORD

Deputy Prime Minister and the Chancellor of the Duchy of Lancaster

In the dark days of 2020 and 2021, we witnessed the devastating impact of a novel infectious disease outbreak spreading across the world. To date, the COVID-19 pandemic has killed over 200,000 people in the UK, close to seven million globally. It ravaged health systems, destroyed economies and damaged livelihoods.

It has been the biggest crisis the UK has faced in generations, and the greatest peacetime challenge in a century. And it has taught us a number of things since the last Biological Security Strategy was published in 2018.

First, our world is increasingly vulnerable to biological threats with catastrophic impacts - whether it is another pandemic, a terrorist attack or antimicrobial resistance. Those threats have only multiplied in recent years, and they overlap and intersect with each other in increasingly complex ways. Second, the pandemic demonstrated the sheer ingenuity and innovation of the UK's Life Sciences sector, including the phenomenal success of the COVID-19 vaccine development and rollout programme. The partnerships forged between the public, private and philanthropic sectors, allied in their determination

to defeat the virus, were an unqualified success, saving countless lives.

We can defeat the threats of the future - but only if we refuse to stand still, and instead continue to innovate and strengthen our health resilience to protect the future wellbeing and economic security of the UK. This new Biological Security Strategy contains a number of new commitments to achieve those aims, including:

- Launching a real-time Biothreats Radar to monitor threats and risks as and when they appear
- Establishing a dedicated minister for the Biological Security Strategy, who will report regularly to Parliament
- Carrying out regular domestic and international exercises
- Creating a UK Biosecurity Leadership Council, to work with businesses and organisations on the ground

Our vision is that by 2030 the UK is resilient to a spectrum of biological threats and a world leader in innovation. We will continue to work with like-minded partners and allies globally to move away from the 'one bug, one drug' approach of the 20th century, and to ensure the biotechnology innovations of the future are used to help improve our lives and the health of the planet, rather than as a tool for spreading fear.

This strategy plays to our strengths as a country. We are home to some of the best universities in the world. We have the highest number of unicorns in Europe, and we are the continent's leading biotech hub in breakthrough life-sciences start-ups. The UK is well positioned not just to respond to the biological threats of the future, but to seize the opportunities associated with tackling them - stimulating growth, creating high tech jobs and attracting investment across the country. As the last five years has shown, this work could not be more important.

A handwritten signature in black ink, appearing to read 'Oliver Dowden', with a long horizontal flourish extending to the right.

The Rt Hon Oliver Dowden CBE MP
Deputy Prime Minister

Executive Summary

This Strategy sets out our renewed vision, mission, outcomes and plans to protect the UK and our interests from significant biological risks, no matter how these occur and no matter who or what they affect. It provides the overarching strategic framework for mitigating biological risks within which a number of threat and disease specific UK strategies critically contribute.

Our vision is that, by 2030, the UK is resilient to a spectrum of biological threats, and a world leader in responsible innovation, making a positive impact on global health, economic and security outcomes.

Our mission: To implement a UK-wide approach to biosecurity which strengthens deterrence and resilience, projects global leadership, and exploits opportunities for UK prosperity and science and technology (S&T) advantage.

Part One – The Context

Part One describes the strategic drivers and context for the strategy, the nature of the risks we face out to 2030, and the opportunities for UK growth and strategic advantage.

Part Two – Our Response

Part Two sets out our strategic framework, including how we will organise to deliver the priority outcomes.

The Strategy describes the four pillars of our response to biological risks:

- **Understand** the biological risks we face today and could face in the future.
- **Prevent** biological risks from emerging (where possible) or from threatening the UK and UK interests.
- **Detect**, characterise and report biological risks when they do emerge as early and reliably as possible.
- **Respond** to biological risks that have reached the UK or UK interests to lessen their impact and to enable a rapid return to business as usual.

In addition, three crosscutting enablers run through all four pillars and are drawn out separately:

- **UK Leadership, Governance and Coordination:** formalise central leadership, governance and accountabilities to strengthen collective decision making and preparedness across the UK.
- **UK Science Base, Health and Life Sciences Sectors:** strengthening and protecting our specialist biological security capabilities, and stimulating innovation and growth in the Health and Life Sciences sectors across the UK.
- **International Leadership:** UK engagement to strengthen global health security, pandemic prevention, preparedness and response, international biosafety and biosecurity practices and non proliferation instruments and mechanisms.

This Strategy is accompanied by an implementation plan. A high level summary is provided overleaf.

High Level Strategy Implementation Plan

A summary of short, medium and longer term commitments.

	Short Term	Medium Term	Long Term
Understand	<ul style="list-style-type: none"> • Scope the development of a Biothreats Radar, assured by experts. • Increase data and intelligence capture on biological threats to the UK. • Facilitate simpler exchange of data across UK government. • Develop a coordinated biological security communications campaign. 	<ul style="list-style-type: none"> • Deliver a UK biothreats R&D package to strengthen the use of advanced analytics, modelling and simulation in decision making. • Deliver a coordinated package of exercises on priority biological security scenarios to improve UK preparedness. • Test a UK-wide biological security communications campaign. • Develop a plant health data system to support outbreak response. 	<ul style="list-style-type: none"> • Implement continuous improvement of the Biothreats Radar, and foresight analytical products. • Project UK standards and protocols, and sustain support for global initiatives promoting safe data use. • Incorporate behavioural science research into biological security communications campaigns to better inform, test and assess their effectiveness.
Prevent	<ul style="list-style-type: none"> • Establish a new UK Biological Security Leadership Council: a forum to engage strategically with the Life Sciences and Biotechnology sectors, and develop proportionate and pro-innovation approaches to risk management. • Work with our allies and partners to build the case for, and consensus on, proposals to strengthen the Biological and Toxin Weapons Convention (BTWC). • Use findings from the Call for Evidence on antimicrobial resistance (AMR) to inform the next National Action Plan. 	<ul style="list-style-type: none"> • Undertake a programme of work to minimise the risks from biodata without stifling innovation. • Introduce new Sanitary and Phytosanitary (SPS) measures at the Border. • Publish the new National Action Plan for AMR (2024 - 2029). 	<ul style="list-style-type: none"> • Continue to promote and develop responsible innovation practices across the UK and internationally. • Promote UK innovation in biosecurity technologies internationally, attract inward investment, and support UK exports. • Regularly assess and update export controls for dual-use biotechnologies, in collaboration with industry.
Detect	<ul style="list-style-type: none"> • Scope a networked biosurveillance capability across the UK, linked to the International Pathogen Surveillance Network (IPSN), and a strategic approach to diagnostics. • Continue to mature detection technologies for in-field use, and pilot new environmental threat monitoring systems. • Conduct an audit of, and develop plans to strengthen, the UK's leading microbial forensics capabilities. 	<ul style="list-style-type: none"> • Further develop a system-wide approach to UK surveillance capabilities, including developing new nodes or networks towards a pathogen agnostic approach. • Continue to provide assistance with the development of effective pathogen security, biosafety, diagnostics and disease surveillance in partner countries. • Further develop the UK's microbial forensics capability. 	<ul style="list-style-type: none"> • Continue to develop biodetection and monitoring capabilities, collaborating with allies and partners. • Implement a new strategic approach to diagnostics, including prototype diagnostics against priority pathogens. • Sustain development of UK microbial forensics capabilities.
Respond	<ul style="list-style-type: none"> • Lead efforts to implement the 100 Days Mission, including support to the International Pandemic Preparedness Secretariat. • Publish generic invasive non-native species contingency plans that cover terrestrial, freshwater and marine environments. • Develop a roadmap towards comprehensive response plans against a spectrum of biological threats. 	<ul style="list-style-type: none"> • Develop a new strategic approach to pandemic preparedness across government. • Participate in negotiations towards a legally binding instrument on pandemic prevention, preparedness and response with international partners. • Develop an updated capability to effectively remediate a scene contaminated with biological threat material. 	<ul style="list-style-type: none"> • Develop and evaluate prototype vaccines, therapeutics and diagnostics for priority pathogens of pandemic potential. • Continue to strengthen the UK's vaccine capability, capacity and resilience, including the supply chain. • Implement, with international partners, a legally binding instrument for pandemic preparedness.
Crosscutting	<ul style="list-style-type: none"> • Implement formalised leadership and governance structures for oversight of biological security. Establish a dedicated coordination unit in the Cabinet Office. • Periodically review capability health and take action to address identified gaps. • Stimulate innovation and growth via a pipeline of biological security S&T Missions. 	<ul style="list-style-type: none"> • Develop a roadmap for UK specialist biological security S&T infrastructure, capability and skills. • Scope a new, agile procurement mechanism for commissioning S&T from UK academia and industry, using simplified processes to stimulate innovation. 	<ul style="list-style-type: none"> • Continue to play a leading role in international fora to strengthen pandemic preparedness and response. • Implement the roadmap to develop specialist biological security S&T infrastructure (including high containment laboratories), capability and skills across the UK. • Conduct a stocktake of the Strategy implementation plan to inform future iterations of the Strategy.

PART ONE: THE CONTEXT

Strategic Context

1. The UK's first Biological Security Strategy was published in July 2018 and brought together, for the first time, all the work that takes place across government to protect the UK and our interests from significant biological risks. The 2018 Strategy identified several high consequence risks¹ to human, animal, plant and environmental health including:
 - a major health crisis (such as pandemic influenza or new infectious disease)
 - antimicrobial resistance (AMR)
 - a deliberate biological attack by state or non-state actors (including terrorists)
 - animal and plant diseases, which themselves can pose risks to human health
 - accidental release and dual-use research of concern
2. Published in March 2021, and updated in 2023, the Integrated Review of Security, Defence,

1 There are many different definitions of biological security. In this strategy, we use the term to mean the protection of the UK and UK interests from biological risks whether these arise naturally, or through an accidental release of hazardous biological material, or a deliberate biological attack. These risks could affect humans, animals, plants or the environment more broadly.

Development and Foreign Policy (the Integrated Review)² set out the vision for the UK's role in the world over the next decade. The Integrated Review identified that it is likely that a terrorist group will launch a successful Chemical, Biological, Radiological or Nuclear (CBRN) attack by 2030 and set out the need to review and reinforce the cross-government approach to biological security, including a refresh of the 2018 Strategy in light of the rapidly changing biological risk landscape.

3. The UK has faced a number of significant biological outbreaks since the 2018 Strategy was published, including three public health emergencies of international concern (COVID-19, Ebola and Mpox), as well as the ongoing avian influenza outbreak. The continued increase in AMR is creating a new generation of 'superbugs' that cannot be treated with existing medicines, killing thousands of people every year across the UK and millions globally, as well as having a significant economic impact^{3,4,5}.

2 Cabinet Office (2023), Integrated Review Refresh 2023: Responding to a more contested and volatile world - GOV.UK

3 European Antimicrobial Resistance Collaborators (2022), The burden of bacterial antimicrobial resistance in the WHO European region in 2019: a cross-country systematic analysis, The Lancet Public Health, Volume 7, Issue 11.

4 OECD (2018), Stemming the Superbug Tide: Just A Few Dollars More, OECD Health Policy Studies, OECD Publishing, Paris.

5 Jim O'Neill (2016), Tackling Drug-Resistant Infections Globally: Final Report And Recommendations, The Review On Antimicrobial Resistance.

The Risks

4. Biological threats neither recognise nor respect political or geographic boundaries. Naturally-occurring and self-replicating, they pose a unique threat to global security.
 - The UK Government has spent £321 billion on COVID-19 measures so far.⁶ The estimated lifetime cost of government spending as a result of COVID-19 is £376 billion⁷ and is likely to increase as the cost of living with COVID-19 continues.
 - As of October 2022, AI-first drug discovery companies have 18 assets in clinical trials, up from 0 in 2020.⁸
 - In 2018, DNA sequence information allowed researchers to resurrect the previously extinct horsepox virus.⁹
 - 61% of infectious diseases in humans originate from animals.¹⁰

6 National Audit Office (2022), [COVID-19 cost tracker - National Audit Office \(NAO\) overview](#).

7 National Audit Office (2022), [COVID-19 cost tracker - National Audit Office \(NAO\) overview](#).

8 Benaich, N & Hogarth, I (2022), [State of AI Report 2022](#).

9 Inglesby T (2018), [Horsepox and the need for a new norm, more transparency, and stronger oversight for experiments that pose pandemic risks](#), PLoS Pathogens, Volume 14, Issue 10.

10 World Health Organization (2014), [Zoonotic disease: emerging public health threats in the Region](#).

- The 2001 Foot and Mouth Disease (FMD) outbreak cost the UK public sector £3 billion and the private sector a further £5 billion.¹¹
- Invasive non-native species are one of the biggest threats to global biodiversity and cost the Great Britain economy nearly £1.9 billion per annum in direct costs.¹²
- Almost 1.3 million people worldwide die annually from drug-resistant infections, including 7,600 in the UK.¹³ This is estimated to cost the NHS £95 million per year.¹⁴
- Foodborne diseases are estimated to account for 2.4 million human cases and more than 16,000 hospitalisations per year in the UK.¹⁵

Natural Infectious Disease and Pest Outbreaks

5. COVID-19 reminded us that the UK, as a global trading and tourism hub, is vulnerable to biological threats with catastrophic impacts. As devastating as COVID-19 was, there is a reasonable likelihood that another serious pandemic could occur soon,

11 National Audit Office (2005), Foot and Mouth Disease: Applying the Lessons - National Audit Office (NAO) report.

12 Plant Biosecurity Strategy for Great Britain (2023 to 2028) - GOV.UK.

13 Antimicrobial Resistance Collaborators (2022), Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis, The Lancet, Volume 399, Issue 10325.

14 OECD (2018), Stemming the Superbug Tide: Just A Few Dollars More, OECD Health Policy Studies, OECD Publishing, Paris.

15 Food Standards Agency (2020), Foodborne Disease Estimates for the United Kingdom in 2018.

possibly within the next decade.¹⁶ The risk of a new pathogen emerging and becoming a threat is rising constantly as humanity expands into previously uninhabited regions,¹⁷ as trade, tourism and migration increases and as climate change affects the distribution of disease vectors and biodiversity.¹⁸

6. The likelihood of an incursion of exotic notifiable animal or plant disease in the UK is likely to increase out to 2030.¹⁹ Trade with global partners, carries the risk of incursion of novel animal and plant pathogens and pests which are more prevalent in some areas. With changing trade and consumer patterns generally increasing volumes of global trade into the UK, and climate change affecting weather and biodiversity within the UK and around the world, the risk of an outbreak of a new animal or plant pest or pathogen in the UK over the next five years has increased and is likely to continue to do so over the next decade.
7. The development and spread of AMR is accelerating rapidly due to the rise in the incidence of infections, the extended use of antimicrobials across multiple industries, and the lack of new and innovative antimicrobials. As AMR increases, certain infections

16 The White House (2021), [American Pandemic Preparedness: Transforming Our Capabilities](#).

17 World Health Organization (2003), [Climate change and human health: risks and responses](#).

18 IPBES (2020), [Workshop Report on Biodiversity and Pandemics of the Intergovernmental Platform on Biodiversity and Ecosystem Services](#).

19 Tellefson, J (2020), [Why deforestation and extinctions make pandemics more likely](#).

will no longer be treatable and routine medical care may become too risky leading to significant loss of life. A lack of effective antibiotics would also exacerbate disease outbreaks and put pressure on food security.²⁰

Accidental Release

8. The number of laboratories around the world able to handle the highest hazard pathogens has increased since the onset of COVID-19. This has been driven by an increase in funding for research (such as ‘gain of function research’, which aims to improve understanding of disease causing agents) and global pandemic preparedness activities. The risk of accidental release or misuse is increasing as the number of laboratories and people working with high hazard pathogens rises.

Risk of Deliberate Misuse

9. Advances in life sciences and biotechnology promise better and faster cures, more sustainable energy sources, and improved quality of life, but they also bring new risks that must be managed. The proliferation of information online, and the growing numbers of skilled researchers able to perform high risk experiments, has blurred the boundaries

²⁰ Antimicrobial Resistance Collaborators (2022), *Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis*, The Lancet, Volume 399, Issue 10325.

between research for good and research that could be used to cause harm.

10. This Strategy sets out the UK's commitment to increase our preparedness and strengthen our defences against the biological risks we face out to 2030.

The Opportunities

11. We have entered the Age of Biology. The 2022 Global Innovation Index²¹ describes a 'Deep Science innovation wave' evolving around breakthrough inventions and innovations in the fields of life sciences and health, agri-food, energy and clean tech, and transport.
12. The UK is well positioned to seize the opportunities of this new innovation wave, stimulating our vibrant life sciences and artificial intelligence sectors²² to develop market leading biosecurity solutions (detection systems, novel diagnostics, vaccines, therapeutics), that also support the Life Sciences Vision 2021²³ to drive growth across the UK.

21 World Intellectual Property Organization (2022), [Global Innovation Index 2022 - What is the future of innovation driven growth?](#)

22 Benaich, N & Hogarth, I (2022), [State of AI Report 2022](#).

23 Office for Life Sciences, Department for Health and Social Care, and Department for Business, Energy & Industrial Strategy (2021): [Bioscience and health technology sector statistics 2021 - GOV.UK](#).

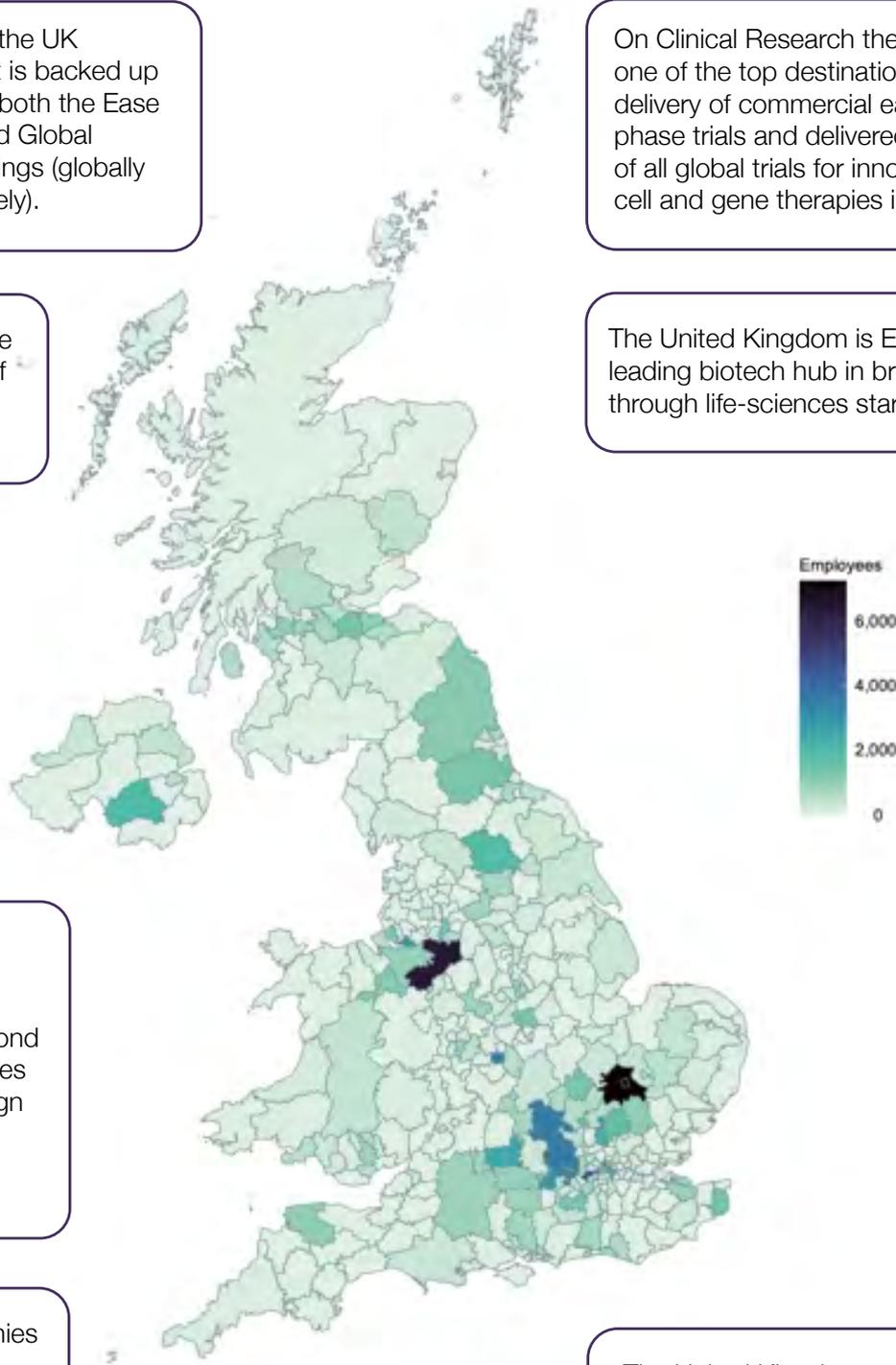
Distribution of life sciences employment across the UK, 2021

The attractiveness of the UK business environment is backed up by strong rankings in both the Ease of Doing Business and Global Innovation Index rankings (globally 8th and 4th respectively).

On Clinical Research the UK is one of the top destinations for delivery of commercial early phase trials and delivered 12% of all global trials for innovative cell and gene therapies in 2019.

The UK has created the third highest number of AI Unicorns (24 with a value of \$207B).

The United Kingdom is Europe's leading biotech hub in breakthrough life-sciences start-ups.

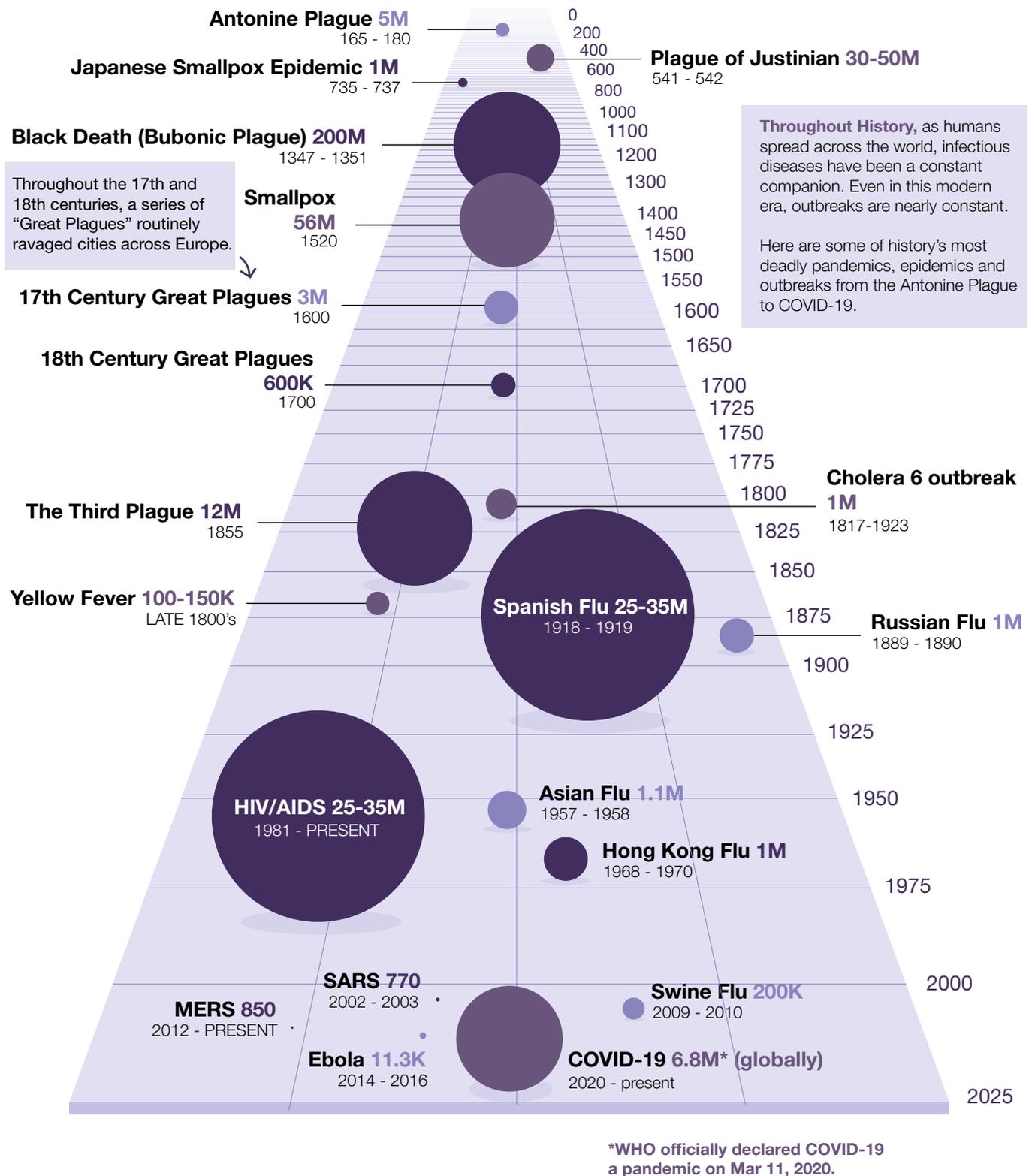


The UK is seen as an attractive market for investment in the Life Sciences, ranking second only to the United States in the number of Foreign Direct Investment projects financed in 2019.

4.3% of UK AI companies are university spinouts, compared to 0.03% for all UK companies.

The United Kingdom ranks 4th among the 132 economies featured in the GII 2021.

History of Pandemics, Epidemics and Outbreaks



This graphic was adapted from 'Visualizing the History of Pandemics' by Visual Capitalist, and represents the number of deaths for each pandemic. Available <https://www.visualcapitalist.com/history-of-pandemics-deadliest/>

Image courtesy of Original source: Visual Capitalist

PART TWO: OUR RESPONSE

Strategic Framework

Our vision is that by 2030, the UK is resilient to a spectrum of biological threats and a world leader in responsible innovation, making a positive impact on global health, economic and security outcomes.

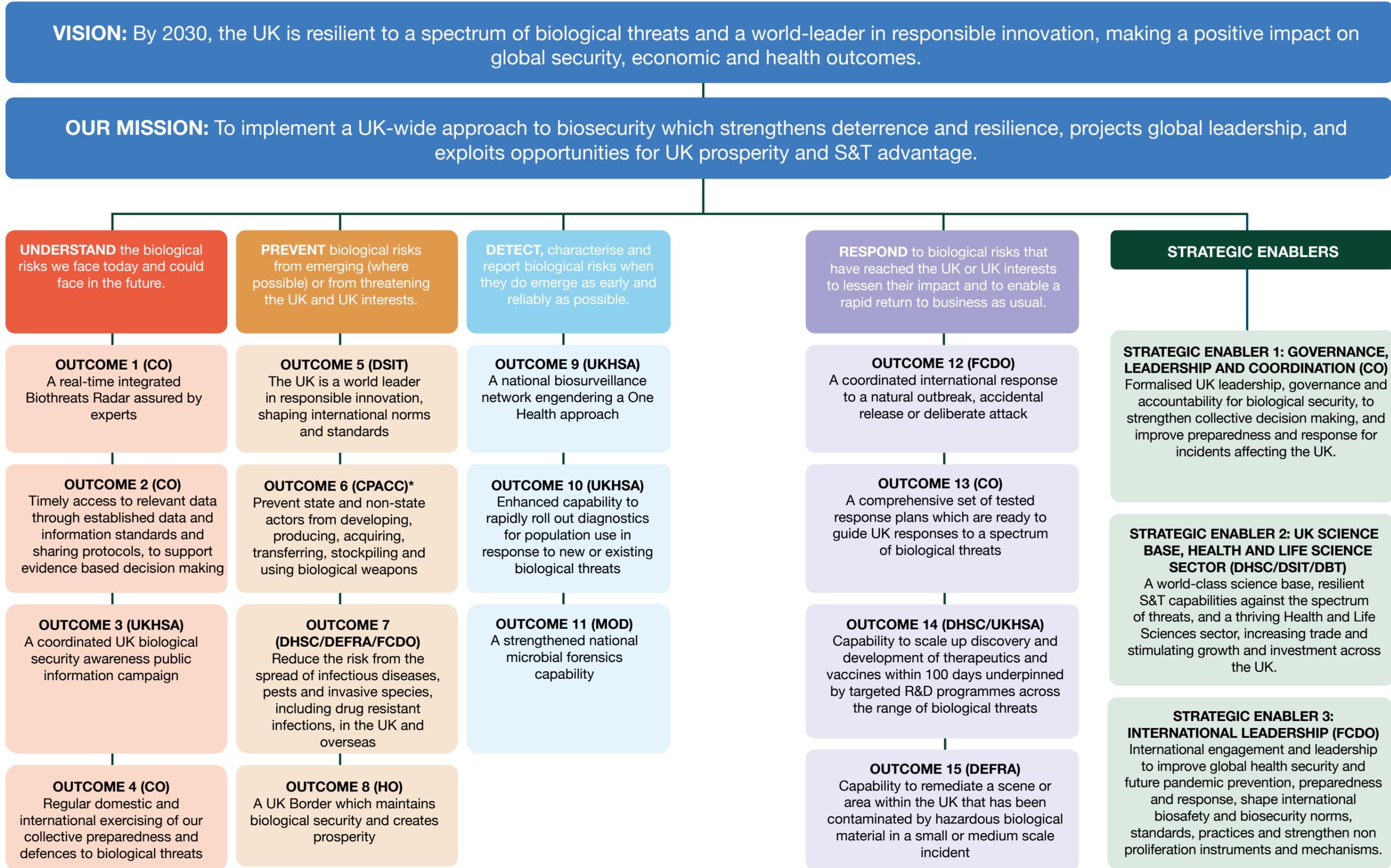
13. Achieving this ambitious vision will require a comprehensive approach that draws together biological security expertise across the UK, harnesses our collective strengths to transform our domestic resilience, and maximises our contribution globally. UK-wide coordination and an outward facing world-view is essential.
14. Effective preparedness for future biological threats requires a combination of strong foresight, expert risk assessment, science informed decision making, system-wide contingency and capability planning, strong health and R&D systems - and a commitment to sustaining and developing these during inter-pandemic periods. Together with our commitment to mainstream collaborative ways of working with our partners inside and outside government, across the UK and globally, and learning lessons from COVID-19, we will:

- Embed a One Health and climate focused approach²⁴ to biological security, recognising the interdependencies between environmental, plant, animal and human health.
- Strengthen persistent situational awareness and surveillance of a broad range of high consequence biological threats to the UK, making use of all key sources of relevant data, expert insight and analysis, and tools to detect threats early and tackle risks upstream.
- Incentivise innovation and technology development against a set of priority biosecurity ‘missions’, strengthening surveillance, microbial detection and forensics and developing prototype vaccines and therapeutics against priority pathogens of pandemic potential. Working closely with industry and academia, we will further develop, embed and champion responsible innovation practices.
- Put in place clear UK biosecurity leadership, accountability and governance, including in light of recent machinery of UK government changes, and set out actionable deliverables in our accompanying strategy implementation plan.

24 The UK sees One Health as referring to two related ideas: first, it is the concept that the health of humans, animals, plants and the environment we live in are inextricably linked and interdependent. Second, it refers to the collaborative and sustained effort of multiple disciplines working locally, nationally, regionally, and globally to attain optimal health for all living things and the ecosystems in which they co-exist.

- Project UK leadership globally to strengthen biosafety and biosecurity, improve pandemic prevention, readiness and response, and counter the proliferation of biological weapons.

Overarching Strategic Framework Diagram:



* The Counter Proliferation and Arms Control Centre (CPACC) consolidates expertise and policy-making on international counter proliferation and arms control issues; it is made up of the DBT, FCDO and MOD

Understand

Understand the biological threats that we face today and could face in the future.

15. Increases in the likelihood and diversity of biological threats require the UK to strengthen our capabilities and systems to better understand risks and to share situational awareness across government, with the devolved and local governments, international partners, industry, academia and the public. A deeper understanding of threats will allow us to better forecast the impacts of global trends, drivers and policy developments on the UK's resilience and better prepare our collective defences.
16. Our ability to anticipate, detect and respond to a diversity of future threats is dependent on timely access to reliable data and robust analysis to assess risks, impacts and inform decision making. A risk-based approach, with clear ownership at ministerial and departmental level, supported by authoritative analysis and advice, will ensure the UK is well placed to respond in an agile and effective manner to mitigate impacts.
17. Since the 2018 Biological Security Strategy was published, the UK has developed its capability to access, assess and share relevant biological data:
 - The UK National Situation Centre (SitCen) was established during the pandemic to bring timely

data analysis and insights from across and beyond Government to support situational awareness on crisis and national security issues to improve decision making. This includes data feeds on emerging disease outbreaks and incidents.

- The Joint Biosecurity Centre was established to provide evidence-based, objective analysis, assessment and advice to inform local and national decision-making in response to COVID-19 outbreaks across all four nations of the UK. The UK Health Security Agency (UKHSA) has brought together staff and capabilities of National Health Service (NHS) Test and Trace, the health protection elements of Public Health England, the Joint Biosecurity Centre and, since April 2022, the Managed Quarantine Service to strengthen health protection capability across the UK. UKHSA is the government's permanent standing capacity to prepare for, prevent and respond to threats to health. Its responsibilities are for England, across the UK on reserved health matters, and in partnership with lead agencies in Scotland, Wales and Northern Ireland on devolved issues where relevant.
- A number of departments and agencies have strengthened their horizon scanning and expert advisory groups to provide early warning and risk assessment on emerging diseases, in conjunction with wider UK and international partners. These

groups include representatives from across the UK's world leading science base, bringing multidisciplinary expertise and insights to bear to strengthen decision making. Examples include:

- NERVTAG,²⁵ an expert committee of the Department of Health and Social Care (DHSC) established in 2014, advises the Chief Medical Officer (CMO) and ministers, on the threat posed by new and emerging respiratory viruses.
- The Human and Animal Infection Risk Surveillance Group (HAIRS),²⁶ a multi agency, cross government group identifies and risk assesses emerging and potentially zoonotic infections which pose a threat to UK public health.
- The Health and Safety Executive's (HSE) Scientific Advisory Committee on Genetic Modification (Contained Use) (SACGM) advises on emerging biosafety risks.
- Defence Science and Technology Laboratory (Dstl)²⁷ Hazard Assessment capability addresses key knowledge gaps relating to existing and emerging biological threats (materials and delivery systems). The outputs of this work feed into Intelligence Assessments, capability

25 [New and Emerging Respiratory Virus Threats Advisory Group – GOV.UK.](#)

26 [Human Animal Infections and Risk Surveillance Group - GOV.UK.](#)

27 Ministry of Defence (2022), [The Defence Capability Framework - GOV.UK.](#)

development, policy and mitigation strategies, and is reported into various cross government fora.

- The UK Plant Health Risk Group coordinates work across the UK Plant Health Service, including commissioning and reviewing pest risk assessments and deciding on actions arising from entries to the UK Plant Health Risk Register.²⁸
- The UK's sharing arrangements with international partners, and our global information systems, are able to monitor risks as they emerge. UKHSA works closely with the World Health Organisation (WHO) and other partners to exchange pathogen genomic sequences, scientific expertise and to improve surveillance around the world through platforms such as the Global Initiative on Sharing Avian Influenza Data (GISAID), Phylogenetic Assignment of Named Global Outbreak Lineages (PANGOLIN) and the New Variant Assessment Platform (NVAP). By February 2022, the UK had uploaded over 2 million genome sequences to the international GISAID database, accounting for a quarter of all SARS-CoV-2 genomes shared globally.

28 Department for Environment, Food and Rural Affairs, [UK Plant Health Risk Register- GOV.UK](https://www.gov.uk/government/collections/uk-plant-health-risk-register).

18. Improved understanding, both within and outside of government, of the full range of biological threats is fundamental to timely and effective detection, prevention and response. By accessing and sharing a wider range of data, expert assessment, intelligence and horizon scanning, and fusing these together to enhance shared situational awareness, we will strengthen collective decision making and improve the effectiveness of our response.

UNDERSTAND Pillar Outcomes

- A real-time integrated ‘Biothreats Radar’ assured by experts.
- Timely access to relevant data through established data and information standards and sharing protocols, to support evidence based decision making.
- A coordinated UK biological security awareness public information campaign.
- Regular domestic and international exercising of our collective defences to biological threats.

Case study: The National Situation Centre

The UK National Situation Centre (SitCen) was established in 2021 to bring timely data, analysis and insights from across and beyond Government to support situational awareness on crisis and national security issues, drawing upon lessons learned from the COVID-19 pandemic. It has supported HMG's response to events including Russia's invasion of Ukraine, extreme heat and Avian Influenza and continues to proactively identify, monitor and manage risks across all areas of the The National Security Risk Assessment (NSRA).



Image courtesy of National Situation Centre

Outcome 1: A real-time integrated Biothreats Radar assured by experts

19. The 2018 Strategy set out that ‘unless we understand the diseases that exist today and that may emerge in the future, we will not be able to address the risks they pose’. Our understanding of biological security must extend to a spectrum of threats at home and abroad. Our domestic biological threat assessment, surveillance and early detection capabilities must be connected into global surveillance networks ensuring we have the best possible picture of threats, wherever they emerge.
20. In the UK, there are established independent expert advisory committees and groups who conduct analysis focused on subsets of biological threats and trends. The assessment products from these groups, and from wider sources of data and information, will be brought together to develop a centralised pan **biothreats decision support package, or Biothreats Radar**. Data from government and non-government sources will be analysed by government analysts and external experts for assurance.
21. The Biothreats Radar will be synthesised by the National Situation Centre, and will be accessible across Government and to devolved governments, allowing effective links to ministerial decision-makers and to planning and crisis response.

22. The National Security Risk Assessment (NSRA) is the government's internal, classified assessment of the most serious risks facing the United Kingdom. It is a single, authoritative articulation of acute risks, based on extensive input from across government and underpinned by a rigorous methodology. The National Risk Register (NRR) is the external version of the NSRA. The UK Government Resilience Framework published in December 2022, set out the core principle that developing a shared understanding of the risks we face is fundamental, so the structure and content of the 2023 National Risk Register will align more with the classified internal NSRA, providing greater transparency.
23. To complement the NRR, and ensure we consider trends and impacts over the full timeframe of this strategy and beyond, we will conduct an annual forecast of the impacts of longer-term global trends on our biological security policies, programmes and capabilities. Regular consideration and review of emerging threats, trends and opportunities (e.g. for the UK health and life science sector) on UK biological security will strengthen our evidence base for changes in policies and plans, and strengthen our overall resilience and readiness.
24. A redacted version of our forecast and analysis will be made publicly available, where possible, to raise awareness and support readiness and contingency planning across the UK.

25. An escalation in current, new or emerging threats will trigger a review by decision makers with recommendations made on suitable courses of action for decisions by ministers, as appropriate and proportionate.
26. The Scientific Advisory Group for Emergencies (SAGE) will continue to be a key science advisory function for ministers during a crisis - advising on the latest data and research.

Outcome 2: Timely access to relevant data through established data and information standards and sharing protocols, to support evidence based decision making.

27. We will promote shared data standards and sharing protocols, in collaboration with data producers and consumers within and outside of Government.
28. During the COVID-19 pandemic, data sharing became much more commonplace, with open-source information shared on sites such as Our World in Data²⁹ and John Hopkins³⁰ dashboards, the National Center for Biotechnology Information (NCBI)³¹ and GISAID,³² adopting the core principles of timely international sharing of health data to

29 Global Change Data Lab (2023), [Our World In Data](#)

30 Johns Hopkins Coronavirus Resource Center, [COVID-19 Dashboard](#).

31 National Institutes of Health (2022), [About - NCBI](#).

32 [GISAID](#)

protect populations, provided open access to genomic data on the coronavirus causing COVID-19.

29. Building on this good practice, we will continue to support ongoing projects, such as the data.org Epiverse project funded by Wellcome and The Rockefeller Foundation, to develop a trustworthy data analysis ecosystem dedicated to getting ahead of the next public health crisis. We will explore routes to facilitate sensitive and appropriate data sharing across classification levels. This will ensure the UK is well placed to inform and support the development of international standards for the timely sharing of biothreat related data.
30. We will support the International Plant Protection Convention in its ambition to develop a global pest alert system with mechanisms to evaluate and communicate emerging pest risks, providing regular information to devolved governments on changes in pest status around the world. We will be able to use this to quickly adapt our phytosanitary systems to reduce the risk of introduction and spread of plant pests.

Outcome 3: A coordinated UK biological security awareness public information campaign

31. Public communication of risk is an essential part of building trust and facilitating public and private sector partnerships, as it ensures a common understanding of potential threats, threat indicators and the impact of policy interventions.
32. We will develop a coordinated communication campaign to improve public understanding and awareness of natural, deliberate and accidental biological risks. We will work with behavioural scientists and communications experts, learning lessons from the COVID-19 pandemic and building on the successes of National Cyber Security Centre's 'cyber aware' campaign,³³ to develop a coherent approach to increasing public awareness of risk.
33. We will explore how additional objective data sources could be used to understand and interpret public behaviour - providing more accurate feedback loops to inform communications strategies during a response. We will engage the UK transport industry, given their key role in disseminating messages to those travelling in and out of the UK.

33 National Cyber Security Centre, [Cyber Aware](#).

Outcome 4: Regular domestic and international exercising of our collective defences to biological threats

34. National-level and smaller scale tabletop exercises are powerful tools for improving our understanding of, and clarifying roles and effective responses to, biological threats.
35. To be successful, these exercises must be carried out on a regular basis and their results must be shared widely across the system and acted upon. Regular exercising is key to ensuring that the appropriate response is shaped by practice rather than theory (to the extent that that is possible). This is particularly important for complex threats that cross departmental boundaries and borders, and those which involve specialist scientific and operational response capabilities.
36. Regular tabletop exercises will be conducted within and between departments, across natural, accidental and deliberate threats, to validate plans and prepare teams. They will aim to explore the interdependencies between different risks, including cascading and concurrent risks.
37. We will invest in larger-scale national exercises, bringing together key national, local and operational partners to stress test our plans, structures and skills and embed lessons into our doctrine and standards.

The exercises will aim to understand gaps in government planning by testing national and local level coordination. Departments, local authorities and operational partners will continue to conduct their own exercises to develop response plans against specific biological risks.

38. All exercises will be geared towards practical outputs. Importantly, these exercises will join up frontline responders (who run practical exercises regularly) with policymakers across UK, devolved and local governments. To maximise the effectiveness of exercising, lessons learnt will be centrally collected and disseminated, and follow up actions prioritised.³⁴
39. The programme will facilitate the appropriate level of join-up with international partners, maximising outputs and building consensus on the capability gaps in the international system.

³⁴ National Audit Office (2021), [The government's preparedness for the COVID-19 pandemic: lessons for government on risk management](#).

Case Study: DeepMind

London-based DeepMind's AI system AlphaFold has been recognised as a solution to the grand scientific challenge known as the protein structure prediction problem. AlphaFold can predict the shape of a protein - the building blocks of life, which underpin every biological process in every living thing - based on its amino acid sequence at scale and in minutes, down to atomic accuracy.

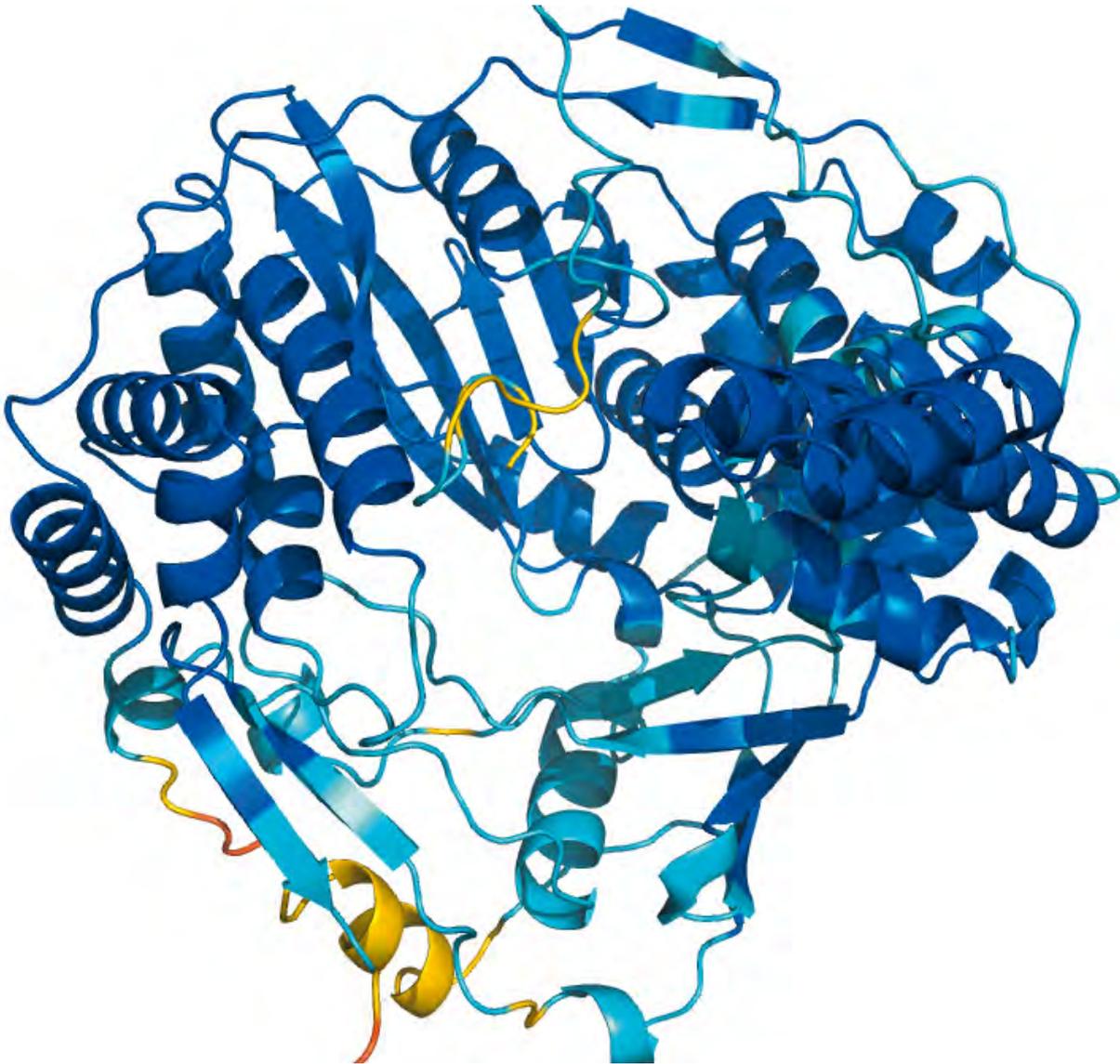
DeepMind open sourced AlphaFold and also launched the AlphaFold Protein Structure Database in partnership with EMBL's European Bioinformatics Institute. The most recent update of the Database included nearly all catalogued proteins known to science - totalling over 200 million structures - all freely and openly available to the scientific community.

Scientists around the world are using AlphaFold to unlock challenges and accelerate research in nearly every field of biology - including in areas relevant to biological security. For example, AlphaFold has helped to support research into tackling bacterial infections that have antibiotic resistance. It is also accelerating drug discovery by providing a better understanding of newly identified proteins that could be drug targets, and helping scientists to more quickly find potential medicines that bind to them.

DeepMind sought input from more than 30 experts across biology research, biosecurity, bioethics, human rights and more before open sourcing AlphaFold and launching the

Database - to help them understand how to do so in a way that would maximise potential benefits and minimise potential risks.

AlphaFold's structural prediction of NSP4 from the Chikungunya Virus,³⁵ one of the viruses highlighted in the G7's 100 Days Mission.³⁶



Courtesy of Google Deepmind, 2023

35 Tan YB et al (2022), *Molecular architecture of the Chikungunya virus replication complex*, Science Advances, Volume 8, Issue 4.

36 Cabinet Office (2021), *100 Days Mission to Respond to Future Pandemic Threats - GOV.UK*.

Prevent

Prevent biological risks from emerging, where possible, and threatening the UK and UK interests.

40. The foundations of effective prevention are strong health systems and robust biological security and biosafety standards, practices and capabilities.
41. Since the 2018 Biological Security Strategy was published, the UK has taken steps to strengthen its approach to prevention:
 - Overseas, the UK is leading work to strengthen biological security and counter proliferation, including through the G7 Global Partnership against the spread of weapons and materials of mass destruction. The UK's International Biological Security Programme (IBSP) is developing projects to minimise the potential for hostile states or terrorists to acquire or use biological materials or expertise to threaten the UK or UK interests.
 - On global health security, the UK is a top donor to the World Health Organisation (WHO). Our £340m fully flexible core funding (2020-24) aims to facilitate reform, address global health priorities, and tackle future pandemics.

- In May 2023, we launched the Global Health Framework³⁷ which outlines shared objectives across government to strengthen global health security, reform the global health architecture, strengthen health systems in the UK and globally, and advance the UK's position as a leader in global health science and technology.
- We supported the establishment of the Financial Intermediary Fund for Pandemic Prevention, Preparedness and Response through the G20 including committing £25m, and continue to play a leading role in the Global Health Security Initiative (GHSI), a network of trusted experts across G7 countries and Mexico, dedicated to strengthening international preparedness for biological threats.
- We have continued our global leadership on AMR, including piloting a new model to incentivise the development of innovative antimicrobial treatments, contributing to our 2040 vision for a world in which AMR is effectively contained, controlled and mitigated.

37 Foreign, Commonwealth and Development Office and Department of Health and Social Care (2023), [Global Health Framework: working together towards a healthier world - GOV.UK.](#)

- We have published the 2025 UK Border Strategy³⁸ which sets out our vision for the UK Border to be the most effective in the world, embracing innovation, simplifying processes for traders and travellers and improving biosecurity of the UK.
- The UK Government is accelerating a transformative programme to digitise Britain's borders, harnessing new technologies and data to reduce friction and costs for businesses and consumers.³⁹ A new Design Authority for the border has been established to bring together all public sector bodies who design and deliver the border across the UK Government and the devolved governments.
- Within the UK, our world renowned regimes for animal, plant, bee and invasive non-native species have continued to reduce the spread of pests and diseases within the UK.
- We will deliver the commitments within our new Plant Biosecurity Strategy (2023 - 2028), having successfully delivered all the commitments in the 2014 version.

42. The UK is at the forefront of global preventative work, but there are areas where we can draw together and focus our activity on the overarching

38 HM Government (2020), [2025 UK Border Strategy - GOV.UK](#).

39 HM Government (2022), [The Border with the European Union, Importing and Exporting Goods - GOV.UK](#).

priorities to be even more effective. This is critical given the increasing likelihood, diversity and complexity of biological threats we face out to 2030.

PREVENT Pillar Outcomes

- The UK is a world leader in responsible innovation, shaping international norms and standards
- Prevent state and non-state actors from developing, producing, acquiring, transferring, stockpiling and using biological weapons
- Reduce the spread of infectious diseases, pests and invasive species, including drug resistant infections, in the UK and overseas
- A UK Border which maintains biological security and creates prosperity

The UK's International Biological Security Programme

The International Biological Security Programme aims to minimise the risk that states or terrorists seeking to develop a biological weapons capability will acquire and use materials or expertise which could threaten the UK, UK Armed Forces, UK interests or our partners. Managed by MOD and largely implemented through the Defence, Science and Technology Laboratory (Dstl), it comprises a number of overseas projects which directly improve pathogen security systems, promote safety and security

best-practice, and strengthen disease diagnostics and surveillance capabilities in vulnerable regions, including the Middle East and Africa.

In addition to a primary focus on reducing the threat of a deliberately caused disease outbreak, the IBSP supports cooperative international biological security activities that reduce the risks and impacts of naturally occurring or accidental disease events, co-investing with our international partners to scale our collective efforts and maximise output from our technical experts.

Through the IBSP, the UK:

- Provides assistance with the development of effective pathogen security, biosafety, diagnostics and disease surveillance capabilities in partner countries;
- Addresses international concerns related to the misuse of science and “dual-use” science;
- Strengthens non-proliferation awareness; and
- Improves opportunities for technical collaboration, assistance and sustainable capacity building through cooperative biological security activities

Our objective to foster responsible innovation across the UK - including through promoting high standards of professional conduct - is replicated through the IBSP internationally, as we use our global influence to protect ourselves from the spread of pathogens across borders. The IBSP promotes responsible handling of pathogens

and international cooperation on biological issues, which is essential if we are to meet our outcomes of deterring and preventing state and non-state actors from developing, acquiring or utilising biological weapons, and of reducing the spread of endemic diseases.

Outcome 5: The UK is a world leader in responsible innovation, shaping international norms and standards

44. In the last decade, the UK bioeconomy has grown significantly, fuelled by advances in synthetic biology, genomic sequencing and bioinformatics.
45. The field of bioscience has converged with advances in artificial intelligence (AI). AI is now being applied in several fields of drug discovery, customised medicine, gene editing, radiography, image processing and medication. The UK pioneered many of the innovations so essential in our response to the recent COVID-19 pandemic; specifically, the adenovirus vaccine vector used to create the Oxford-Astrazeneca vaccine,⁴⁰ Whole Genome Sequencing (WGS), which has been used to rapidly characterise new and emerging COVID-19 variants.⁴¹

40 University of Oxford (2020), [About the Oxford COVID-19 vaccine](#).

41 UK Health Security Agency (2022), [UK completes over 2 million SARS-CoV-2 whole genome sequences - GOV.UK](#).

46. However, as science and technology advances, it also presents new, potentially extreme risks. More people now have the necessary skills to perform high risk research at low cost.⁴² Rapidly developing DNA synthesis capabilities used for advancing biomedical research, could also be deliberately misused to build new pathogens with harmful impacts.
47. The convergence of bioscience with robotics, machine learning and AI has paved the way for automated approaches to biology,⁴³ creating new cyberbiosecurity risk.⁴⁴
48. To ensure the UK secures the economic, health and wider societal value from advances in biosciences and biotechnologies, whilst safeguarding against potential misuse, our ambition is to make the UK a world leader in responsible innovation by 2030. This will require working closely with UK industry, academia and international partners to find proportionate, practical solutions to reduce the costs UK small and medium-sized enterprises (SMEs) face to innovate responsibly to reduce risk and boost competitiveness.

42 Esvelt K.M (2018), *Inoculating science against potential pandemics and information hazards*, PLoS Pathogens Volume 14, Issue 10.

43 Richardson et al. (2019), *Cyberbiosecurity: A Call for Cooperation in a New Threat Landscape*, Frontiers in Bioengineering and Biotechnology, Volume 7, Issue 99.

44 Murch, R. S et al (2018), *Cyberbiosecurity: an emerging new discipline to help safeguard the bioeconomy*, Frontiers in Bioengineering and Biotechnology, Volume 6, Issue 39.

49. We will define success through the following indicators:

- UK companies, especially SMEs, have an enabling environment to innovate and grow, supported by forums to share understanding of risk, and best practice and tools to innovate responsibly.
- The UK is seen as an attractive market for biotechnology and engineering biology investments, underpinned by the Life Science Vision, the UK's world renowned ethical, safety and security standards in bioscience and our support for companies to innovate responsibly.
- The UK is showcased internationally as best practice for responsible innovation, enabling us to speak with authority on the international stage, where we can shape regulations and standards, reducing risks whilst also stimulating trade and investment in the UK.
- We will continue to propose Innovation Chapters with strategic partners in Free Trade Agreements (FTAs) to ensure we can capitalise on the opportunities innovation in all sectors presents, and allow FTAs to remain fit for purpose as new technologies emerge and our trade relationships grow. Department for Business and Trade (DBT) will continue to share best practice and use the UK's independent voice at the World Trade Organisation to advocate for the development of

responsible innovation and shaping of regulations and standards.

50. We will continue to enforce the Anti-terrorism, Crime and Security Act 2001, which restricts the development or transfer of certain biological agents and toxins, and the Genetically Modified Organisms Regulations 2014 which mandates that suitable and sufficient risk assessments to be reviewed by the Health and Safety Executive.
51. The National Security and Investment Act 2021⁴⁵ gives the UK new powers to scrutinise business transactions to protect national security, including in the synthetic biology sector, while providing businesses and investors with the certainty and transparency they need to do business in the UK.
52. To achieve our outcome, we will prioritise the following:
 - Establishing a permanent, two- way dialogue with UK industry on responsible innovation by creating a UK Biosecurity Leadership Council.
 - To foster a culture of responsible innovation, we will promote, and update where necessary, the National Protective Security Authority (NPSA, formerly the CPNI) Trusted Research Guidance

45 Cabinet Office (2020), [National Security and Investment Act - GOV.UK](https://www.gov.uk/government/legislation/national-security-and-investment-act-2021)

for academia⁴⁶ and industry,⁴⁷ as well as relevant codes of conduct,⁴⁸ to clarify expectations for researchers in the UK, aligning with the recently updated WHO framework.⁴⁹

- To reduce dual use risks across the R&D cycle, we will continue to work closely with UK Research and Innovation (UKRI) and other government funding bodies to ensure security concerns continue to be embedded in funding decision making processes, and with journal editors, other publishers and preprint repositories to reduce potential information hazards.
- To prevent the misuse or misapplication of bioscience and biotechnology, we will work alongside UK industry and academia through the UK Biosecurity Leadership Council, as well as international partners, to agree a proportionate approach towards security-conscious ways of working.
- This could include incentivising DNA sequence and customer screening, as well as requirements for selling or operating benchtop DNA synthesis devices within the UK, alongside other forms of regulation or voluntary reporting. Screening tools

46 National Protective Security Authority (2023), [Trusted Research Guidance for Academia](#).

47 National Protective Security Authority (2022), [Trusted Research Guidance for Industry](#).

48 For example, the [Code of Practice for Research](#) published by the UK Research and Integrity Office

49 World Health Organization (2022): [Global guidance framework for the responsible use of the life sciences: mitigating biorisks and governing dual-use research](#).

have the potential to significantly reduce costs, and we will explore, with colleagues in the sector, ways in which these may be developed and adopted to reduce the cost for UK academics and business to innovate responsibly.

53. The UK has a strong package of legislative and regulatory measures in place, including the Academic Technology Approval Scheme and Export Controls,⁵⁰ to manage the risks related to potential misuse of data and Intellectual Property. We will keep all our measures under review, and will strengthen these where necessary (reflecting emerging risks) in collaboration with academia and industry to ensure innovation and growth are not hindered as a result.
54. We have strengthened support to academia and industry considerably in recent years, launching the Trusted Research Campaign⁵¹ and also supporting UK universities to develop guidelines on tackling security risks in international collaboration. We have established a new Research Collaboration Advice Team, which provides direct support to research institutions to help them understand and manage risks.

50 Foreign, Commonwealth and Development Office (2013), [Academic Technology Approval Scheme \(ATAS\) - GOV.UK](#).

51 UK Energy Research Centre (2021), [Trusted Research Campaign](#).

55. We will continue to work closely with academia and industry to improve shared awareness of security risks, and ensure any measures to mitigate risks (including those related to biological data) remain proportionate and do not impede innovation.

Outcome 6: Prevent state and non-state actors from developing, producing, acquiring, transferring, stockpiling and using biological weapons

56. The UK is committed to working with our allies and partners to uphold, update and strengthen international regimes, treaties, initiatives and global norms that underpin global non-proliferation and biosafety and biological security objectives. This includes working to strengthen the Biological and Toxin Weapons Convention (BTWC) and improve the capability of the UN Secretary General's Mechanism for Investigating Alleged Use of Chemical and Biological Weapons.

57. Given the rapid pace of technological change, we will recommend changes to strengthen counter-proliferation regimes and international governance that take account of new routes to biological weapons development and deployment.

58. The 9th Review Conference of the BTWC held in Geneva in December 2022⁵² agreed a set of issues on which parties would work to strengthen the Convention. We will work closely with a wide range of international partners to make the most of this opportunity.
59. We will continue to prevent access to the technology and knowledge required to create biological weapons. Using intelligence analysis, we will increase our knowledge of those who seek access to biological weapons.
60. Working with experts, industry and allies, the UK will maintain an efficient export control system on materials and dual-use technology that keeps pace with technological change.
61. Through the UK International Biological Security Programme (IBSP), we will minimise the potential for hostile actors to acquire and use biological materials, pathogens and expertise to threaten the UK or UK interests. The IBSP has a strong pedigree in strengthening biological security and biosafety systems, and there are significant opportunities for the IBSP to leverage Overseas Development Assistance (ODA) efforts (and vice versa) in regions where the IBSP and ODA interests intersect.

52 European Union (2022), [General Statement at the Ninth Review Conference of the BTWC.](#)

Outcome 7: Reduce the risk from the spread of infectious diseases, pests and invasive species, including drug resistant infections, in the UK and overseas

62. We will continue to be a world leader in global health. In 2023 we have launched the Global Health Framework setting out the UK's continued commitment to global health efforts. We convened the Global Vaccine Summit in 2020 and, as part of the UK's presidency of the G7 in 2021, we agreed ambitious global vaccination targets,⁵³ a groundbreaking Clinical Trials charter⁵⁴ and a Global 100 Days Mission to respond to future pandemic threats.⁵⁵ Through our support for negotiations to establish a legally binding instrument for pandemic prevention, preparedness and response, we will push to strengthen work in key areas including data, sample sharing and surveillance, and embedding a One Health approach into standard ways of working on pandemic prevention, preparedness and response.
63. In 2018, we committed to strengthening our One Health approach by recognising the interdependencies between threats affecting

53 Cabinet Office (2021), [Carbis Bay G7 Summit Communique - GOV.UK](#).

54 Department of Health and Social Care (2021), [G7 Therapeutics and Vaccines Clinical Trials Charter - GOV.UK](#).

55 Cabinet Office (2021), [100 Days Mission to Respond to Future Pandemic Threats - GOV.UK](#).

humans, animals and plants, and the impact of pathogens, drug resistant infections, pests, and invasive non-native species (INNS) on the environment. These interdependencies, including the link between global and domestic health, will continue to change and become more complex out to 2030. Consequently, we will further champion and embed a One Health approach, tackling antimicrobial resistance and reducing the spread of infectious diseases, at home and overseas.

64. Through the UK International Development Strategy,⁵⁶ our immediate priority is to transition towards endemic COVID-19, and prepare for new threats through supporting R&D, transfer of technology and know-how on a voluntary basis, sustained manufacturing capacity, and enabling new interventions (vaccines, therapeutics, diagnostics) to be safely authorised and available on an equitable basis as soon as possible after a threat is identified. We will continue to support lower and middle income countries to strengthen their health systems, embedding a One Health approach, through our bilateral work, investments and policy, and diplomatic influencing.
65. We will continue to reduce the risk of the spread of infectious diseases within the UK, including new variants of COVID-19. Through the Living

⁵⁶ Foreign, Commonwealth and Development Office (2022), [UK government's strategy for international development](https://www.gov.uk/government/strategies/uk-government-strategy-for-international-development) - GOV.UK.

with COVID Strategy, and Scotland, Wales and Northern Ireland's COVID programmes to transition to endemic management, we aim to reduce transmission by protecting the most vulnerable from COVID-19, maintaining resilient capabilities and securing new innovations and opportunities. We were the first country to approve a dual vaccine which tackles both the original SARS-CoV-2 virus and the newer Omicron variant.

66. We are on course to the deliver the majority of commitments in the National Action Plan (NAP) for AMR (2019-2024),⁵⁷ designed to make progress towards the vision of a world in which AMR is effectively contained, controlled and mitigated by 2040. We have conducted a Call for Evidence to inform the next NAP, which will continue to drive a reduction in need for, and unintentional exposure to, antibiotics; ensure optimal use of antimicrobials; and invest in innovation, supply of and access to tools to tackle AMR. Overseas, we aim to continue to be recognised as a global leader in tackling AMR, through our advocacy work bilaterally and multilaterally (such as through the WHO, G7 and

⁵⁷ Department of Health and Social Care (2019), [UK 5-year action plan for antimicrobial resistance 2019 to 2024 - GOV.UK](#).

G20) and the Fleming Fund which supports the gathering and sharing and use of AMR data in Africa and Asia.⁵⁸

67. The new Plant Biosecurity Strategy for Great Britain has been published and its implementation from 2023-2028 will improve public awareness⁵⁹ of the need to maintain a healthy plant environment as well as increase partnerships between the Government and industry to support a biosecure plant supply chain and domestic production. It will also draw on emerging technologies to keep pace with changing threats and ensure preparedness for future threats and outbreaks. We will continue to be leading voices in the European and Mediterranean Plant Protection Organisation and International Plant Protection Convention, ensuring timely data sharing and sharing best practice.
68. For animal diseases, we aim to reduce adverse impacts on the rural and wider economy, the public, rural communities and the environment (including impact on wildlife). Our disease control measures seek to contain the number of animals that need to be culled, either for disease control purposes or to safeguard animal welfare. Our objective in

58 The Fleming Fund brings evidence and people together to encourage action against drug resistance for a healthier world by supporting low- and middle-income countries to generate, share and use antimicrobial resistance data

59 Department for Environment, Food & Rural Affairs, Forestry Commission, The Scottish Government, and Welsh Government (2023), Plant biosecurity strategy for Great Britain (2023 to 2028) - GOV.UK.

tackling any outbreak of exotic notifiable disease is to eradicate the disease as quickly as possible from the UK national livestock population and regain UK World Organisation for Animal Health (WOAH) disease-free status. Our approach is to use the latest evidence from laboratory, epidemiological, veterinary and other scientific advice to inform best practice.

69. The new GB Invasive Non-Native Species Strategy will outline our key aims and actions for addressing the threats posed by invasive non-native species (INNS), including the establishment of a new inspectorate. The strategy will enhance our ability to prevent, detect and rapidly respond to new invasive non-native species, including those that benefit from climate change, through a combination of Pathway Action Plans, the continued establishment of the Non-Native Species inspectorate, and the eradication of new incursions.

Outcome 8: A UK Border which maintains biological security and delivers prosperity

70. The UK left the European Union in 2020, meaning that we have taken back control of our border policy.
71. As a global trading hub, we are vulnerable to importing biological threats affecting humans, animals and plants. As we expand trading

relationships across the world, the risk of previously unencountered diseases entering the UK may rise.⁶⁰ We will adapt our border policy accordingly.

72. The UK exports over £9 billion of animal and plant products each year which rely on the UK's biological security reputation, so it is imperative we maintain capacity and capabilities at the border.⁶¹
73. We will work closely with relevant industries, including the agricultural community and the aviation industry to reduce risks before they arrive at the UK border. We will continue to work closely with the devolved governments, given significant elements of border policy are devolved, to achieve the outcomes in Borders 2025, to protect the public and encourage legitimate trade and travel for businesses and passengers.
74. Our first step is to incorporate a Pre-Departure Health Check (PDHC) into the rollout of the Universal Permission to Travel (UPT) to be available if required in a future health emergency. UKHSA will take the leading role nationally on the public health aspects of the UK border and develop a strengthened vision for the future. This will include evaluating and identifying any gaps in the border health system, determining our priority deliverables

60 Jonathan Holmes (2021), [Brexit and the end of the transition period: what does it mean for the health and care system?](#)

61 Department for Environment, Food and Rural Affairs [analysis](#) of HMRC trade data, including all products covered by OCR.

and developing the capabilities required to better protect the public from cross-border threats to health.

75. The UK Government is working closely with the devolved governments and relevant industries to agree new SPS measures to be introduced at the border. SPS goods will be segmented across three categories of risk, each with a proportionate level of controls.
76. These will be based on the inherent risk posed by the commodity and the effectiveness of controls in the country of origin. We will employ a trusted trader approach, based on compliance history, self-assessment, and technology-derived assurance, to reduce controls further, where this does not lead to an unacceptable risk to biological security. In addition, we will move away from physical phytosanitary certificates to electronic versions for the trade of regulated plants and plant products. This will speed up the process, improve sustainability and reduce fraud.

Detect

Rapidly detect, characterise and report the presence and nature of biological hazards that have the potential to represent a significant risk or threat to the UK or UK interests.

77. The sooner we are able to accurately detect, identify and locate a biological threat, the sooner we can warn and inform decision makers and the public, and the sooner we can put in place the right interventions and deploy the right medical counter measures (pharmaceutical and non-pharmaceutical) to contain the infection and save lives.
78. The UK has a comprehensive and well-tested system in place for rapidly detecting and identifying disease and pest outbreaks. At the front line are our world-leading clinicians, veterinarians, scientists and industry professionals who, on a day-to-day basis, identify and report the first signs of significant disease and pest outbreaks or other biological incidents. Supporting these professionals are a range of domestic and global surveillance systems that aim to draw together isolated cases and events to identify patterns and provide early warning, including:
 - UKHSA's real-time syndromic surveillance team, who collect and analyse health data from multiple sources, indicating higher-than-usual levels of

illness, and publish bulletins to keep public health professionals informed.⁶²

- UKHSA's AMR local indicators work enables local teams to identify key issues and allows them to benchmark their performance against the national picture and other similar organisations on antibiotic prescribing, healthcare-associated infections (HCAI), infection prevention and control (IPC), and antimicrobial stewardship (AMS).
- DHSC's work to support the establishment of the International Pandemic Surveillance Network with the WHO and the ongoing engagement to strengthen the International Health Regulations National Focal Points sharing system.
- Animal health surveillance, led by the Animal and Plant Health Agency (APHA) in England and Wales, Scottish Rural Colleges (SRUC) in Scotland, and the Department of Agriculture, Environment and Rural Affairs (DAERA) in Northern Ireland, including risk assessments on the potential introduction of animal health threats and consequent amendments in surveillance systems to ensure that these threats can be identified both at the border and in the national animal population.

62 UK Health Security Agency (2023), [Syndromic surveillance: systems and analyses - GOV.UK](#).

- The PATH-SAFE project, delivered by the Food Standards Agency, which uses the latest DNA-sequencing technology and environmental sampling to improve the detection, and tracking of foodborne human pathogens and AMR through the whole agri-food system from farm-to-fork.
- Plant health surveillance led by plant health inspectors from APHA and the devolved governments for horticulture, agricultural crops and forestry threats, including detection at the border, risk based inspection of plant importers, wholesalers, retailers, nurseries and forests, and outreach campaigns; and strengthening our surveillance of plant pests through the involvement of ‘citizen science’ in programmes such as Observatree.⁶³
- We have mature, in-service systems to detect, identify and monitor biological threats in overseas theatres of operation, and in response to suspected incidents across the UK homeland. This includes a high confidence analysis and attribution capability for current and emerging chemical and biological materials to inform foreign policy and the UK criminal justice system. Dstl uses defence and security networks to identify research or capabilities that could be used as part

63 [Observatree: Monitoring Tree Health.](#)

of an international network and link appropriate UK points of contact.

DETECT Pillar Outcomes

- A National Biosurveillance Network engendering a One Health approach.
- Enhanced capability to rapidly roll out diagnostics for population use in response to new or existing biological threats.
- A strengthened national microbial forensics capability.

Case Study: Wastewater Monitoring

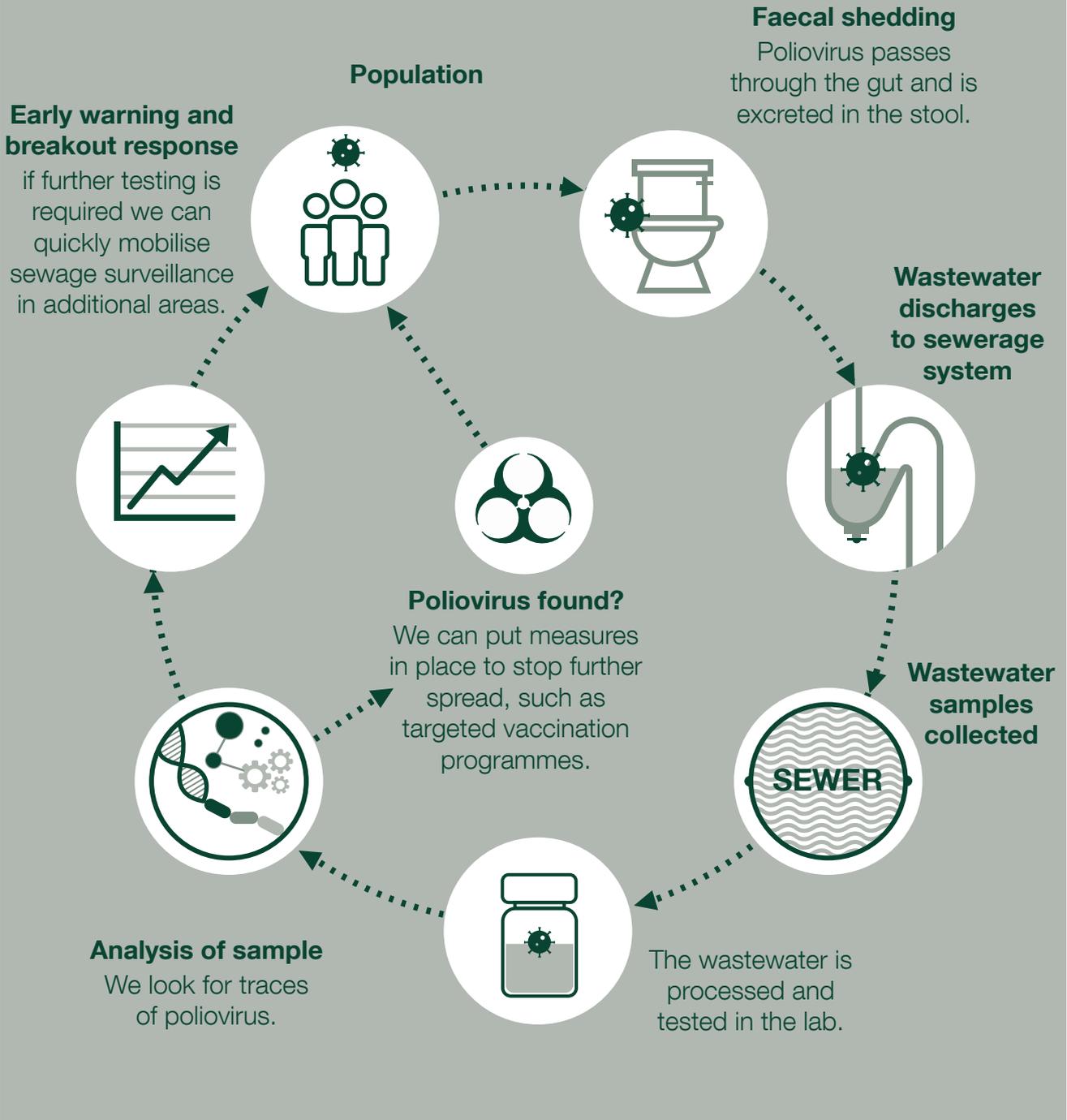
During the COVID-19 pandemic, a government-led programme to test sewage for SARS-CoV-2 was established in England (similar programmes were stood up in Scotland, Wales and Northern Ireland). The Environmental Monitoring for Health Protection (EMHP) SARS-CoV-2 wastewater monitoring programme was led by the UKHSA in partnership with DEFRA, the Environment Agency (EA), the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), academia, and water companies.

The programme tested sewage for fragments of SARS-CoV-2 RNA from over 300 Sewage Treatment Works (STW) and over 190 sewer network sites (manholes). This helped to build a better picture of where the virus was spreading within and between communities, particularly with asymptomatic COVID-19 infections that may have otherwise gone undetected. Genomic sequencing of samples indicated where variants and mutations may be circulating undetected.

This technology was recently successful in detecting another dangerous pathogen in the UK. Following the discovery of type 2 vaccine-derived poliovirus in sewage in north and east London, the Joint Committee on Vaccination and Immunisation (JCVI) advised that a targeted inactivated polio vaccine (IPV) booster dose should be offered to all children between the ages of 1 and 9 in all London boroughs.

Wastewater monitoring

How it works for Poliovirus



Case Study: SIGMA+ Collaboration

The UK Government is working alongside the US Defence Advanced Research Programme Agency (DARPA) to develop and investigate the potential for a networked system of sensors to detect the production or release of chemical and biological threats in urban settings and transport hubs. This is the successor to the previous SIGMA programme which developed networked sensing capability for illicit radioactive and nuclear material.

The programme, which is jointly funded by the Department for Transport and the Home Office, is highly ambitious and is driving advancements in sensor development whilst bringing together existing capabilities and emerging technologies. The crucial challenge addressed by the programme is to develop novel, scalable, and highly sensitive, high confidence detection technologies.

These detection technologies will be transformative for detection in urban areas and could offer alternative options for screening at borders. By sampling the air and gaining background data, we aim to establish an understanding of the challenge associated with detection in an urban environment, enabling immediate identification of outliers. A trial to evaluate the SIGMA+ sensing equipment and collection of ambient background data took place in London over the summer. The Home Office will continue their close working with DARPA to strengthen the technology and test potential use cases in the UK.



Image courtesy of DARPA

Outcome 9: A National Biosurveillance Network engendering a One Health approach

79. As set out above, the scope of potential biological threats is vast, from naturally occurring infectious diseases affecting humans, animals, plants or the environment, to pest outbreaks, accidental release and potential misuse by state or non state actors. There is, therefore, a need to embed a One Health approach to surveillance, connecting diverse and disparate capabilities and data sources across UK government departments, agencies, academic

centres of excellence and wider capabilities and programmes.

80. The development of a **National Biosurveillance Network**, connecting syndromic, epidemiological and promising environmental surveillance capabilities (wastewater, air), will be scoped by UKHSA. This will allow for more comprehensive monitoring of threats over time. Data and analysis, assured by experts, will flow from the network into the National Situation Centre's proposed Biothreats Radar, providing decision makers with a comprehensive picture of known and nascent biological threats.
81. Gaining actionable insights from genomic data relies on being able to link epidemiological and metagenomic data, including from clinical settings, imports or environmental samples, to understand pathogen behaviour and interactions between humans, animals, plants and the environment. For human health, this capability is currently held across the devolved national health services, UKHSA and DHSC and relies on strong relationships with academic institutes, as demonstrated through the world leading work of the COVID-19 Genomics UK consortium (COG-UK⁶⁴). Surveillance capability for plant and zoonotic disease will be scoped alongside human health surveillance programmes to deepen

64 [COVID-19 Genetics UK Consortium](#)

the collaboration between DEFRA, UKHSA, APHA, and institutes across the UK and ensure datasets are shared across the system.

82. Importantly almost all data considered for the National Biosurveillance Network will be non patient identifiable information. Where patient specific clinical data is considered, in only very specific and urgent cases, all protective measures will be in place in line with the relevant legislation.⁶⁵
83. A modular approach to the scoping of the National Biosurveillance Network will, in the first instance, seek to bring together the output from existing surveillance capabilities to monitor known threats. Over time, the ambition is to incorporate unbiased metagenomic approaches that could identify emerging pathogens in real time, with the potential to identify unknown threats. A similar approach can be used with invasive species, using environmental DNA in metagenomic analysis to identify new invasive species and pathogens.
84. Through understanding disease prevalence baselines and tracking changes of pathogens within a community, threats could be detected sooner, shortening the time it takes to trigger a response.
85. Our strong history in genomics means the UK is uniquely placed to make a difference. We will

65 At time of publication this is Section 251 of the [National Health Service Act 2006](#).

develop our detection capabilities, continuing to invest at the nexus of bioengineering and applied data science as part of our commitment to become a global science superpower. The development of new pathogen agnostic environmental detection and surveillance technologies will open up opportunities for the UK to showcase its scientific strengths, and attract inward investment. Sustained government investment, boosted by partnerships with key allies and private/philanthropic partners, will de-risk procurement with the aim of deploying in a range of operationally relevant settings.

86. We will advance two promising areas of environmental surveillance:

Wastewater monitoring. We will explore rapid, coordinated and efficient research to further develop methods and use-cases for wastewater monitoring.

- Wastewater monitoring was used extensively during the COVID-19 pandemic to indicate disease prevalence and the presence of SARS-CoV-2 variants. Such widespread application led to accelerated development of the technique and heightened interest in its potential for other surveillance uses. Fulfilling a G7 pledge to explore non-invasive surveillance methods,⁶⁶ we will explore further research opportunities into the use of wastewater monitoring for new SARS-CoV-2-

66 European Council (2022), [G7 Leaders' Communique](#).

variants and for monitoring the spread of other infectious agents and drug resistant pathogens.

- A national sampling and analysis network could support rapid, coordinated and efficient research and testing to explore the operational deployment of pathogen agnostic wastewater monitoring to 2030. We will continue to assess the feasibility of real-time detection in global travel corridors, such as airports and ferry terminals.

Air testing and monitoring: The possible advantage of air surveillance linked to a data network and to operational and policy decision-makers is clear: a marked reduction in the time taken to detect a hostile (or accidental) threat, and to determine its nature, shortening the time to understand the threat and respond appropriately.

- The development of stand-off detectors for the surveillance of chemical, biological or radiological substances in the air is maturing. These detection systems have the potential to cover a large metropolitan area, and eventually provide near real-time surveillance with military and homeland security applications. We will continue to explore how to mature these technologies further, aiming to get closer to automated real-time surveillance.
- We will scope the requirements for emerging biodetection technology and solutions, with the aim of supporting pull through into operational

capability. While current uses of the technology are aimed more at deliberate threats, there is the potential to expand the uses of this technology across the full range of biological threats.

Case Study: Metagenomics

Ultimately, the ambition of the National Biosurveillance Network is to incorporate unbiased, metagenomic approaches that could identify emerging pathogens in real time, with the potential to identify unknown threats. A similar approach is commonly used for invasive species, using environmental DNA to identify new species and pathogens.

Metagenomics describes the process of obtaining sequence data for multiple pathogens from the same samples. There are current and planned metagenomics capabilities across many parts of the UK Government. These are small-scale or targeted efforts such as developing new bioinformatics techniques and an ongoing wastewater analysis programme for narcotic detection.

UKHSA, the Food Standards Agency (FSA) and APHA are scoping pathogen agnostic metagenomic sequencing. The FSA has pilot-scale work in this area, focussed on sample processing and methodology validation to develop metagenomic sequencing approaches for food borne diseases and antimicrobial resistance in agri-food settings. UKHSA is developing an academic network to enable the creation of pathogen-agnostic metagenomics.

There are significant technical and operational challenges with metagenomic approaches that require considerable and sustained funding. The Government will bolster

existing capabilities, moving beyond incremental progress addressing specific departmental aims and accelerate the creation of pathogen-agnostic metagenomics across a variety of use cases.

Outcome 10: Enhanced capability to rapidly roll out diagnostics in response to new or existing biological threats

87. Access to rapid, accurate diagnostic tests is critical to detecting pathogens and pests within a population, interrupting transmission chains, and preventing spread of disease. During the COVID-19 pandemic, diagnostics developers were initially hindered in their efforts to create accurate tests due to slow access to samples, a lack of clear specifications, and insufficient global regulatory harmonisation.⁶⁷ Once these difficulties were overcome, the largest network of diagnostic testing facilities in British history was rolled out across the UK.
88. As part of the 100 Days Mission,⁶⁸ which aims to have safe and effective vaccines, therapeutics and diagnostics available within 100 days of an epidemic or pandemic threat being identified, we will support the development of prototype

67 Venkatesan, P. (2020), *COVID-19 diagnostics—not at the expense of other diseases*, The Lancet Microbe, Volume 1, Issue 2.

68 Cabinet Office (2021), *100 Days Mission to Respond to Future Pandemic Threats - GOV.UK*.

diagnostic libraries against priority pathogens and pests, as well as against a future ‘Disease X’.⁶⁹ This requires a combined and concerted effort between governments, industry and international organisations. A long-term UK strategic approach for diagnostics is essential to ensure that we have sufficient capacity to rapidly respond to future pandemics, wider infectious disease outbreaks and to mitigate against the acceleration of AMR. This strategic approach will build upon NHS England’s diagnostics transformation programme, and ensure close alignment with APHA’s ongoing diagnostic development.

Outcome 11: A strengthened national microbial forensics capability

89. An effective sovereign attribution capability in appropriately-equipped laboratories is a key component of both domestic security and public health. It consists of a suite of UK-based forensic tools and investigation capabilities to conduct forensic examinations to support the attribution of a biological threat or a biological incident to hold those responsible for its development or use accountable. This capability is essential for reducing the UK’s vulnerability to concealed

⁶⁹ Simpson S et al (2020), *Disease X: accelerating the development of medical countermeasures for the next pandemic*, The Lancet, Volume 20, Issue 5.

biological attacks as it deters actors from using offensive weapons due to the severe repercussions if attributed to them. The UK Government currently maintains programmes for the attribution of a diverse range of biological hazards, including existing threats and emerging materials of concern.

90. The MOD and HO maintain the Chemical and Biological (CB) Analysis and Attribution Capability based in Dstl which analyses and attributes current and emerging chemical and biological materials to inform foreign policy and the UK criminal justice system; the Food Standards Agency works to detect and respond to contamination threats (accidental or deliberate) in the food or feed chain; the Home Office maintains a national network of laboratories to screen suspected CB material. At an international level, the UK supports the United Nations Secretary-General Mechanism (UNSGM) laboratory network by participating in external quality assessment exercises (EQAEs) which often include the challenge of determining the origin of an event, or strain differentiation.
91. A systematic audit of our specialist diagnostic, forensics and high containment laboratories will build a shared understanding of supply and demand, and in the medium-longer term support a move towards a coherent national alliance of labs, enabling a more resilient and efficient UK response. Such an audit

would also be an opportunity to identify gaps in the pipeline of future Suitably Qualified and Experienced Persons (SQEP) in the UK.

Respond

Respond to biological risks that have reached the UK or UK interests to lessen their impact and to enable a rapid return to business as usual.

92. Outbreaks and biological incidents will continue to occur despite our best efforts to prevent them. It is vital we are ready with a quick, flexible, and comprehensive response, working with international, national and local authorities and local resilience arrangements to ensure there are clear roles, responsibilities and contingency plans in place in the event of a significant outbreak.
93. In 2018, we committed to a swift, scalable and comprehensive response system that is flexible between risks and able to cope with new risks as they emerge. We have taken significant steps to implement this:
- Internationally, **we have increased our core voluntary contribution for the WHO** and continue to support the Global Outbreak Alert and Response Network, including through our UK Public Health Rapid Support Team, to respond to disease outbreaks around the world.
 - In 2020, we were a founding member of COVID-19 Vaccines Global Access (COVAX) and continue to work closely with the WHO, CEPI and other international partners to ensure an

end to COVID-19. We work closely with partners to respond to animal disease and plant pest outbreaks, including through the International Animal Health Emergency Reserve agreement.

- Our **domestic response plans** have been well tested, and we are evolving our capabilities to adapt to the rapidly evolving risk landscape. We have updated our Contingency Plan for Exotic Notifiable Diseases of Animals, our Generic Contingency Plan for Plant Health (England) and our new GB Plant Biosecurity Strategy⁷⁰ outlines our plans to enhance capabilities to respond to pests and pathogens that pose a threat to plant health.
- We are continually developing and improving our capabilities to remediate a scene or area within the UK that has been contaminated by hazardous biological, chemical or radiological material in a small or medium scale incident, in order to allow a return to normal as soon as possible.

94. COVID-19 demonstrated the prowess of our **world class science base** and thriving life science and pharmaceutical sector. Building on close to a decade of prior investment through the Overseas Development Assistance funded UK Vaccine Network and on the 2018 commitment to work

70 Department for Environment, Food & Rural Affairs, Forestry Commission, The Scottish Government, and Welsh Government (2023), Plant biosecurity strategy for Great Britain (2023 to 2028) - GOV.UK.

together with external partners to improve the speed that vaccines can be generated rapidly in an emergency, the Vaccines Taskforce worked closely with researchers, manufacturers and the NHS to enable the fastest vaccine rollout in the world. In 2021, the Government, NHS and the life science sector published the Life Science Vision,⁷¹ a shared plan to create a thriving sector and tackle the major causes of death and disease in the UK.

95. Our refreshed approach to RESPOND is part of our new vision for the UK Government Resilience Strategy: to make the UK the most resilient nation in the world, through embedding a whole of society approach to planning and response and maximising the opportunities to grow our life sciences sector and become a science superpower.

RESPOND Pillar Outcomes

- A coordinated international response to a natural outbreak, accidental release or deliberate attack affecting humans, animals, plants and the environment.
- A comprehensive set of tested response plans which are ready to guide UK responses to a spectrum of biological threats.
- Capability to scale up discovery and development of therapeutics and vaccines underpinned by targeted

71 [Life Sciences Vision - GOV.UK](#): The government and the life science sector's plan to create a thriving sector, and tackle the major causes of death and disease.

R&D programmes across the range of biological threats.

- The ability to efficiently remediate a scene or area within the UK as soon as possible that has been contaminated by hazardous biological material in a small or medium scale incident.

Case Study: Oxford-AstraZeneca Vaccine

On Tuesday 4 January 2021, the UK became the first country in the world to administer the Oxford University/AstraZeneca Covid-19 vaccine. Since then, over 90 million AstraZeneca vaccines have been administered in the UK, saving countless lives, keeping people out of hospital and reducing the pressure on the NHS. Around 3.1 billion doses have been distributed at-cost to more than 180 countries, of which almost two-thirds of these have gone to low and lower-middle-income countries.

The foundation of this success was years of research into vaccine development. On the back of the 2014-15 Ebola virus outbreak, the UK Vaccine Network funded the Jenner Institute's outbreak pathogen program, which sought to lay the groundwork for the development of vaccines for potential pandemic threats. This included known threats such as Middle Eastern Respiratory Syndrome (MERS) coronavirus as well as theoretical ones, the so called 'disease X' pathogens. The program was built around the newly developed ChAdOx1 viral vector platform technology. Described as a 'plug and play'

approach, platform technologies allow for generation of new vaccines using a standardised production pipeline that ensures rapid and consistent results in terms of safety and effectiveness. This contrasts with more traditional approaches, where customised approaches can take years or even decades to yield results. Once the sequence of SARS-CoV-2 was available, the team at Oxford University, led by Professor Sarah Gilbert, and Teresa Lambe, worked around the clock at an incredible pace, using this platform technology to develop a candidate vaccine against SARS-CoV-2 in a matter of months, and completed clinical trials to prove it was both safe and effective within one year.

Once licenced, ensuring that it could be rolled out globally and in perpetuity for low- and middle-income countries was of paramount importance. As a result of this commitment to ensuring global and equitable access, it is estimated that the Oxford-AstraZeneca vaccine saved approximately 6.3 million lives in the first year of the global vaccine rollout⁷² – the most out of all the vaccines in circulation at the time.

Long-term funding through the UK Vaccine Network and UKRI, adding up to more than a decade of investment, was vital to developing the viral vector vaccine platform and optimising our manufacturing methods. This meant that all the pieces were in place for Oxford University to be able to develop a novel coronavirus vaccine at speed.

72 Airfinity (2022), AstraZeneca and Pfizer/BioNTech saved over 12 million lives in the first year of vaccination.

Outcome 12: A coordinated international response to a natural outbreak, accidental release or deliberate attack affecting humans, animals, plants and the environment

96. The continuous circulation of pathogens and pests around the world demands an international response. Our strong global partnerships (bilateral, multilateral, with international organisations and fora) leverage the UK's significant health and scientific expertise to play a pivotal role in improving global preparedness and health outcomes. We will continue to empower the WHO to coordinate international responses to outbreaks. Our membership of WOAHP and close working relationship with the IPCC, United Nations Environment Programme (UNEP) and the Food and Agriculture Organisation (FAO) are all vital to improve our response, both domestically and internationally.
97. Alongside our international partners, we are playing a key role in the negotiations (via the WHO Intergovernmental Negotiating Body (INB)) towards a legally binding instrument on pandemic prevention, preparedness and response (PPR). This is complementary to ongoing efforts to strengthen the International Health Regulations (IHR).

98. As part of the 2022 G7 Pact for Pandemic Readiness, learning from the Quadripartite alliance on One Health,⁷³ we are supporting a stronger operational framework to ensure an “always-ready” professional public health emergency workforce to respond to future outbreaks, building on proven initiatives.
99. To facilitate the rapid development of diagnostics, therapeutics and vaccines for new and emerging biological threats, we will prioritise working with the WHO and international partners, to ensure biological samples are shared rapidly and unhindered in disease outbreaks.
100. As part of the 100 Days Mission, we will support the work of the Global Pandemic Data Alliance⁷⁴ to improve the availability and accessibility of data for critical insights during public health emergencies.
101. We will continue to play a leading role in strengthening the UNSGM by nominating qualified experts, expert consultants and laboratories, providing training, and supporting the Friends of the UNSGM group. We have recently participated in its first full scale exercise, testing our international preparedness and response to a deliberate biological attack, which covered several aspects

73 Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP), World Organisation for Animal Health (WOAH) and World Health Organisation (WHO)

74 [The Global Pandemic Data Alliance](#)

of an investigation, including border crossing and negotiation with the host country, sampling and decontamination.

Outcome 13: A comprehensive set of tested response plans which are ready to guide UK responses to a spectrum of biological threats

102. We will ensure that our response plans cover a range of biological threats, through regularly testing operational readiness and challenging underlying assumptions. These plans will have agreed Ministerial trigger points, which will provide a clear signal to scale up capacity and pivot R&D activities. We will facilitate learning within the biological security community, especially from colleagues in the animal and plant health spaces, who have historically delivered leading-edge responses to outbreaks which are recognised around the world.
103. Many of our existing response plans focus on increasing preparedness to outbreaks of known pathogens and pests; however, we also need to prepare for the unknown by having plans that can adapt to uncertain, complex and interconnected threats:
- The new **strategic approach to pandemic preparedness** will prepare the UK for a range of possible pandemic scenarios.

- The **Contingency Plan for Exotic Notifiable Diseases of Animals in England** is reviewed annually. Likewise, Scotland, Wales, and Northern Ireland also maintain contingency plans, ensuring joined-up approaches to our control strategies.
- The **Generic Contingency Plan for Plant Health in England** describes how the Plant Health Service in England will manage outbreaks of plant pests. Plant and tree specific pest contingency plans describe additional measures over and above those set out in the generic contingency plan to manage certain high risk pests. There are similar arrangements in place in the devolved governments for plants.
- Generic invasive species contingency plans under the new **GB Invasive Non-Native Species Strategy**⁷⁵ outline actions which should be taken to eradicate an invasive species or prevent its further establishment or spread within GB.

⁷⁵ Department for Environment, Food & Rural Affairs (2023), [The Great Britain invasive non-native species strategy - GOV.UK](#).

Outcome 14: Capability to scale up discovery and development of therapeutics and vaccines within 100 days underpinned by targeted R&D programmes across the range of biological threats

104. During COVID-19, we witnessed an unprecedented investment in vaccines and therapeutics which accelerated the development of novel platform technologies, including viral vector and mRNA, and significantly increased our collective understanding of immune responses. Further development of platform technologies, and advances in computer-aided design and machine learning, are opening up unprecedented opportunities for new drugs and vaccines.
105. We will explore how to best support UK industry and academia to maximise these opportunities, supporting our ambition to have therapeutics and vaccines ready to be deployed within 100 days of a future pandemic. We will drive further collaboration across the biosecurity community, adopting a One Health approach to invest in technologies which can support the development of countermeasures against priority human, animal and plant threats.
106. We will focus on how to accelerate the development of underlying platform technologies, including innovative administration methods, which can pivot rapidly towards a future 'Disease X'. We aim to

sustain the UK's position in novel vaccine discovery development and manufacturing and attract inward investment in the UK. For example, under a ten year partnership agreement, Moderna will build a new mRNA Innovation and Technology Centre,⁷⁶ which will have the capacity to produce up to 250 million vaccines per year and the potential to develop vaccines targeting a range of infectious diseases.

107. Leveraging our unique strengths in the UK, we will scope options to incentivise industry and academia to develop prototype vaccines and therapeutics against a range of high priority virus families. We will facilitate collaboration with our academic centres of excellence, to accelerate this process in line with the ambitious timelines outlined in the 100 Days Mission.

Outcome 15: The capability to remediate a scene or area within the UK that has been contaminated by hazardous biological material in a small or medium scale incident

108. We will have in place effective and proportionate capabilities to remediate a scene or area within the UK that has been contaminated by hazardous biological material in a small or medium scale incident. This will allow a return to normal (or a 'new

76 Department of Health and Social Care (2022), Moderna to open vaccine research and manufacturing centre in UK - GOV.UK.

normal') as soon as possible and reduce the social, economic, and health impacts of the incident.

109. Many of these capabilities are being developed as part of the National Technical Advisory Group for Chemical, Biological and Radiological Recovery (NTAG-R). The NTAG-R provides authoritative technical advice on the requirements and capabilities required to conduct CBR recovery operations. The group seeks to establish recovery requirements against a set of defined scenarios, and seeks to identify and qualify technology options that meet these requirements. The group works with providers to develop and establish recovery capability. For a CBR incident, the group will directly support the planning and delivery of recovery operations, including the production of site recovery plans and site release plans.
110. In particular, the NTAG-R are working with public laboratories to identify requirements and develop capabilities for surge activities. This will support a strengthened network of laboratories, including high containment facilities, which would be essential during both response and recovery phases of a biological incident. The NTAG-R are also conducting technology acceleration and focussed research activities, to identify and develop improved technical options for remediation of biological agents. This includes exploration of the efficacy of different decontaminants, and novel sampling methods.

Case Study: Moderna

The pandemic taught us that closer collaboration between government and industry can lead to greater innovation, faster breakthroughs and, ultimately, better emergency preparedness. With this in mind, in December 2022, the government and Moderna entered a strategic partnership to invest in mRNA research, UK vaccine manufacturing and pandemic preparedness.

As part of this 10-year partnership, Moderna is building a state-of-the-art vaccine innovation and technology centre in Harwell, Oxfordshire. The Moderna Innovation and Technology Centre will create more than 150 highly skilled jobs and develop cutting-edge mRNA vaccines for a wide range of illnesses, including COVID-19, flu and RSV.

Construction of the centre commenced in April 2023, with the first mRNA vaccine for use in the NHS expected in 2025. This will give NHS patients across all 4 nations access to a UK-made supply of mRNA vaccines while also future-proofing the UK against emerging health threats. The facility will have the capacity to produce up to 250 million doses of mRNA vaccines a year, greatly improving the UK's future pandemic preparedness.

COVID-19 vaccines were developed, trialled and manufactured at unprecedented speed. mRNA technology has proven to be one of the fastest routes to develop highly effective vaccines during the pandemic and has been pivotal in protecting the public. mRNA

vaccines also have potential use as treatments for cancer and rare diseases. The new centre will unlock this potential by developing revolutionary treatments in the UK, benefitting NHS patients and people worldwide.

Our partnership with Moderna supports the government's ambitious Life Sciences Vision, helping to cement the UK's status as a life sciences superpower.

Leadership, Governance and Coordination

Strategic Enabler 1

- Formalised UK leadership, governance and accountability for biological security, to strengthen collective decision making, and improve preparedness and response for incidents affecting the UK.
111. Many of the commitments set out in this strategy can only be delivered if government departments, agencies, devolved governments and the wider public and private sector work together routinely to develop coherent plans and resilient, interoperable capabilities and systems.
 112. Whilst leadership and oversight for much of the activity described in this strategy falls within existing government department and agency portfolios and governance mechanisms, the Strategy brings that activity together across boundaries, to embed a system-wide approach to mitigate the spectrum of risks, jointly develop capabilities and seize opportunities.
 113. Interim governance mechanisms put in place to develop this Strategy will be formalised as part of strategy implementation to strengthen collective decision-making and delivery. The proposed

governance mechanisms will ensure full coverage and alignment across Chemical, Biological and Radiological threats.

114. Priority commitments out to 2030:

- We have established a lead minister for the Strategy, the Chancellor of the Duchy of Lancaster, who will convene and chair cross government ministerial meetings to collectively set direction and oversee implementation on behalf of the Prime Minister (PM). The lead Minister will engage with devolved government ministers from Scotland, Wales and Northern Ireland via the Inter Ministerial Standing Committee (IMSC),⁷⁷ and engage with First Ministers to ensure devolved matters of biosecurity are coordinated.
- The lead Minister will **report annually to Parliament** on progress on implementation of the Strategy.
- In consultation with the lead Minister, an overall **Senior Responsible Officer (SRO)** for biological security will be appointed to oversee implementation of the Strategy as a whole out to 2030. The SRO

⁷⁷ The Inter Ministerial Standing Committee (IMSC), chaired by the Chancellor of the Duchy of Lancaster, meets every other month and is attended by intergovernmental ministers from all four governments. It provides oversight of the intergovernmental relations system, bringing together strategic considerations affecting many different portfolios. The IMSC considers issues bearing wider implications for relationships between the governments, including issues cutting across different portfolios, cross-governmental programmes of work, cross-cutting international issues, or policy issues which have moved beyond technical considerations and into a wider political agenda.

will be accountable to the lead Minister and report to the relevant Cabinet Committee for National Security, convening regular **implementation group** meetings across government and the devolved governments to monitor and report risks, priorities and progress, advising the PM alongside the lead Minister.

- Departments responsible for delivering strategy commitments will report to the SRO and implementation group, with Senior Officials from the devolved governments also attending. The implementation group will formally agree how ‘nested’ strategies - including those for specific groups of biological threats or related areas of national security or prosperity policy⁷⁸ that are critical to the delivery of the Strategy - will report into the new governance structures to ensure coherent implementation.
- The SRO will appoint a **departmental lead** to oversee implementation of system-wide commitments across each of the Understand, Prevent, Detect and Respond pillars. They will be responsible for working with responsible departments, agencies and devolved governments under their assigned pillar, maintaining an awareness of overall risks, priorities, capability health and delivery towards pillar outcomes.

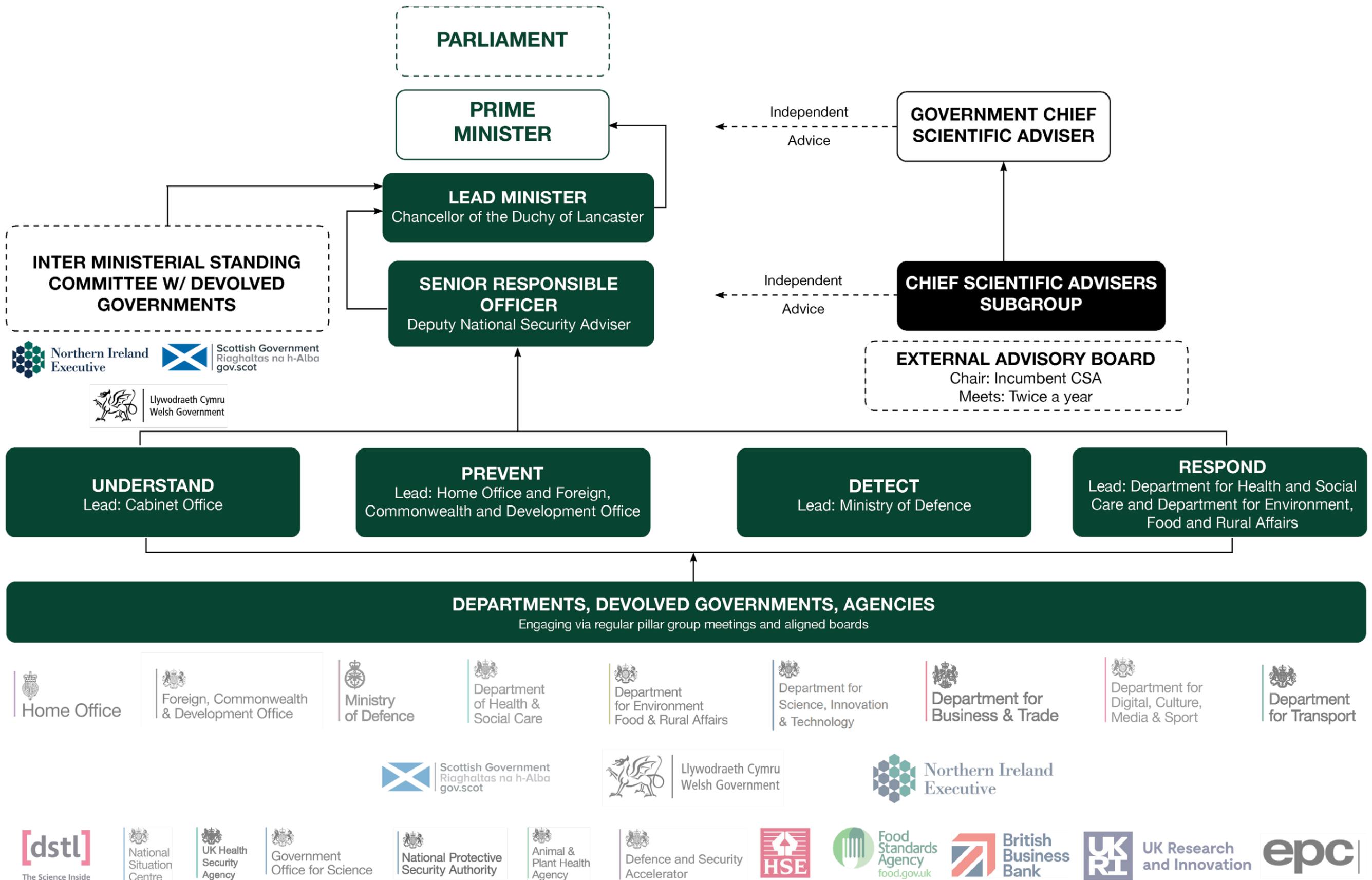
78 Such as pandemic preparedness, AMR, global health, and counter proliferation.

115. Ensuring that strong and independent scientific evidence, capability and analysis underpins all elements of decision making is critical to realising the mission and vision. This will be the key responsibility of a **subgroup consisting of Chief Scientific Advisers (CSA)**, appointed by the SRO. Together, the CSA subgroup will convene an **external CBR advisory board** which will include experts, innovators and investors from industry and academia, to provide authoritative independent challenge and advice to the SRO and lead Minister.
116. The CSA Subgroup will adopt a pragmatic approach, linking into and drawing expertise from advisory committees such as the Emerging Respiratory Virus Threats Advisory Group (NERVTAG), the Advisory Committee on Dangerous Pathogens (ACDP), the Human Animal Infections and Risk Surveillance (HAIRS) group, the Veterinary Risk Group, the Plant Health Risk Group and the Joint Committee on Vaccination and Immunisation (JCVI), and working with Science Advisory Councils across government.
117. To ensure effective implementation of the new governance and leadership structures and wide ranging strategy commitments, we will establish a central Biological Security Coordination Unit in the Cabinet Office. The unit will provide programmatic and secretariat support to the SRO and CSA subgroup, convene the cross-government and wider UK community, and coordinate, track and assist in

the reporting of progress in achieving the outcomes set out in this strategy.

- The unit will directly implement cross-cutting commitments that require stronger central ownership, particularly in the ‘Understand’ pillar, including collating the latest data, intelligence and expert assessments for the SRO and ministers on biological threats and trends, coordinating a regular programme of exercising for testing our preparedness and response plans for biological security risks, building a strong UK biological security community and coordinating engagement with international partners.

UK Biological Security Governance Structure



UK Science Base, Health and Life Science Sector

Strategic Enabler 2

- A world-class science base, resilient S&T capabilities against a spectrum of threats, and a thriving Health and Life Sciences sector, increasing trade and stimulating growth and investment across the UK.

118. The COVID-19 pandemic confirmed that the bedrock of our biological security is a robust One Health and R&D infrastructure, with public-private partnership and international collaboration driving a timely and effective response. Our ability to understand, prevent, detect and respond effectively to a spectrum of future biological threats is critically reliant on a strong UK science base both inside and outside government, and a thriving health and life science sector.

119. Our international strength in areas such as genomics, bioinformatics, population-level health data AI, modelling, virology and testing and trialling reflects our research talent across the UK. We will continue to support and grow these areas, to attract investment from across the globe and increase the UK's competitive advantage. Our commitment to invest £20 billion by 2024/25, in alignment with

the UK Innovation Strategy⁷⁹ and the Integrated Review,⁸⁰ will support our ambition - ensuring we capitalise on our strengths to cement the UK as a global science and technology (S&T) superpower.

120. For Life Sciences, UK universities rank second in the top five globally, UK researchers produce the third highest number of Life Sciences papers in high quality journals worldwide, after the USA and China, and the UK field-weighted citation impact is the highest in the G7.⁸¹
121. The UK is an attractive and secure place for R&D intensive S&T organisations to do business, with strong inward foreign direct investment, a vibrant venture capital market and Europe's leading unicorn companies sector.
122. The 2021 Life Sciences Vision set our ambition for the UK to become the leading global hub for Life Sciences,⁸² with genomics and health data identified as priority areas in which the UK has, or can gain, a competitive advantage globally.

79 Department for Business, Energy and Industrial Strategy (2021), [UK Innovation Strategy - GOV.UK](#).

80 Cabinet Office (2021), [Global Britain in a Competitive Age - The Integrated Review of Security Development and Foreign Policy - GOV.UK](#).

81 Department of Business, Energy and Industrial Strategy (2022), [International comparison of the UK research base - GOV.UK](#).

82 Office for Life Sciences, Department for Science, Innovation and Technology, and Department for Business, Energy & Industrial Strategy (2021), [Life Sciences Vision - GOV.UK](#).

123. We are a leading nation in developing the means to prevent, detect, and treat newly-emerged diseases. We have an opportunity to consolidate this leadership, drawing on our scientific strengths and our strong voice in the international fora in which standards and ethical and legal S&T regulations are set (including for emerging fields such as engineering biology), to help set and promote strong global standards and values for responsible innovation, consistent with our International Technology Strategy.⁸³
124. Specialist biological security infrastructure and a strengthened network of laboratories are critical to future preparedness across One Health and National Security, particularly for surveillance, detection and forensics capabilities. We will develop a national alliance and agree a **system-wide roadmap** for specialist biological security S&T infrastructure out to 2030, driving closer engagement between public and private sector labs and institutions to increase capacity across a range of critical capabilities and bolster system wide resilience to a spectrum of future biological security threats. This may include national reference laboratories, biosafety levels and higher containment facilities.
125. We will continue to work across government, with industry, academia and beyond to support the UK

83 Department for Science, Innovation and Technology and Foreign, Commonwealth & Development Office (2023), [The UK International Technology Strategy - GOV.UK](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/117111/uk-international-technology-strategy-2023.pdf)

to focus its science and technology capabilities and create a system that has real impact. This includes having the right skills and talent in the UK, a pro-innovation regulatory environment and available capital for innovative companies.

126. UK Research and Innovation (UKRI)⁸⁴ funds world-leading research and innovation that stimulates economic growth and the creation of jobs, while tackling national priorities. Within UKRI, support for vaccine development remains a key priority, with activity spanning discovery research to innovative product development. For example, a £16m ‘proactive vaccinology’ funding call has been recently launched by the Medical Research Council (MRC),⁸⁵ building on the best of the UK research response to the COVID-19 pandemic to support major new discovery research consortia, will underpin next-generation vaccine development. In parallel, a new animal vaccine manufacturing and innovation centre is being established at the Pirbright Institute.⁸⁶ The centre will rapidly assess promising new technologies in the field and develop and test novel vaccines for emerging diseases. This initiative is supported by £18.5 million from the

84 A non-departmental public body sponsored by the Department for Science, Innovation and Technology (DSIT).

85 UKRI, [Research Consortia to Underpin Proactive Vaccinology](#)

86 Funded by the Biotechnology and Biological Sciences Research Council (BBSRC), Foreign Commonwealth and Development Office and the Bill & Melinda Gates Foundation.

UK Government and UKRI, with a contribution of £14.5m from the Bill & Melinda Gates Foundation.

127. We will work with partners across government to **improve access to finance** and support for UK companies developing innovative biological security solutions, including through the following routes:

- The National Institute for Health and Care Research⁸⁷ has launched a scheme to provide NIHR infrastructure funding for centres to support the development of HealthTech and enable effective implementation of innovations to improve care and the healthcare system; to support industry partners with market access and early adoption, and support skills development to meet growing demands in the HealthTech space.
- The National Security Strategic Investment Fund (NSSIF)⁸⁸ is the Government's corporate venture capital arm for dual-use⁸⁹ advanced technologies. NSSIF invests commercially in advanced technology firms, alongside other investors, meaning that every pound invested is leveraged by private investment. NSSIF plans to deploy both equity investments and R&D contracts, to stimulate growth in the UK's biological security ecosystem,

87 [National Institute of Health and Care Research](#)

88 British Business Bank, [National Security Strategic Investment Fund](#).

89 Technology that has both commercial and national security applications.

while supporting the UK's defensive and protective biological security objectives.

- The Defence and Security Accelerator⁹⁰ (DASA) finds and funds innovations from across all industrial sectors and academia in the UK and overseas for defence and security purposes, including biological threats and healthcare challenges. DASA works across all technologies and maturity levels, delivering access to cutting edge science through its themed and open call mechanisms. It also provides support to developing businesses through novel access to mentoring and finance services, supporting companies in increasing the maturity of their innovations to deliver new or improved operational capabilities. This includes technologies directly relevant to biological security challenges.
- In 2021, BEIS launched the Life Sciences Investment Programme (LSIP) – a targeted, sectoral intervention to address the funding gap faced by growth-stage life sciences companies in the UK. Through LSIP, British Patient Capital (the commercial arm of the British Business Bank) has been allocated an additional £200m to make cornerstone commitments to later stage life sciences venture growth funds. This is expected to attract at least a further £400m of private

90 Ministry of Defence, [Defence and Security Accelerator - GOV.UK](https://www.gov.uk/government/organisations/defence-and-security-accelerator).

investment, ensuring the UK continues to be a world leader in health and life sciences innovation. Alongside LSIP, and as part of the UK-UAE Sovereign Investment Partnership (SIP) led by the Office for Investment, Mubadala (one of the UAE's sovereign wealth funds) committed to invest £800 million in the UK life sciences sector, meaning a total of £1 billion (£200m LSIP; £800m Mubadala) investment in the Life Sciences sector alone.

- BPC's £2.5bn Core Programme launched with the creation of BPC in 2018 to support the UK's venture and growth capital ecosystem and improve access to long-term finance for the most promising UK companies.
- The £375m Future Fund: Breakthrough, a UK-wide programme which encourages private investors to co-invest with BPC into high-growth, innovative firms.

128. The Innovate UK Knowledge Transfer Networks health funding opportunities map,⁹¹ developed with the BioIndustry Association (BIA),⁹² provides further information and advice to help navigate the diverse innovation landscape.

129. Through its sector teams and international network, the Department for Business and Trade (DBT) will leverage its role in export promotion and inward

91 Innovate UK KTN (2022), [Health Funding Map](#)

92 [UK BioIndustry Association](#)

investment to **achieve economic growth** through UK innovation and leadership in biological security. This will include proactively engaging global industry and capital investors on co-funding opportunities or calls-to-action aligned with priority UK policy or domestic industry requirements, reinforcing UK leadership in biological security and responsible innovation at key global events and engagements, and developing or extending export and investment propositions (including on One Health, genomics and engineering biology) targeted at global audiences. Maximising our presence at premier international tradeshows and conferences and through initiatives such as the DIT (now DBT) Global Innovators Showcase 2022, DBT continues to support innovative UK companies to export, invest, and invest to export, promoting the UK as a growth destination.

130. UK companies, with the support of the DBT, are creating industry leading hygiene programmes overseas using technology and standards exported from the UK as internationally recognised protocols. Hygiene standards are critical across the agriculture, food and health sectors to maintain biosecurity. VITEC Aspida⁹³ has operations in five locations overseas supporting hygiene programmes for more sustainable and ecologically safe biosecurity in medical, veterinary, food/beverage, hospitality

93 VITEC ASPIDA LIMITED

and leisure facilities, on farms (aquaculture, crops and livestock) and in slaughterhouses, as well as purification systems to disinfect and protect air, food, surface and water quality.

131. We will establish a pipeline of biological security S&T missions to mobilise public and private sector investment and innovation. In the first instance, the missions will focus on advancing:

- Next generation sequencing and surveillance: boosting investment in metagenomics and bioinformatics to enhance future detection technologies and systems - conducting regular trials to test effectiveness in a range of relevant clinical and operational environments (part of the DETECT pillar).
- Novel attribution in an era of engineered biology: developing novel methodologies and tools to reliably and confidently detect the presence and source of engineered biological agents (part of the 'DETECT' pillar).
- 100 Days Mission: Developing prototype therapeutics and vaccines against priority pathogens and threats, and accelerating innovations in platform technology against a future Disease X (part of the 'RESPOND' pillar).

132. A system-wide approach to biological security S&T missions will align and scale investments across the system, maximising efficiencies and incentivising the development of solutions able to address multiple threats and use cases. It will align with ongoing work such as the UKRI funding for Technology Missions; DSIT's work on the systems interventions that aim to solidify the UK's status as a science superpower.
133. The 2019 Science Capability Review⁹⁴ (SCR) provided a comprehensive assessment of the role of science in government. The review set out specific recommendations around our public sector research establishment (PSRE) capability, and skills - all of which aim to strengthen the use of science across government including in policy making and operational delivery. We will implement the SCR's recommendations to ensure that the Government has the right science system to deliver the objectives set out in this strategy.
134. Building on the work of the 2019 SCR and the framework it provides, we will **periodically review our biological security S&T capability health** to identify UK gaps and strengths, working across the public and private sector, to join up discussions on future capability investment and development plans.

94 Government Office for Science (2019), [Government Science Capability Review - GOV.UK](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/414247/government-science-capability-review.pdf).

135. We will build on nascent work to **develop the pipeline of biological security skills across the UK**, addressing skills gaps identified through the capability health assessment, including in key areas such as virology, bacteriology, modelling, plant science, bioinformatics and artificial intelligence. We will emulate the work set out under the National Cyber Security Skills Strategy, setting out skills needs publically, and influencing investment decisions to ensure we have a cadre of suitably qualified and experienced personnel (SQEP) that meets demands, both now and in the future.

Case Study: COVID-19 Genetics UK Consortium (COG-UK)

UK leadership in genomic sequencing came into the spotlight during the COVID-19 pandemic, as scientists prepared for the reality that the virus would mutate and new variants would emerge.

In assessing the likely progression of COVID-19, it was clear that the UK needed a national sequencing capability as part of the response, and that existing sequencing capability needed to be scaled up significantly and at great pace.

The COVID-19 Genetics UK Consortium (COG-UK) was established in response to this need in the very early stages of the pandemic response. It brought together, for

the first time, the four public health agencies of the UK and academic institutions to deliver a national capability for sequencing COVID-19 genomes. The network it built enabled decisions on public health to be taken, those that were predicated on robust data and enacted in times of emergency. £20 million of funding was provided by the National Institute for Health Research (NIHR), UK Research and Innovation (UKRI), and the Wellcome Sanger Institute, to support the establishment of the consortium. At the heart of COG UK's approach was a culture of close collaboration, data sharing and a willingness from the scientific community to contribute to public health action, policy decisions and long-term innovation that ultimately drove its success.

The success of COG-UK partnership has been profound. Prior to the pandemic, Public Health England sequenced around 50,000 genomes a year to track infectious disease outbreaks. In April 2022, around 70,000 SARS-CoV-2 genomes were sequenced across the UK in one week. Not only has the success of COG-UK been realised in the UK, but it has been transferred across the globe. The data generated here was shared with other nations to help shape their response during the pandemic. To bestow an important legacy, COG-UK took a decision to focus on training and education and in doing so, build sequencing capability in countries to support their efforts in responding to new outbreaks and tackling ongoing areas such as the fight against antimicrobial resistance.

International Leadership

Strategic Enabler 3

- International engagement and leadership to improve global health security and future pandemic prevention, preparedness and response, shape international biosafety and biosecurity norms, standards, practices and strengthen non-proliferation instruments and mechanisms.

136. COVID-19 demonstrated that the interconnected world is increasingly vulnerable to pathogens with catastrophic impacts. International engagement and collaboration is vital to prevent threats emerging from any source and to detect and respond early to contain global outbreaks, including by developing connected surveillance systems, resilient health systems and safe and effective diagnostics, therapeutics and vaccines.

137. In line with the Integrated Review, we will project 'One HMG' overseas by enhancing the coordination and coherence of our diplomatic, security and global health work. The recent launch of the Global Health Framework is reflective of the UK's continued commitment to improving global health outcomes, building on our record of working with others to deliver an impact on global health. We are well placed to provide greater global leadership across all aspects of biological security, working with our

international partners and through multilateral organisations, leveraging our scientific and technical capabilities to maximise our contribution.

138. During the UK's presidency of the G7 in 2021, we secured a Trade Ministerial statement on Trade and Health underlining the importance of open, diversified, secure, and resilient supply chains in the manufacture of COVID-19 critical goods and vaccines and their components and the need to reduce unnecessary barriers. Subsequently, at the World Trade Organisation's 12th Ministerial conference, where the UK played an active role, WTO Members agreed a Ministerial declaration on the WTO response to the COVID-19 pandemic and preparedness for future pandemics, which identifies areas of trade impacted during the pandemic and commits to ongoing work. We continue to work collaboratively at WTO to learn lessons and support future pandemic preparedness.

Understand

- The UK contributes to regular international tabletop exercises on biological security. In 2022, UK officials attended *Every Day Counts: A Pandemic Vaccine Exercise*⁹⁵ and the Nuclear Threat Initiative's annual exercise on *Reducing High-Consequence Biological Threats*.

95 [CEPI \(2022\), Johns Hopkins Center for Health Security, the German Federal Ministry of Education and Research, and the Munich Security Conference Convene Global Actors on Accelerating the Development of Vaccines against Future Pandemic Threats.](#)

Prevent

- The UK plays an active role in all relevant international non proliferation fora and supports the key multilateral regimes, including as a Depositary government to the BTWC. In 2021, we chaired the G7 Global Partnership against the Spread of Weapons of Mass Destruction, leading the development of a Biosecurity Signature Initiative for Africa.
- We have a proud record of leadership in global health and international development, including world leading work on AMR, and One Health, including via the Global Antimicrobial Resistance Innovation Fund (GAMRIF). GAMRIF supports early-stage innovative research in underinvested areas of science to reduce the threat of AMR for the benefit of people in low- and middle-income countries (LMICs) who bear the greatest burden of AMR.

Detect

- Through our G7 Presidency in 2021, we promoted the development of the International Pathogen Surveillance Network, which aims to bring genomic surveillance to speed and scale, to provide quality, timely and representative data within the broader surveillance architecture to better inform decision-making and public health action.

Respond

- We are the largest donor to Gavi,⁹⁶ whose core mission is to save lives and protect people's health by increasing equitable and sustainable use of vaccines, and the UK is a founding member of COVID-19 Vaccines Global Access (COVAX). British researchers offered their expertise in genome sequencing to support other countries in tracking new variants. AstraZeneca and its partners have released two billion doses of their COVID-19 vaccine, developed at Oxford University, to more than 170 countries around the world. The findings of the UK's RECOVERY Trial have prevented over a million deaths worldwide.⁹⁷
- During the UK's presidency of the G7 in 2021, at the height of the COVID-19 pandemic, we secured commitment to vaccine dose sharing, established the 100 Days Mission for vaccines, therapeutics and diagnostics, set up the International Zoonoses Community of Experts and in March 2022 hosted the CEPI Global Pandemic Preparedness Summit, where the global community pledged over \$1.5 billion for their ambitious plan to tackle epidemics and pandemics.⁹⁸

96 The UK is one of Gavi's six original donors and one of two donor countries that support Gavi through all four funding channels (direct grants, IFFIm, PCV AMC and COVAX AMC).

97 NHS England (2021), COVID treatment developed in the NHS saves a million lives.

98 CEPI (2022), Global community comes together in support of 100 Days Mission and pledges over \$1.5 billion for CEPI's pandemic-busting plan.

Case Study: The 100 Days Mission

The 100 Days Mission aims to have safe and effective vaccines, therapeutics and diagnostics within 100 days of an epidemic or pandemic threat being identified. It calls on the international community, including governments, industry, academia and international organisations, to work together to achieve the mission, which could prevent future pandemics before they start, saving millions of lives. The mission was put forward by the UK under its Presidency of the Group of 7 (G7) in 2021 and has been welcomed by leaders of the G7 and Group of 20 (G20) and backed by representatives of the life sciences industry.

The 100 Days Mission report⁹⁹ sets out a roadmap for making collective resilience to pandemics achievable, through recommendations for governments, international organisations, and industry partners to take forward, working collectively and collaboratively to achieve this ambitious target for the global good. When it was launched in 2021 G7 leaders recognised that to achieve these ambitions, the work had to be inclusive. We need to find solutions that will work at all income levels and will address the needs of groups who are too easily excluded, such as the diverse experiences of countries around the world, and the key needs of women and girls.

Close working between the UK government, the Coalition for Epidemic Preparedness Innovations (CEPI),

99 Cabinet Office (2021), [100 Days Mission: First Implementation Report - GOV.UK](#)

Foundation for Innovative New Diagnostics (FIND), Unitaid and the life sciences industry has been critical in the response to COVID-19 and has enabled the development of safe and effective vaccines, therapeutics and diagnostics in unprecedented timeframes. The UK has supported the establishment of a time limited, independent international secretariat and permanent domestic secretariat to ensure that the Mission succeeds, putting it on a global footing, facilitating partnerships across the public and private sectors, and continuing to produce annual implementation reports on progress and necessary future milestones to achieve the mission. In addition to other critical enabling factors within the global health architecture, such as improved pathogen surveillance and immediate information, biosample and data sharing.

139. We will pursue our objectives to strengthen global health and biological security through key multilateral fora, recognising we may face obstacles to progress in certain areas:

- The UK is a top donor to the WHO. Our £340m fully flexible core funding (2020-24) aims to enable WHO reform, address UK global health priorities, and tackle future pandemics. We are playing a key role in the negotiations for a legally binding instrument on pandemic preparedness and response.
- To reinforce global non proliferation instruments and mechanisms, we will continue to promote confidence building measures (CBMs) in the BTWC, including sharing expertise and providing assistance; continue to play a leading role in strengthening the UNSGM for investigations of alleged use of chemical and biological weapons by nominating qualified experts, expert consultants and laboratories, providing training and funding capacity building, and supporting the Friends of the UNSGM group; and work with different groupings of countries (e.g. the Australia Group) to maintain export controls on dual-use biotechnologies and materials.
- We will work closely with the private sector and non-government partners, including the Wellcome Trust, the Organisation for Economic Co-operation

and Development (OECD), the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA), the Bill and Melinda Gates Foundation (BMGF) and the International Biosecurity and Biosafety Initiative for Science (IBBIS), who will be increasingly influential in promoting strong regulations, standards and best practice.

140. To support in-country global health and security initiatives, we will continue to be a major funder of projects overseas and will maximise their impact through better strategic coherence across HMG, reducing the excessive bureaucracy associated with delivering aid:

- We will continue to contribute to filling the remaining gaps in vaccination efforts and enabling the scaling-up of sustainable regional production capacity, as detailed in the G7 Foreign Ministers Action Plan. We have committed to continued investment in The Coalition for Epidemic Preparedness Innovations (up to £160 million over five years) to coordinate and catalyse global activity to reduce the risk of future outbreaks and strengthen the world's defences through developing and scaling up vaccines.
- Through our International Development strategy, in line with the 100 Days Mission, we directly support improving disease diagnostics in Low and Middle

Income Countries (LMICs), including by supporting the Foundation for Innovative Diagnostics (FIND) to drive down the price of diagnostic tests, and invest in R&D to develop next generation diagnostics, which are easy to use and can identify variants across priority virus families.

- We will continue to be a world leader in supporting the gathering and sharing of AMR data, through the Fleming Fund and work with partner countries to strengthen their compliance with International Health Regulations (IHR), including on surveillance and response, through the IHR Strengthening Project and the UK-Public Health Rapid Support Team.
- In the UK's Plant Biosecurity Strategy 2023 - 2028,¹⁰⁰ we have committed to support the advance the plant health systems of other nations, including developing countries and our overseas territories. This will be achieved through technical assistance activities, such as training programmes and active development of processes and facilities.
- The UK International Biological Security Programme has received a significant uplift in funding to minimise the potential for hostile actors to acquire and use biological materials, pathogens and expertise to threaten the UK or UK interests.

100 Department for Environment, Food & Rural Affairs, Forestry Commission, The Scottish Government, and Welsh Government (2023), Plant Biosecurity Strategy for Great Britain (2023 to 2028) - GOV.UK.

141. As outlined in Outcome 12, **we will continue to be a world leader in supporting international responses to a natural outbreak, accidental release or deliberate attack**, including by prioritising the development and agreement of standards and protocols for the rapid sharing of data and samples.

Annex A: Glossary

Animal and Plant Health Agency (APHA)

An executive agency of the Department for Environment, Food and Rural Affairs responsible for safeguarding animal and plant health for the benefit of people, the environment and the economy.

Antimicrobial resistance (AMR)

Resistance of micro-organisms which cause infection to a medicine that would normally kill them or stop their growth.

Artificial Intelligence (AI)

The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

Attribution

The linkage of biological material to a particular source through comparison of the characteristics of the material in question to those of a known origin.

Australia Group

A co-operative and voluntary group of 42 member states (including the EU) working to counter the spread of materials, equipment and technologies that could contribute to the development or acquisition of chemical and biological weapons by states or terrorist groups.

Biological and Toxin Weapons Convention (BTWC)

The BTWC prohibits the development, production and stockpiling of biological and toxin weapons and, as recognised by its Review Conferences, effectively prohibits their use. It entered into force on 26 March 1975. The UK is one of three depository states for the Convention.

Biological Safety Levels (BSL)

Biological Safety Levels (BSL) are a series of protections relegated to autoclave-related activities that take place in particular biological labs. They are individual safeguards designed to protect laboratory personnel, as well as the surrounding environment and community.

BSL-1

As the lowest of the four, biosafety level 1 applies to laboratory settings in which personnel work with low-risk microbes that pose little to no threat of infection in healthy adults. An example of a microbe that is typically worked with at a BSL-1 is a nonpathogenic strain of *E. coli*.

BSL-2

This biosafety level covers laboratories that work with agents associated with human diseases (i.e. pathogenic or infectious organisms) that pose a moderate health hazard. Examples of agents typically worked with in a BSL-2 include equine encephalitis viruses and HIV, as well as *Staphylococcus aureus* (staph infections).

BSL-3

Again building upon the two prior biosafety levels, a BSL-3 laboratory typically includes work on microbes that are either indigenous or exotic, and can cause serious or potentially lethal disease through inhalation. Examples of microbes worked with in a BSL-3 includes; yellow fever, West Nile virus, and the bacteria that causes tuberculosis.

BSL-4

BSL-4 labs are rare. As the highest level of biological safety, a BSL-4 lab consists of work with highly dangerous and exotic microbes. Infections caused by these types of microbes are frequently fatal, and come without treatment or vaccines. Two examples of such microbes include Ebola and Marburg viruses.

CBRN

Chemical, biological, radiological and nuclear.

Chemical and biological warfare

The intentional use of chemicals, bacteria, viruses, toxins, or poisons to injure or kill individuals.

COG-UK

The COVID-19 Genomics UK Consortium is a group of public health agencies and academic institutions in the United Kingdom created in April 2020 to collect, sequence and analyse genomes of SARS-CoV-2 as part of COVID-19 pandemic response.

CONTEST

The UK's counter-terrorism strategy.

COVID-19

SARS-CoV-2 is the coronavirus that emerged in December 2019. COVID-19 has caused millions of deaths around the world, as well as longer term health problems in some who have survived.

CSA

Chief Scientific Advisers (CSA) are responsible for providing scientific advice to their respective departments on aspects of policy on science and technology, as well as ensuring and improving the quality and use of scientific evidence and advice across government.

DARPA

The Defense Advanced Research Projects Agency is a research and development agency of the United States Department of Defense responsible for the development of emerging technologies for use by the military.

Defence Science and Technology Laboratory (Dstl)

An executive agency of the Ministry of Defence that supplies specialist science and technology advice and expertise for UK defence and security.

Department for Business and Trade (DBT)

A UK government department that brings together the business focused functions of the former Department for Business, Energy and Industrial Strategy (BEIS) and the Department for International Trade (DIT).

Department of Science, Innovation and Technology (DSIT)

A UK government department that brings together the relevant parts of the former Department for Business, Energy and Industrial Strategy and the former Department for Digital, Culture, Media and Sport to position the UK at the forefront of global scientific and technological advancement.

Department for Environment, Food and Rural Affairs (DEFRA)

The UK Government department responsible for safeguarding our natural environment, supporting our world-leading food and farming industry, and sustaining a thriving rural economy.

Department of Health and Social Care (DHSC)

The UK Government department responsible for leading, shaping and funding health and care in England.

Devolved governments

The Scottish Government, Welsh Government and Northern Ireland Executive.

Disease X

Disease X is the mysterious name given to the very serious threat that unknown viruses pose to human health.

Fleming Fund

A £265m project which aims to improve laboratory capacity for diagnosis as well as surveillance of

antimicrobial resistance (AMR) in low and middle income countries across Asia and Africa.

Foreign, Commonwealth and Development Office (FCDO)

The UK Government department responsible for promoting the UK's interests overseas and supporting our citizens and businesses around the globe.

National Security Council (NSC)

The UK's National Security Council is a Cabinet Subcommittee to consider matters relating to national security, foreign policy, defence, trade strategy, international relations, development, resilience and resource security.

G7

A group of seven of the world's leading industrial nations: Canada, France, Germany, Italy, Japan, UK and USA, along with representation from the EU.

Genomic Sequencing

A method that is used to determine the entire genetic makeup of a specific organism or cell type. This method can be used to find changes in areas of the genome.

Global Health Security Initiative (GHSI)

An informal, international partnership among like-minded countries to strengthen health preparedness and the global response to threats of CBRN terrorism and pandemic influenza.

Global Partnership (GP)

The G7 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction has 31 member states, and addresses non-proliferation, disarmament, counter-terrorism and nuclear safety issues through co-operative projects.

GCSA

The Government Chief Scientific Adviser (GCSA) is responsible for providing scientific advice to the Prime Minister and members of the Cabinet, advising the government on aspects of policy on science and technology, as well as ensuring and improving the quality and use of scientific evidence and advice in government. Sir Patrick Vallance is the incumbent UK GCSA.

Government Office for Science (GO Science)

The UK Government agency responsible for ensuring that Government policies and decisions are informed by the best scientific evidence and strategic long term thinking.

Health and Safety Executive (HSE)

Britain's national regulator for workplace health and safety.

Home Office

The UK Government department responsible for immigration and passports, crime, drugs policy, fire, counter-terrorism and police.

Hostile actors

They include foreign states, criminals and terrorists. The resources and capabilities of such actors vary.

Integrated Review

The Integrated Review is a comprehensive articulation of the UK's national security and international policy. It outlines three fundamental national interests that bind together the citizens of the UK – sovereignty, security and prosperity – alongside our values of democracy and a commitment to universal human rights, the rule of law, freedom of speech and faith, and equality.

International Biological Security Programme (IBSP)

Managed by MOD and largely implemented through the Defence, Science and Technology Laboratory (Dstl), the International Biological Security Programme aims to minimise the risk that states or terrorists seeking to develop a biological weapons capability will acquire and use materials or expertise which could threaten the UK, UK Armed Forces, UK interests or our partners.

International Health Regulations (IHR)

An international legal instrument with the aim to help the international community prevent and respond to acute public health risks that have the potential to cross borders and threaten people worldwide.

International rules based order

Regularised practices of exchange among discrete political units that recognize each other to be interdependent.

Life Sciences

The sciences concerned with the study of living organisms, including biology, botany, zoology, microbiology, physiology, biochemistry, and related subjects.

Ministry of Defence (MOD)

The UK Government department responsible for protecting the security, independence and interests of our country at home and abroad.

NERVTAG

The New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG) advises the government on the threat posed by new and emerging respiratory viruses.

National Protective Security Authority

The UK Government's national technical authority for physical and personnel protective security.

NSRA

The National Security Risk Assessment (NSRA) was designed to compare, assess and prioritise all major disruptive risks to our national security.

National Security Council (NSC)

The main forum for collective discussion of the Government's objectives for national security and how best to deliver them. It currently has four subcommittees, including the Threats, Hazards, Resilience and Contingencies Subcommittee.

Office for Life Sciences (OLS)

The UK agency that leads on Government's policy for the UK's health and biological sciences industries.

One Health

The UK sees One Health as referring to two related ideas: first, it is the concept that the health of humans, animals, plants and the environment we live in are inextricably linked and interdependent. Second, it refers to the collaborative and sustained effort of multiple disciplines working locally, nationally, regionally, and globally to attain optimal health for all living things and the ecosystems in which they co-exist.

Responsible innovation

As defined by UKRI, Responsible innovation is a process that takes the wider impacts of research and innovation into account. It aims to ensure that unintended negative impacts are avoided, that barriers to dissemination, adoption and diffusion of research and innovation are reduced, and that the positive societal and economic benefits of research and innovation are fully realised.

Sanitary and Phytosanitary (SPS) Measures

Sanitary and phytosanitary (SPS) measures, stemming from the Agreement on the Application of Sanitary and Phytosanitary Measures, an international treaty of the World Trade Organization, aim to protect human, animal or plant life or health from certain risks.

SIGMA+

The SIGMA+ program aims to expand SIGMA's advance capability to detect illicit radioactive and nuclear materials by developing new sensors and networks that would alert authorities to chemical, biological, and explosives threats as well. SIGMA+ calls for the development of highly sensitive detectors and advanced intelligence analytics to detect minute traces of various substances related to weapons of mass destruction (WMD) threats.

The National Situation Centre

The National Situation Centre brings together a unique set of skilled people, capabilities and experience, operating 24/7 and extended hours to support horizon scanning and crisis-response across the full range of national risks, from civil emergencies to national security issues.

UKPLC

An informal term meaning the United Kingdom commercial community considered as a single organisation; or the commercial interests of the United Kingdom considered as a whole

UK Research and Innovation (UKRI)

Unified organisation championing UK research nationally and internationally, bringing together the seven Research Councils, Innovate UK and Research England.

UNSGM

United Nations Secretary-General's Mechanism for Investigation of Alleged Use of Chemical and Biological Weapons.

Vector

Agent responsible for the transmission of a pathogen. Typical examples include mosquitoes, midges, biting flies and ticks.

World Health Organization (WHO)

The international organisation within the United Nations responsible for directing global health responses.

Zoonoses

Diseases that can be transmitted from animals to humans. The animals may not show clinical signs, while the humans may be severely affected. Examples include Salmonella, E. coli, rabies and West Nile fever.

Zoonotic spillover events/zoonoses

The transmission of pathogens from animals to humans is called "zoonotic spillover".

Bibliographies

1. There are many different definitions of biological security. In this strategy, we use the term to mean the protection of the UK and UK interests from biological risks whether these arise naturally, or through an accidental release of hazardous biological material, or a deliberate biological attack. These risks could affect humans, animals, plants or the environment more broadly.
2. Cabinet Office (2023), [Integrated Review Refresh 2023: Responding to a more contested and volatile world - GOV.UK](#)
3. European Antimicrobial Resistance Collaborators (2022), [The burden of bacterial antimicrobial resistance in the WHO European region in 2019: a cross-country systematic analysis](#), The Lancet Public Health, Volume 7, Issue 11.
4. OECD (2018), [Stemming the Superbug Tide: Just A Few Dollars More](#), OECD Health Policy Studies, OECD Publishing, Paris.
5. Jim O'Neill (2016), [Tackling Drug-Resistant Infections Globally: Final Report And Recommendations](#), The Review On Antimicrobial Resistance.
6. National Audit Office (2022), [COVID-19 cost tracker - National Audit Office \(NAO\) overview](#).

7. National Audit Office (2022), COVID-19 cost tracker - National Audit Office (NAO) overview.
8. Benaich, N & Hogarth, I (2022), State of AI Report 2022.
9. Inglesby T (2018), Horsepox and the need for a new norm, more transparency, and stronger oversight for experiments that pose pandemic risks, PLoS Pathogens, Volume 14, Issue 10.
10. World Health Organization (2014), Zoonotic disease: emerging public health threats in the Region.
11. National Audit Office (2005), Foot and Mouth Disease: Applying the Lessons - National Audit Office (NAO) report.
12. Plant Biosecurity Strategy for Great Britain (2023 to 2028) - GOV.UK.
13. Antimicrobial Resistance Collaborators (2022), Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis, The Lancet, Volume 399, Issue 10325.
14. OECD (2018), Stemming the Superbug Tide: Just A Few Dollars More, OECD Health Policy Studies, OECD Publishing, Paris.
15. Food Standards Agency (2020), Foodborne Disease Estimates for the United Kingdom in 2018.

16. The White House (2021), American Pandemic Preparedness: Transforming Our Capabilities.
17. World Health Organization (2003), Climate change and human health: risks and responses.
18. IPBES (2020), Workshop Report on Biodiversity and Pandemics of the Intergovernmental Platform on Biodiversity and Ecosystem Services.
19. Tellefson, J (2020), Why deforestation and extinctions make pandemics more likely.
20. Antimicrobial Resistance Collaborators (2022), Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis, The Lancet, Volume 399, Issue 10325.
21. World Intellectual Property Organization (2022), Global Innovation Index 2022 - What is the future of innovation driven growth?
22. Benaich, N & Hogarth, I (2022), State of AI Report 2022.
23. Office for Life Sciences, Department for Science, Innovation and Technology, and Department for Business, Energy & Industrial Strategy (2021), Life Sciences Vision - GOV.UK.
24. The UK sees One Health as referring to two related ideas: first, it is the concept that the health of humans, animals, plants and the environment we live in are inextricably linked and interdependent.

Second, it refers to the collaborative and sustained effort of multiple disciplines working locally, nationally, regionally, and globally to attain optimal health for all living things and the ecosystems in which they co-exist.

25. New and Emerging Respiratory Virus Threats Advisory Group – GOV.UK.
26. Human Animal Infections and Risk Surveillance Group - GOV.UK.
27. Ministry of Defence (2022), The Defence Capability Framework - GOV.UK.
28. Department for Environment, Food and Rural Affairs, UK Plant Health Risk Register- GOV.UK.
29. Global Change Data Lab (2023), Our World In Data
30. Johns Hopkins Coronavirus Resource Center, COVID-19 Dashboard.
31. National Institutes of Health (2022), About - NCBI.
32. GISAID
33. National Cyber Security Centre, Cyber Aware.
34. National Audit Office (2021), The government's preparedness for the COVID-19 pandemic: lessons for government on risk management.
35. Tan YB et al (2022), Molecular architecture of the Chikungunya virus replication complex, Science Advances, Volume 8, Issue 4.

36. Cabinet Office (2021), 100 Days Mission to Respond to Future Pandemic Threats - GOV.UK.
37. Foreign, Commonwealth and Development Office and Department of Health and Social Care (2023), Global Health Framework: working together towards a healthier world - GOV.UK.
38. HM Government (2020), 2025 UK Border Strategy - GOV.UK.
39. HM Government (2022), The Border with the European Union, Importing and Exporting Goods - GOV.UK.
40. University of Oxford (2020), About the Oxford COVID-19 vaccine.
41. UK Health Security Agency (2022), UK completes over 2 million SARS-CoV-2 whole genome sequences - GOV.UK.
42. Esvelt K.M (2018), Inoculating science against potential pandemics and information hazards, PLoS Pathogens Volume 14, Issue 10.
43. Richardson et al. (2019), Cyberbiosecurity: A Call for Cooperation in a New Threat Landscape, Frontiers in Bioengineering and Biotechnology, Volume 7, Issue 99.
44. Murch, R. S et al (2018), Cyberbiosecurity: an emerging new discipline to help safeguard the

bioeconomy, *Frontiers in Bioengineering and Biotechnology*, Volume 6, Issue 39.

45. Cabinet Office (2020), National Security and Investment Act - GOV.UK
46. National Protective Security Authority (2023), Trusted Research Guidance for Academia.
47. National Protective Security Authority (2022), Trusted Research Guidance for Industry
48. For example, the Code of Practice for Research published by the UK Research and Integrity Office
49. World Health Organization (2022): Global guidance framework for the responsible use of the life sciences: mitigating biorisks and governing dual-use research.
50. Foreign, Commonwealth and Development Office (2013), Academic Technology Approval Scheme (ATAS) - GOV.UK.
51. UK Energy Research Centre (2021), Trusted Research Campaign.
52. European Union (2022), General Statement at the Ninth Review Conference of the BTWC.
53. Cabinet Office (2021), Carbis Bay G7 Summit Communique - GOV.UK.

54. Department of Health and Social Care (2021), G7 Therapeutics and Vaccines Clinical Trials Charter - GOV.UK.
55. Cabinet Office (2021), 100 Days Mission to Respond to Future Pandemic Threats - GOV.UK.
56. Foreign, Commonwealth and Development Office (2022), UK government's strategy for international development - GOV.UK.
57. Department of Health and Social Care (2019), UK 5-year action plan for antimicrobial resistance 2019 to 2024 - GOV.UK.
58. The Fleming Fund brings evidence and people together to encourage action against drug resistance for a healthier world by supporting low- and middle-income countries to generate, share and use antimicrobial resistance data
59. Department for Environment, Food & Rural Affairs, Forestry Commission, The Scottish Government, and Welsh Government (2023), Plant biosecurity strategy for Great Britain (2023 to 2028) - GOV.UK.
60. Jonathan Holmes (2021), Brexit and the end of the transition period: what does it mean for the health and care system?
61. Department for Environment, Food and Rural Affairs analysis of HMRC trade data, including all products covered by OCR.

62. UK Health Security Agency (2023), Syndromic surveillance: systems and analyses - GOV.UK.
63. Observatree: Monitoring Tree Health.
64. COVID-19 Genetics UK Consortium
65. At time of publication this is Section 251 of the National Health Service Act 2006.
66. European Council (2022), G7 Leaders' Communique.
67. Venkatesan, P. (2020), COVID-19 diagnostics— not at the expense of other diseases, The Lancet Microbe, Volume 1, Issue 2.
68. Cabinet Office (2021), 100 Days Mission to Respond to Future Pandemic Threats - GOV.UK.
69. Simpson S et al (2020), Disease X: accelerating the development of medical countermeasures for the next pandemic, The Lancet, Volume 20, Issue 5.
70. Department for Environment, Food & Rural Affairs, Forestry Commission, The Scottish Government, and Welsh Government (2023), Plant biosecurity strategy for Great Britain (2023 to 2028) - GOV.UK.
71. Life Sciences Vision - GOV.UK: The government and the life science sector's plan to create a thriving sector, and tackle the major causes of death and disease.

72. Airfinity (2022), AstraZeneca and Pfizer/BioNTech saved over 12 million lives in the first year of vaccination.
73. Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP), World Organisation for Animal Health (WOAH) and World Health Organisation (WHO)
74. The Global Pandemic Data Alliance
75. Department for Environment, Food & Rural Affairs (2023), The Great Britain invasive non-native species strategy - GOV.UK.
76. Department of Health and Social Care (2022), Moderna to open vaccine research and manufacturing centre in UK - GOV.UK.
77. The Inter Ministerial Standing Committee (IMSC), chaired by the Chancellor of the Duchy of Lancaster, meets every other month and is attended by intergovernmental ministers from all four governments. It provides oversight of the intergovernmental relations system, bringing together strategic considerations affecting many different portfolios. The IMSC considers issues bearing wider implications for relationships between the governments, including issues cutting across different portfolios, cross-governmental programmes of work, cross-cutting international issues, or policy issues which have moved beyond

technical considerations and into a wider political agenda.

78. Such as pandemic preparedness, AMR, global health, and counter proliferation.
79. Department for Business, Energy and Industrial Strategy (2021), [UK Innovation Strategy - GOV.UK](#).
80. Cabinet Office (2021), [Global Britain in a Competitive Age - The Integrated Review of Security Development and Foreign Policy - GOV.UK](#).
81. Department of Business, Energy and Industrial Strategy (2022), [International comparison of the UK research base - GOV.UK](#).
82. Office for Life Sciences, Department for Science, Innovation and Technology, and Department for Business, Energy & Industrial Strategy (2021), [Life Sciences Vision - GOV.UK](#).
83. Department for Science, Innovation and Technology and Foreign, Commonwealth & Development Office (2023), [The UK International Technology Strategy - GOV.UK](#)
84. A non-departmental public body sponsored by the Department for Science, Innovation and Technology (DSIT).
85. UKRI, [Research Consortia to Underpin Proactive Vaccinology](#)

86. Funded by the Biotechnology and Biological Sciences Research Council (BBSRC), Foreign Commonwealth and Development Office and the Bill & Melinda Gates Foundation.
87. National Institute of Health and Care Research
88. British Business Bank, National Security Strategic Investment Fund.
89. Technology that has both commercial and national security applications.
90. Ministry of Defence, Defence and Security Accelerator - GOV.UK.
91. Innovate UK KTN (2022), Health Funding Map
92. UK BioIndustry Association
93. VITEC ASPIDA LIMITED
94. Government Office for Science (2019), Government Science Capability Review - GOV.UK.
95. CEPI (2022), Johns Hopkins Center for Health Security, the German Federal Ministry of Education and Research, and the Munich Security Conference Convene Global Actors on Accelerating the Development of Vaccines against Future Pandemic Threats.
96. The UK is one of Gavi's six original donors and one of two donor countries that support Gavi through all

four funding channels (direct grants, IFFIm, PCV AMC and COVAX AMC).

97. NHS England (2021), COVID treatment developed in the NHS saves a million lives.
98. CEPI (2022), Global community comes together in support of 100 Days Mission and pledges over \$1.5 billion for CEPI's pandemic-busting plan.
99. Cabinet Office (2021), 100 Days Mission: First Implementation Report - GOV.UK
100. Department for Environment, Food & Rural Affairs, Forestry Commission, The Scottish Government, and Welsh Government (2023), Plant Biosecurity Strategy for Great Britain (2023 to 2028) - GOV.UK.



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