

World Leading Genomics and Personalised Medicine in the UK

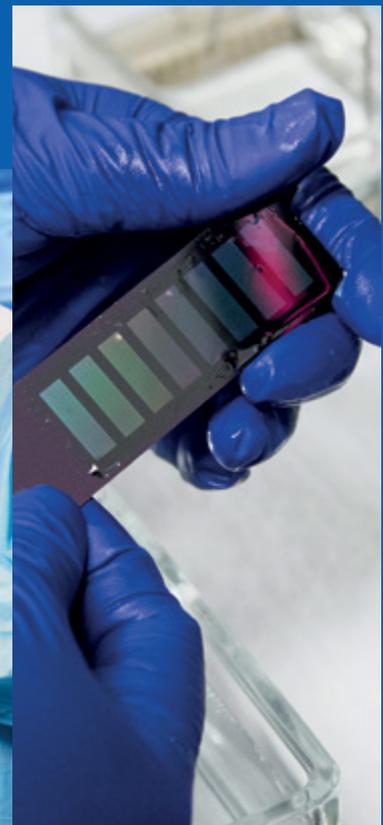


GREAT

BRITAIN & NORTHERN IRELAND

Section 1

Creating a future where genomics is at the heart of patient care



How the UK is leading on genomics

The UK has built an end-to-end ecosystem that accelerates genomic research to deliver healthcare, benefiting patients and innovation.

The UK is a recognised global leader in genomics. From seminal discoveries in fundamental science to translation into clinical practice, and improved patient outcomes, the UK has made a vast contribution to this rapidly evolving and exciting field.

The UK genomics sector is at the forefront of these technologies and its growth is driven by a thriving community of entrepreneurs, scaling SMEs, global companies, and an active investor base. The sector is supported by academic excellence at scale, research institutes, the NHS, government support, and unique data resources such as the UK Biobank and Genomics England.

We are committed to a future where genomics greatly improves the mental and physical wellbeing of the UK population and millions more worldwide. This translates to developing a better understanding of the genetic causes of disease, along with provision of tailored therapies, meaning patients get the treatments and advice that work for them. Predictive interventions and addressing diseases before they appear, are also starting to deliver on the promise of preventative medicine at scale.

This document sets out to explain the core strengths of the UK genomics industry, and how it is changing patient care and health outcomes around the globe.



The UK's genomics sector carries a rich legacy. Just as Franklin, Crick and Watson made scientific progress possible by elucidating the DNA double helix structure in 1953, today UK start-ups and SMEs are leading the world in the genomic revolution. Increased public and private investment in the sector promises to unlock a new era of genomic innovation which will transform patients' lives in the UK and beyond.

Steve Bates OBE, CEO of the BioIndustry Association (BIA)

A partnership working approach between the sector and government is applying billions of pounds of funding to deliver the **Next Generation** of life-changing treatments and technologies

Statistics

100,000

Genomics England project which achieved its 100,000 sequenced genomes target in 2018

£1.2 billion

Companies using genomics to develop therapeutics have raised £1.2bn in private capital since 2011

1st

1st country worldwide to apply whole genome sequencing at scale in direct healthcare

500,000

Aim to sequence 500,000 whole genomes as part of the NHS England Genomics Medicine Service

154

UK genomics companies, employing over 5000 highly skilled people and with a market of over £5bn

Source: [https://www.bioindustry.org/news-listing/new-report-reveals-strength-of-the-uks-thriving-genomics-sector.html#:~:text=The%20BioIndustry%20Association%20\(BIA\)%2C,patients%20and%20the%20UK%20economy.](https://www.bioindustry.org/news-listing/new-report-reveals-strength-of-the-uks-thriving-genomics-sector.html#:~:text=The%20BioIndustry%20Association%20(BIA)%2C,patients%20and%20the%20UK%20economy.)

Section 2

How the UK is creating a vision for the future



The Genome UK strategy from the UK Government

Setting out the plan to maintain and extend the UK's leadership position: to deliver the future of healthcare; enabling the provision of world-leading genomic healthcare to patients in the UK and across the world. The strategy sets out an ambitious and compelling vision for how the UK will create the most advanced genomic healthcare ecosystem in the world, underpinned by the latest scientific advances and public support to deliver better health outcomes for our population.

This strategy sets out an exciting and compelling vision for the future which is focused on three key areas:

Pillar 1:

Diagnosis and personalised medicine

Incorporating the latest genomics advances into routine healthcare to improve the diagnosis and treatment of illness.

Pillar 2:

Prevention

Enabling predictive and preventative care to improve public health and wellness.

Pillar 3:

Research

Supporting fundamental and translational research and ensuring a seamless interface between research and healthcare delivery.

Source: www.gov.uk/government/publications/genome-uk-the-future-of-healthcare



The UK:

Forward-thinking with a track record of scientific breakthroughs

The Life Sciences sector vision was launched by UK Government in July 2021, and one of its strategic goals is to build on the UK's Clinical Research, Genomic and Health Data capabilities. The ambition is to harness the UK's prior investments to fully integrate genomics into health service delivery through the Genomic Medicine Service, and deliver significant advancements in the understanding, diagnosis, and treatment of disease.

www.gov.uk/government/publications/life-sciences-vision

The COVID-19 pandemic has indeed shone a spotlight on the UK's rapidly growing genomics industry, today worth over £5 billion and raising 34% of the wider UK life sciences sector's total investment, according to the BIA's Genomics Nation Report. One of the key strengths of the UK is the vibrant and collaborative innovation ecosystem it has nurtured.

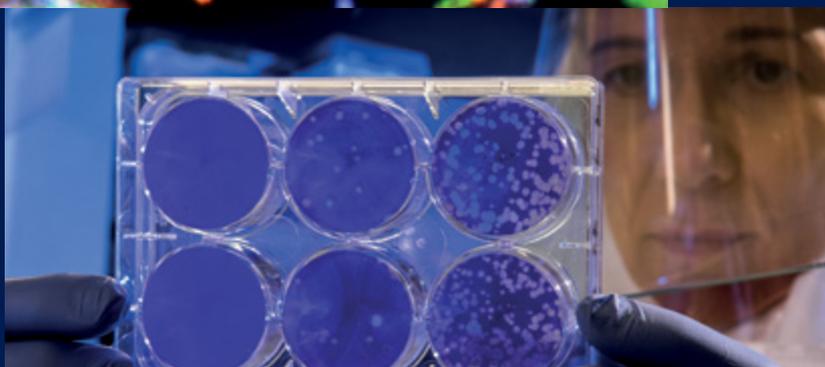
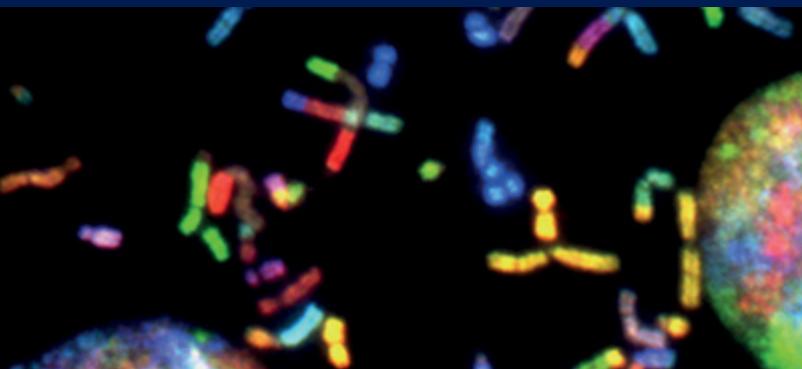
Source: www.bioindustry.org/news-listing/new-report-reveals-strength-of-the-uks-thriving-genomics-sector.html

Section 3

UK Covid-19

Genomics

Initiatives



Enabling faster and deeper genomic research to bring genomic healthcare to all who need it

Genomics England works with the **NHS** to bring forward the use of genomic healthcare and research to help people live longer, healthier lives. It was launched by the UK's Department of Health and Social Care in 2013 to deliver the ground-breaking initiative 100,000 Genomes Project.

Genomics England is now expanding its impact. Their next chapter involves working with patients, doctors, and scientists to improve genomic testing in the NHS and help researchers access the health data and technology they need, to make new medical discoveries and create more effective, targeted medicines for everybody.

www.genomicsengland.co.uk



A major new human whole genome sequencing study

This study will take place across the NHS, involving up to 20,000 people currently or previously in an intensive care unit with coronavirus, as well as 15,000 individuals who have mild or moderate symptoms. Genomics England is partnering with the **GenOMICC** consortium, Illumina and the NHS to launch the research drive, which will reach patients in 170 intensive care units throughout the UK.

The project is backed by £28 million from Genomics England, UK Research and Innovation (UKRI), the Department of Health and Social Care and the National Institute for Health Research (NIHR). Illumina will sequence all 35,000 genomes and share some of the cost via an in-kind contribution.

www.genomicc.org

Rapid whole-genome sequencing of SARs-CoV-2

The **COG-UK Consortium** is an innovative partnership of NHS organisations, the four Public Health Agencies of the UK, the Wellcome Sanger Institute and more than 12 academic institutions providing sequencing and analysis capacity. It is supported by £20 million funding from the UK Department of Health and Social Care (DHSC), UK Research and Innovation (UKRI) and the Wellcome Sanger Institute.

www.cogconsortium.uk

New Variant Assessor Platform (NVAP)

The NVAP was announced in January 2021 and is a non-commercial offer of UK genomics expertise delivered in-country or via the UK, to detect new variants of concern for SARS-CoV-2. Operational since April 2021, this programme is led by **UK Health Security Agency (UKHSA)** together with the UK Department for Health & Social Care (DHSC), Foreign, Commonwealth & Development Office (FCDO) the World Health Organization (WHO).

[www.gov.uk/guidance/
new-variant-assessment-platform](http://www.gov.uk/guidance/new-variant-assessment-platform)



World class genomic testing resource

Genomic testing in the NHS is being provided through a national testing network, consolidating and enhancing the existing laboratory provision. This will create a world class genomic testing resource for the NHS, underpin the **NHS Genomic Medicine Service** and deliver on our commitments as part of the NHS Long Term Plan.

The national genomic testing service is delivered through a network of seven **Genomic Laboratory Hubs (GLHs)**, each responsible for coordinating services for a particular part of the country.

www.england.nhs.uk/genomics/nhs-genomic-med-service

Empowered, high skilled workforce across the system

Health Education England's (HEE) Genomics Education Programme exists to deliver and advise on learning and development opportunities that prepare current and future NHS professionals to make the best use of genomics in their practice. It ensures that our 1.2 million-strong NHS workforce has the knowledge, skills and experience to keep the UK at the heart of the genomics revolution in healthcare.

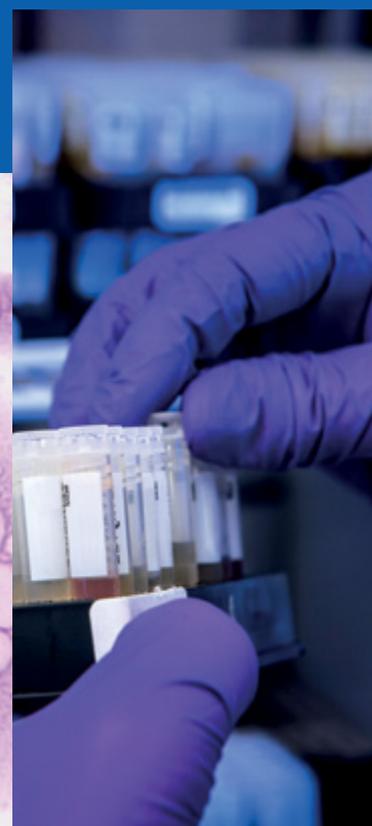
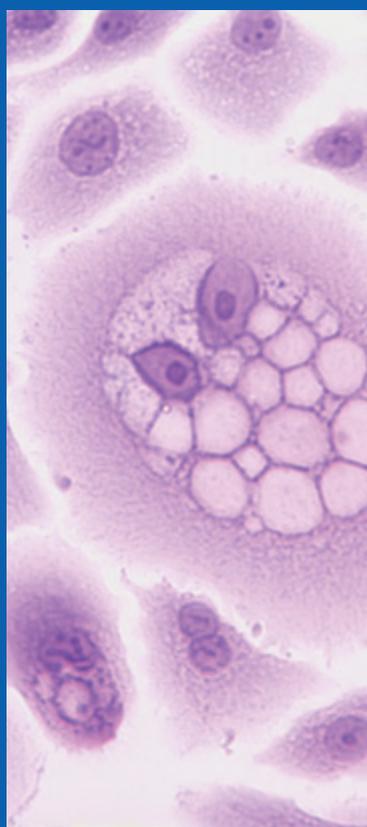
www.genomicseducation.hee.nhs.uk



Since the beginning of the pandemic, 24% of all SARS-CoV-2 sequences submitted to the international GISAID database have been from the UK – we are the second largest contributor globally.

Section 4

Sharing Innovation for the global good



The societal cost of healthcare is rising as people live longer and the prevalence of long-term, complex diseases increases.

The UK is taking advantage of the developments in genomics to increase prevention and early diagnosis of disease. Clinical, scientific and industry innovations, scaled through trusted technologies and delivered through the NHS, must continue to ensure that the UK healthcare system delivers the best possible care to all patients.

The UK Government is working with several countries that are interested in how personalised medicine and genomics can drive down the rise in diseases. Beyond COVID-19, the UK Genomics sector is fast developing innovations, that promise to transform healthcare for patients globally.

Precision Medicine & Biomedical Data

A UK company harnessing the power of connected biomedical data is **Lifebit**. The company's patented technology enables researchers to run analyses on multiple, distributed datasets in-situ and avoid risky movement of highly sensitive data. This innovative and highly secure approach has seen Lifebit work with high-profile clients globally in both the public and private sectors.

This includes powering the secure Trusted Research Environment for the UK Government agency Genomics England, with its 135,000-strong whole genome cohort of cancer and rare disease patients, as well as implementing an end-to-end research and clinical platform for Asia's leading population-scale Precision Medicine Initiative, the Hong Kong Genome Project, which is set to sequence

and analyse 50,000 whole genomes to achieve population-level genomic medicine. This global approach is driven by **Lifebit's** mission to increase both ethnic and disease diversity in available and connected biomedical datasets.

www.lifebit.ai

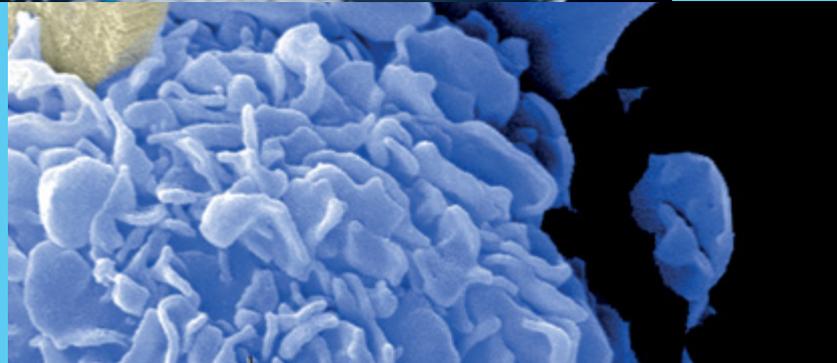
UK Biobank – a global asset

The UK Biobank is a large-scale biomedical database and research resource, containing in-depth genetic and health information from half a million UK participants. The database is regularly augmented with additional data and is globally accessible to approved researchers undertaking vital research into the most common and life-threatening diseases. It is a major contributor to the advancement of modern medicine and treatment.

www.ukbiobank.ac.uk

Section 5

The impact of Genomics



How the UK is harnessing genomics

From the completion of the Human Genome Project, unprecedented expansion of molecular genetics capabilities has made a huge impact in genetic diagnosis research and clinical diagnosis. The UK is harnessing this to bring value to patients and medical understanding of health and wellbeing.

Genomic medicine has already had great impact and amazing power to continue improving health outcomes globally. It provides an incredible opportunity to achieve faster, accurate diagnosis, and has driven a revolutionary shift toward precision and personalised medicine, meaning better, more targeted treatments for patients with diseases such as cancer, obesity and cardiovascular disease.

Today major technological advances are helping to accelerate the time it takes to read, analyse and understand genes, allowing us to discover new personalised medicines and therapies even faster. Combined with an exponential decline in sequencing costs, more clinically relevant sequencing timescales and large-scale public and pharmaceutical investment, genomics is dramatically altering the future of medicine at a level not previously possible.

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100,000 Genomes Project

Illumina is a UK partner for Genomics England, and a world leading genome sequencing company, serving nearly 2,400 institutions, across 78 countries, provided genomic sequencing for the 100,000 Genomes Project. Creating a new genomic medicine service for the NHS, transforming the way people are cared for and bringing advanced diagnosis and personalised treatments to all those who need them, using data from 85,000 NHS patients affected by a rare disease, or cancer.

www.illumina.com

Nanopore Technology

The UK company **Oxford Nanopore Technologies** products represent a new generation of technology; to interpret sequencing data in as little as 5 minutes and thus guide treatment decisions. Their sequencing technology provides traditional properties such as low cost, high throughput data, but with new features in the market, such as the ability to do sequencing in a portable, handheld sequencer, in real time, and to provide richer biological data. Based on electronics rather than optics, nanopore sensing represents not only a new technology, but the potential to broaden access to important biological insights, due to unprecedented accessibility.

www.nanoporetech.com

Harnessing AI

Eagle Genomics is harnessing the power of the microbiome to transform knowledge of disease and wellness, while improving the health of the planet, including the onset and progression of debilitating chronic and metabolic diseases. Gut microbiome can modulate the effects of immunotherapy and chemotherapy and the treatment of gastrointestinal disorders, as well as neurological disorders such as Alzheimer's and Parkinson's diseases.

The Eagle Genomics AI-knowledge Discovery Platform supports the entire innovation workflow - from hypothesis through insight to evidence-based product claims, in minutes rather than months - reducing 'trial and error' and helping to bring novel, safer and more sustainable products to market. Eagle Genomics has played an important role supporting an EU-funded translational medicine bench-to-bedside program, to identify novel gene targets in vascular disease using a systems biology approach.

www.eaglegenomics.com

Clinical Analytics

Congenica leverages its deep capability in genomic analysis and AI to provide high quality data and software systems used by clinicians to rapidly diagnose and characterise rare disease. The Congenica clinical analytics platform has been chosen as partner to the NHS Genomic Medicine Service, in addition to supporting customers and partners in over 20 countries.

www.congenica.com

Cell & Gene Therapy

Cell & Gene Therapy (CGT) has an overall aim of treating underlying causes of both genetic and acquired diseases. CGT is technically complex but offers one-time treatments that may alleviate the root cause of a disease and have the potential to cure certain conditions. CGT has been at the front line of advances in personalised medicine.

Cell and Gene Therapy Catapult, the world's most supported cell and gene therapy environment, was established as an independent centre of excellence to advance the growth of the UK cell and gene therapy industry, by bridging the gap between scientific research and full-scale commercialisation. Its aim is to make the UK the most compelling and logical choice for UK and international partners to develop and commercialise these advanced therapies.

www.ct.catapult.org.uk

Diagnostics

The UK is at the forefront of efforts to drive the development and delivery of new diagnostic solutions in genomics at the speed and scale required to act in a pandemic, and to address other pressing public health challenges. The UK has a thriving private sector, for example **GeneFirst**, a UK molecular diagnostics company and developer / supplier of RT-PCR COVID-19 kits which health ministries around the world have chosen, **Randox** a market leader within the in vitro diagnostics industry, and **QuantumDX** a UK-based developer of transformational point of care diagnostics.

www.genefirst.com

www.randoxbiosciences.com

www.quantumdx.com



UK Genomics Sub Offers

Offer 1: Integrated Genomics Services

Genomics England is the main pillar of the Government's strategy supported by the the Department of Health and Social Care (DHSC). The UK is harnessing the expansion of molecular genetics capabilities, and through the Genomic Medicine Service Alliances, aims to enhance the UK research in Genomics to better serve the population and aims to integrate genomic medicine into routine NHS care by 2025.

Offer 2: Genome Sequencing Software and Consulting

Genome sequencing technologies including array and exome-based sequencing, rely on genomics data for their creation and others, specifically next generation sequencing technologies which are dependent on the human genome sequence to perform basic analysis. The UK offers innovative and ground-breaking solutions to better understand and harness the information within DNA.

Offer 3: Diagnostic Tests and Reagents

The UK is home to many companies producing commercially prepared reagent sets, with accessory devices, containing all of the major components and literature necessary to perform one or more designated diagnostic tests or procedures.

Offer 4: Training and Education

The UK possesses world class Genomics Training and Education programmes and organisations founded to deliver the learning and development necessary to enable both current and future NHS professionals to harness the power of genomic medicine for patient benefit. This draws on best practice across healthcare, education and digital technology.

Offer 5: Clinical Support

The UK has genomics expertise in organisations specialising in key clinical services including inherited children's disease, cancer care, cardiac care and pharmacogenomics.

Offer 6: Cell and Gene Therapy

Cell and Gene Therapy (CGT) has been at the front line of advances in personalised medicine and the UK has the largest CGT cluster outside of the United States. The UK offers a great environment for building a leading global company in the CGT space. In addition the UK system offers fast commercial approval of companies' CGT products.

In Summary

Genomics has played an expanding role in the NHS over the last seven decades. The UK's core strengths in genomics is underpinned through its life sciences heritage and strong foundations. The time is now to focus on its future where the UK is pushing the boundaries of discovery.

Core strengths:

1. Longstanding leadership in genomics research as a pioneer with a peerless heritage following elucidation of the DNA double-helix structure.
2. Genomic revolution led by government, supported by industry, academia, health service and charities.
3. At the cutting-edge of genomic healthcare, informatics tools and precision medicine.
4. Enabling progress through safe and secure access to patient health and genomic data.
5. Excellence underpinned by a highly skilled clinical, genomics and informatics workforce.

Disclaimer and Intended use

- This brochure provides an overview of examples of solutions and innovations that the UK life sciences sector offers
- This brochure is intended as an initial engagement tool to support dialogue with other countries, health systems, companies, and industries to encourage these parties to take a closer look at the UK.
- This document is not a policy position paper from UK Government
- It is not meant to be an exhaustive, complete representation of all UK genomic organisations
- Parties interested to learn more about the UK and solutions, or suppliers tailored to their needs should contact their local Embassy, High Commission or Consulate to start a discussion.



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Department for International Trade

The UK's Department for International Trade (DIT) has overall responsibility for promoting UK trade across the world and attracting foreign investment to our economy. We are a specialised government department with responsibility for negotiating international trade policy, supporting business, as well as delivering an outward looking trade diplomacy strategy.

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