Genomics nation 2023

A genomics-powered UK life science ecosystem

BIA
UK BioIndustry Association

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1. Forewords

Steve Bates OBE,
CEO, BIA

This report is published days after the world's largest collection of full human genomes was published. UK Biobank is a British success story that puts us at the heart of a key global technology of this century. Set up 20 years ago, the charity UK Biobank recruited half a million altruistic volunteers to create the world's most comprehensive source of health data.

It can now be used by researchers across the world, from academic, commercial, government and charitable settings, for scientific discoveries that improve human health.

Professor Sir Rory Collins FRS FMedSci, Principal Investigator, of UK Biobank captured the importance of the project well when he said: "Scientists are looking at UK Biobank like Google Maps when they want to know what are the pathways from lifestyle, environment, genetics to disease, they don't go Google, they go to UK Biobank."

UK Biobank now provides the most detailed picture of human health that exists, equipping researchers with the ultimate toolbox to make previously out-of-reach links and discoveries about disease development possible.

But the UK's capability and opportunity in genomics go far, far beyond Biobank and we have many, many more assets – both in the public sector and in our burgeoning private sector including fantastic small and medium-sized enterprises. The large-scale application of this technology is reshaping both healthcare and the pharmaceutical industry globally, accelerating our understanding of diseases and how to prevent and treat them, and there is a significant economic prize for whichever nation best captures the value of the new industry that will grow from exploiting this technology.

With the right investment, skilled professionals, and partnerships within the NHS ecosystem, UK genomics SMEs are perfectly positioned to be key players in one of the fastest-growing areas of global biotech and life sciences, delivering economic growth to the country at the same time as health insight to the globe. That's why innovative genomics companies are so important to our nation's life science industry. If I have one regret about the way the UK Biobank's £200-million effort was structured, it was that not enough thought was given to potential industrial strategic benefits of finding a way of enabling UK SMEs to be on the inside of this project alongside academic and large pharmaceutical companies from the outset.

This is an opportunity that would not have been overlooked in competitor dynamic economies like Singapore or Israel. But with the proliferation of health data assets, such as Genomics England, Our Future Health and UK Biobank, there will be many more chances to enable UK genomics SMEs to access UK-funded data first within a secure, reliable, and trustworthy framework.

Accessing this data is the lifeblood of, and sustainable competitive advantage of, many genomics companies, enabling them to develop better drugs, reach more accurate diagnoses more quickly, or identify specific predispositions. Being able to access and use large datasets is key to enabling UK SMEs grow and compete in the burgeoning global market for genomic products and services.

The UK's dynamic genomics industry is thriving and stands to benefit both patients and taxpayers as it continues to grow. We possess a vibrant ecosystem of spin-outs, scale-ups, and SMEs that are developing and scaling innovations poised to enhance health and wellbeing, not just in the UK but worldwide. I hope this report helps demonstrate not only their strengths but also the strength of the UK ecosystem in which they are thriving.

This third edition of the Genomics nation report looks forward to the future of how increasingly complex genomic data will be used, and by whom. It calls out the need for easier data access for commercial SMEs, as well as academics and health researchers. Our SMEs are a key source of how innovation is delivered, in the forms of new products, services and assets which benefit us all.

Professor Chris Molloy,
Chief Executive Officer, Medicines Discovery Catapult

I thank our collaborators in this endeavour, the BIA, who campaign tirelessly for the good of the UK biotech sector and the excellent Wellcome Sanger Institute, whose constant stream of invention and insight sharpens the cutting edge of the UK's genomics blade, allowing us to cut through many of the thorniest barriers to progress.

The UK's wealth of genomics data provides a foundation and fertilizer for an increasingly rich and diverse set of companies across data science, diagnostics and an increasing range of advanced drugs.

Data science companies are using genomics, protein or metagenomics data to 'crack' the language of biology. They are building fast from a basic lexicon to develop increasingly accurate predictive models of protein folding and interaction. But – pardon the pun – we are still at a relatively early 'primer' stage of reading. The development and future application of large language models (LLMs) by

industry players will change that, enabling us to have a much more sophisticated understanding of what the genes are telling us about the biology they code for, in all its splendid complexity and variety.

Diagnostics companies are building more multi-layered systems that combine an understanding of genomics and biomarkers to support healthcare decision-making and richer early-stage clinical trials. These richer systems are able to create high-definition 'fingerprints' of disease that can be read more exactly than traditional methods and respond more rapidly to new therapeutic interventions. This will enable early trials, in more complex diseases such as fibrosis, to be run and read out quickly. This in turn will change the way trials are designed to ensure the maximum useful information flows from every patient who puts themselves forward.

Therapeutics companies today anchor their projects on sound genomic linkages to disease. This gives confidence that the biology will be predictive but also enable a stratification of disease that delivers an increasingly precise set of therapeutic tools for specific populations. Now we see the rise of genomically targeted medicines including gene therapies, in-body CRISPR and mRNA vaccines. These new uses of genetics as both targets and tools are at the edge of new medicines discovery, development, regulation and reimbursement.

To seed and scale up all of these young companies need easier commercial access to underlying data. This report calls out some notable progress but without a faster flow of data, our ability to learn and use the language of biology will remain in academic cloisters, whilst our global competitors march past us. If that happens, we have failed UK patients and our sector. We need an acceptance that commercial R&D is beneficial to patients and our bioeconomy, not a rapacious attempt to exploit something from them and deliver smoother pathways to ethical data access for our innovators – all of whom are driven by a shared purpose.

The UK dominates the genomics industry sector in Europe and as reported in the previous Genomics nation report (2022),[1] the UK is a leader in both investment raised by the sector and in the number of genomics companies formed.

Emmanuelle Astoul,
Head of Translation, Wellcome Sanger Institute

Furthermore, the strength of the UK genomics ecosystem was clearly demonstrated by how genomics technologies were deployed at scale to respond to a public health emergency during the COVID-19 pandemic. The COVID-19 Genomics UK Consortium[2] (COG-UK) for example was rapidly assembled by bringing together

academia, health services and public health agencies to monitor the evolution of the epidemic in the UK and track the emergence of variants.

If there was a poster child for how funding emerging technology and large scientific resources early can kick-start an industry, the genomic ecosystem in the UK should be in contention. At the root of the UK's lead in this field, we find very early and bold investment – sustained over 30 years – that has generated fundamental genomic data as shared resources driven by the belief that this would power up science, technology and medicine. Ambitious vision and collaboration between academia, funders, health services and government in support of "big science" has enabled today's successes.

A foundational event that kick-started genomics in the UK has been the landmark decision of the Wellcome Trust to accelerate the sequencing of the first human genome. In 1992, it established the Sanger Centre in Cambridge. The aim – to undertake the most ambitious project ever attempted in biology. This effort resulted in the first human genome published in 2000 with the Sanger Centre (now Wellcome Sanger Institute)[3] being the single largest contributor.

Establishing this early capability in the UK enabled the nucleation of a centre of excellence for genomics research and resource building, exemplified by the European Molecular Biology Laboratory (EMBL) co-locating its Bioinformatics Institute (EMBL-EBI)[4] with the Wellcome Sanger Institute in Cambridge on the Wellcome Genome Campus.[5] The ongoing expansion of the Campus will be one of the largest investments in the UK's life sciences infrastructure.[6]

Another leap forward in the implementation of genomics in medicine in the UK has been the Government's early vision of funding Genomics England (GEL) and the 100,000 Genomes Project,[7] in collaboration with the NHS. By setting up the National Genomic Research Library,[8] Genomics England is creating a virtuous cycle based on rich datasets to support the discovery of new drugs and diagnostics. Together with other world-leading data sources such as the UK Biobank,[9] large-scale collaborative initiatives like Our Future Health[10] and the capabilities developed over decades, the UK now benefits from a rich source of omics assets.

Biodata and genomic technologies now all permeate biomedical industries and to reflect on the success and impact on the sector we need to consider the whole ecosystem. 'Omics-scale' data, for example, power up artificial intelligence (AI) approaches that are accelerating therapeutic R&D. The use of AI could be the single most important factor in accelerating precision drug R&D, reducing attrition in therapeutic development, and therefore supporting the development of cheaper and more efficient future treatments.

The next frontier for the application of genomic sciences includes a shift from 'reading' DNA to 'writing' DNA and enabling engineering biology to address urgent environmental challenges, including protecting biodiversity, feeding the world and combating the effect of climate change.

2. Introduction

The UK's genomics sector stands at an important inflection point. It has already become world-leading, building upon the heritage of Franklin, Watson, Crick, and later the Human Genome Project, delivered by the Wellcome Sanger Institute around the year 2000 and most recently the 100,000 Genomes Project delivered by Genomics England. Now, with more start-ups and scale-ups in the genomics space than ever before, we are on the cusp of this technology becoming one that is embedded within our healthcare system to improve patients' lives: ensuring we are a real genomics nation.

There exists a tendency to group all genomics companies under one umbrella and therefore obscure the wide range of innovations that they offer. Working at the intersection of biology and data science, these companies unlock the human genome, applying their findings to the diagnosis and treatment of disease. Genomics has applications across healthcare, from the initial process of sequencing, through diagnostics to AI-enabled drug discovery. Linking these processes up will deliver immense benefits for patients, facilitating preventative and personalised medicine which will form the backbone of the NHS of the future.

Genomics is also driving another revolution, one linked to combatting climate change and contributing to sustainable living, by applying this science to the planet itself. While this report focuses on the healthcare applications of genomics, many of the same technologies and companies featured are enablers of this new genomics dimension.

This is the third Genomics nation report published by the BIA, in collaboration with Medicines Discovery Catapult (MDC) and the Wellcome Sanger Institute, allowing us to chart the growth of the sector over time. Our 2021 report provided a benchmark, finding that UK genomics had a market cap of £5 billion, projected to reach £50 billion by 2040. In 2022, the second report demonstrated the youth of the sector, with half of companies at the early or seed stage, before identifying the skills gaps that need to be filled for UK genomics to mature.

This report returns to the theme of growth this year. UK genomics is rich in academic expertise and pioneering SMEs, but to retain its status as a genomics superpower, we must ensure that SMEs can scale up. Access to data and opportunities to collaborate are essential ingredients for a thriving ecosystem which this report focuses on.

Genomics powers a long value chain spanned by numerous UK companies. The following chapter explores this ecosystem, starting with the biobanks that collect and store vital genetic information and ending with the development of therapeutics and disease prevention. The key message is one of interdependence; innovation in genomics thrives on the combination of data resources with scaling companies.

High-quality data is the lifeblood of genomics. Our section on 'Data assets and genomics companies', examines the UK's genomics data assets, painting a picture of a healthy landscape populated by resources like Genomics England and UK Biobank, as well as smaller, disease-specific datasets such as the HDR UK Research Hubs.

Collaboration with the technology sector has the potential to catapult the many applications of genomics still further. Working in partnership with major players like Google DeepMind to harness AI can produce game-changing outcomes, as the case studies demonstrate. AI, itself only in its infancy, has turbo-charged fields like proteomics, heralding a future in which cross-sector collaboration enables transformative genomics research.

3. Mapping the UK genomics ecosystem

Genomics companies do not fit neatly into a single category. Standing at the crossroads of biology, data science and AI, these firms delve into the various intricacies of the human genome. Their profound insights not only transform disease diagnosis and treatment but also span the vast expanse of healthcare, from the foundational steps of genome sequencing to the realm of AI-powered drug research.

In this section, we examine the different types of genomics companies, the work they do, and the landscape in which they operate.

The types of genomics companies: human genomics application

Sampling and sequencing

Therapeutics

Diagnostics

Consumer genetics
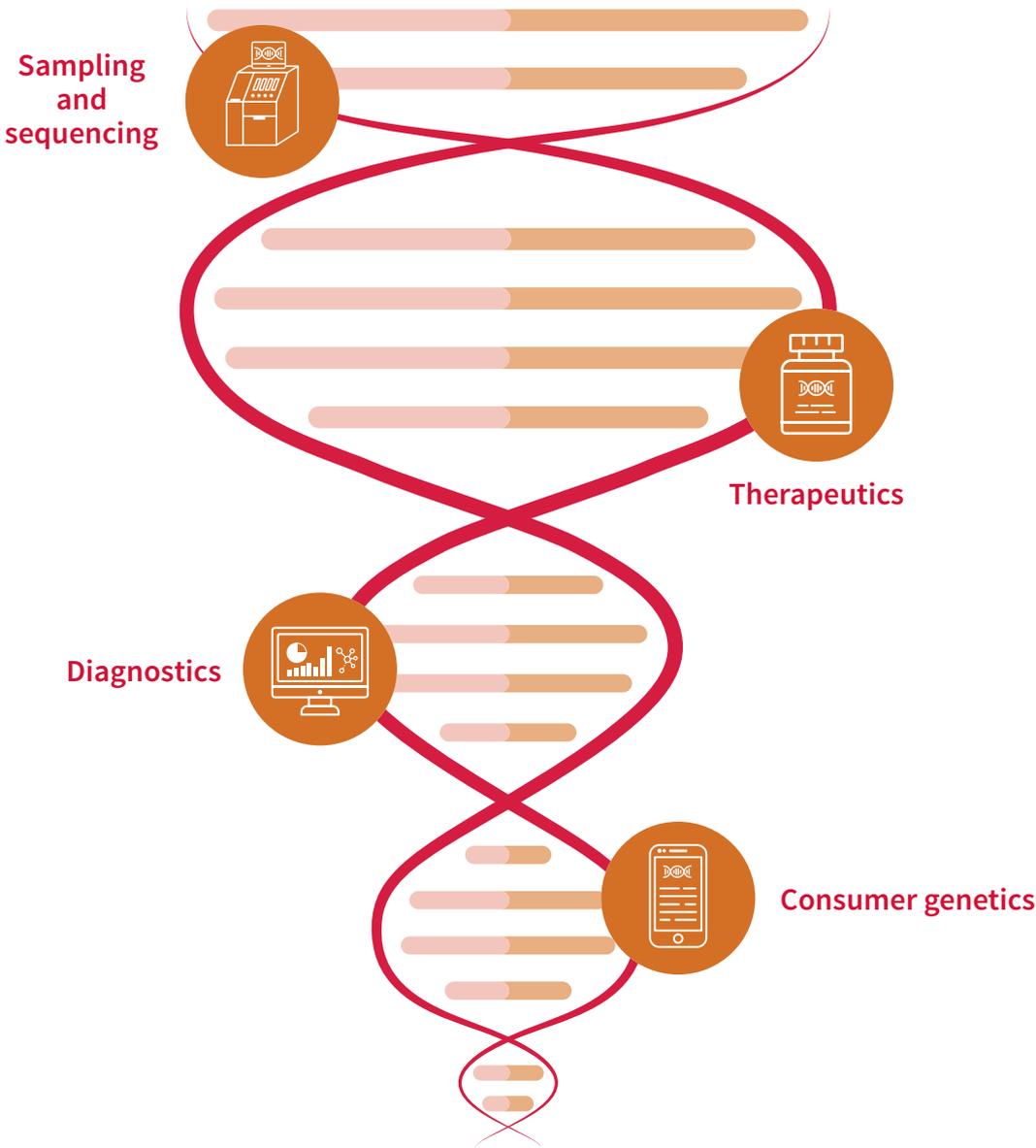
See next page for further information on types of genomics companies and examples of how they operate.

Sampling and sequencing

Sequencing genomics companies specialise in reading and decoding the genetic information of an organism held in DNA and RNA.[11] This information is then used in various fields such as personalised medicine, disease prevention, agricultural biotech, and more, to generate insights about genetic traits, disease susceptibility, and responses to drugs. The UK's pioneering sequencing technology, developed in the early 1990s by Solexa, forms the foundation of Illumina's products, which are widely used around the globe.[12] More recently, Oxford Nanopore Technologies has pioneered an entirely different approach to sequencing.

Oxford Nanopore Technologies, a UK company based in Oxford, is an example of a sequencing genomics company that offers real-time analysis in fully scalable formats, can analyse native DNA or RNA, and sequence any length of the fragment to achieve short to ultra-long read lengths.

Therapeutics

Therapeutic companies harness genomics in myriad ways and form some of the most well-known genomics companies. Gene therapies, genetic modification of the body's immune cells to treat cancer and RNA silencing are just a few examples of how companies are creating the next generation of treatments for patients.

BenevolentAI is a leading UK-based AI company headquartered in London. It harnesses advanced computational methods to accelerate drug discovery by delving deep into genomics and biomedical data. It has created ground-breaking advances by using AI to develop next-generation treatments, including for COVID-19.

Diagnostics

Genomic diagnostics companies specialise in analysing DNA to detect genetic mutations and variations. By doing so, they provide insights into predispositions to certain diseases, inform personalised treatment plans, and aid in early disease detection and prevention.

Genomics plc is a pioneering UK-based company headquartered in Oxford. With a robust foundation in genomic data analysis, they provide invaluable diagnostic insights that illuminate the genetic underpinnings of diseases. They calculate risk for common and chronic health conditions – including cancers, cardiovascular disease, autoimmune disorders, and diabetes – by combining genetic information with other important risk factors. From this, they generate actionable insights targeted to an individual risk profile, based on clinical guidelines and the latest science.

Consumer genetics

Consumer genetics companies analyse DNA to provide insights into ancestry, genetic traits, and potential health predispositions. These companies offer direct-to-consumer kits, allowing people to explore their genetic heritage, understand potential health risks, and gain a deeper understanding of their unique genetic makeup.

Companies such as Living DNA can provide DNA testing for ancestry and genealogy. Based in Frome, Somerset, Living DNA provides detailed ancestry testing, allowing users to trace their lineage, explore migration paths, and even delve into their maternal and paternal deep ancestry.

Non-human genomics application

Genomics isn't just about human health and ancestry; it has vast applications in diverse areas, including agriculture, environmental conservation, animal health, and even efforts to combat climate change. Genomics provides a fundamental understanding of how organisms work, allowing the engineering of biology in different applications.

Agriculture and animal health: Many companies focus on optimising plant and animal genomes for increased yield, disease resistance, or specific desirable traits. For instance, they may develop crops that are drought-resistant or require fewer pesticides, which can be crucial for food security. Additionally, genomic tools are used for breeding programs in livestock to enhance productivity and disease resistance.

Benson Hill Biosystems is a company that harnesses plant genomics to enhance crop production.

Environmental conservation: Genomics can be applied to biodiversity conservation efforts. By understanding the genetic makeup of endangered species, conservationists can make informed decisions to protect genetic diversity and ensure the survival of these species.

The Frozen Ark project, which has roots in the UK, aims to preserve the DNA and living cells of endangered species, acting as a sort of "genomic bank" for conservation purposes.

Bioremediation: Some companies harness microbes' genomic data to address environmental challenges. Certain bacteria and fungi have the ability to break down pollutants or even accumulate heavy metals from their environment, known as bioremediation. By understanding and possibly enhancing these capabilities, companies can enhance bioremediation for environmental purposes.

Climate change mitigation: Genomic technologies are being applied to understand and possibly engineer organisms that can capture carbon dioxide or produce biofuels. Algae, for instance, have the potential to be significant players in biofuel production.

Cynetic Designs focuses on harnessing synthetic biology for solutions to environmental challenges, including those related to climate change.

Bio-based materials: Some companies explore the potential of organisms, through genomics and synthetic biology, to produce sustainable alternatives to plastics and other materials.

Spiber uses microbial fermentation to produce synthetic spider silk, which has applications ranging from clothing to medical devices.

Genomics companies and the wider ecosystem

At the heart of the UK genomics landscape sit the genomics companies who, with their innovative technologies and approaches, are reshaping healthcare by offering advanced diagnostics, tailored therapies, and comprehensive consumer genetics services.
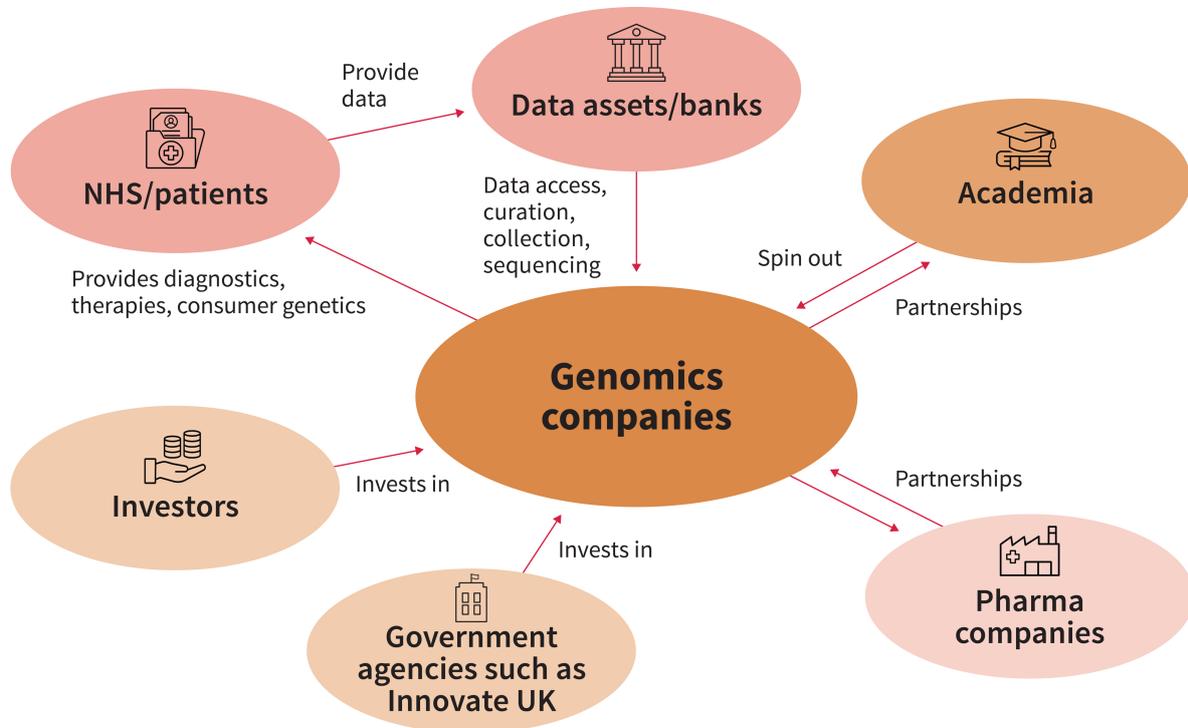
A foundational relationship in this ecosystem is that between the genomics companies and patients, primarily mediated through the **National Health Service (NHS)**. Genomics companies provide the NHS and its patients with diagnostic tools, targeted therapies, and consumer genetics insights. In return, they benefit from the wealth of data generated by patient interactions, diagnostic tests, and treatments.

This symbiotic relationship optimises patient care while enriching the research and development capabilities of the genomics companies.

Serving as intermediaries in this data exchange are **data assets, custodians and banks** such as Our Future Health and the UK Biobank. (See section on 'Health data assets and genomics companies').

The **academic sector's** interplay with genomics companies is multifaceted. Many genomics firms have their origins in academic spin-outs, translating groundbreaking research into commercial solutions. Moreover, the collaboration between academia and genomics companies often takes the form of partnerships, where both parties pool their expertise to drive forward scientific discoveries and develop novel applications.

Pharmaceutical (pharma) companies are significant players. They engage in partnerships with genomics firms, harnessing the latter's unique expertise to expedite drug discovery, development, and personalisation. In some instances, pharma giants directly invest in genomics ventures, recognising their potential to revolutionise healthcare.

Government agencies, like Innovate UK, further bolster the genomics industry by providing crucial investment and fostering an environment conducive to research and innovation. Their role, is instrumental in ensuring that the UK remains at the forefront of global genomics advancements.

Finally, **private investors** play an indispensable role by directly investing in genomics companies to finance their R&D and commercial growth. Their capital and strategic support enable these firms to scale, innovate, and deliver value to both patients and the broader healthcare ecosystem.

The UK genomics ecosystem is a complex, interconnected web of stakeholders, each contributing uniquely to the advancement of genomics and its application in healthcare. Their collective efforts ensure that the UK remains a global leader in this transformative field.

Congenica and Adverse Drug Reaction

Congenica[13] has made extensive use of UK Biobank data for a selection of research, development and testing activities. The combination of demographic, genomics and coded phenotypic data has proven to be invaluable for projects such as testing datasets for relevance to disease phenotypes to accelerate clinical diagnosis, as well as identifying new candidate variants with potential phenotype associations to increase diagnostic yields.

The successful outcome of these projects was possible only due to the quality and consistency of data within UK Biobank.
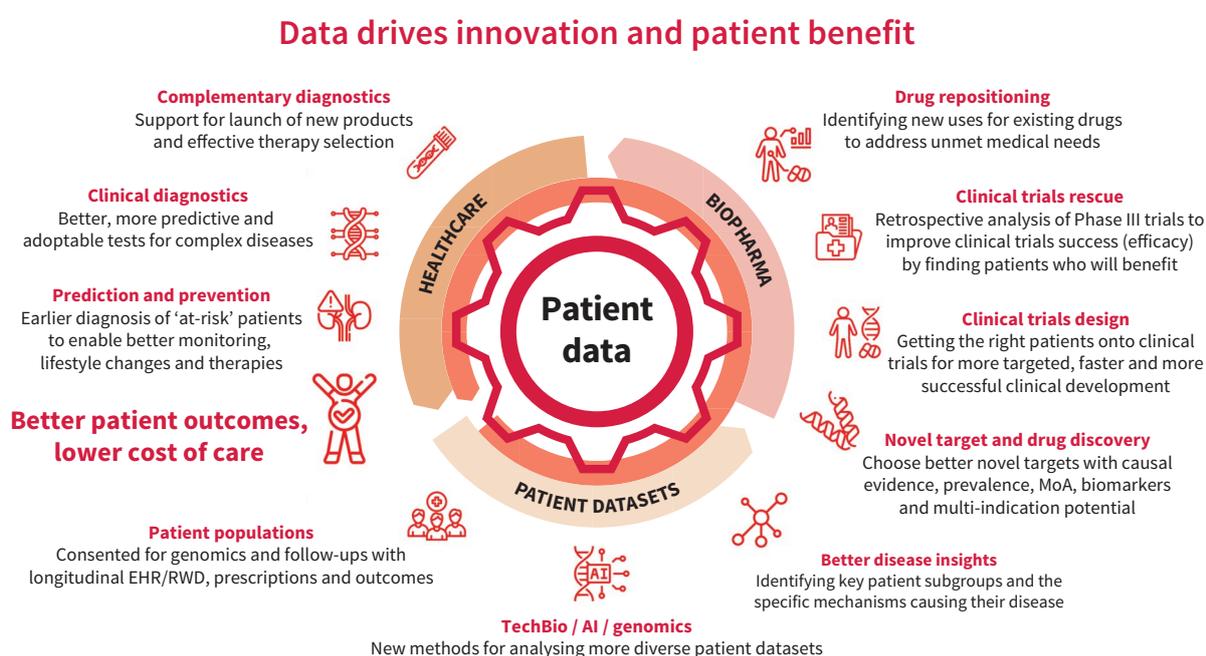
UK Biobank was also used to develop a predictive ML model for Adverse Drug Reactions (ADRs) as part of Congenica's pharmacogenomics initiative. Making use of both genomic data and information such as age, sex and medications prescribed, resulted in a model that showed strong predictive value regarding potential ADR in individuals.

4. Health data assets and genomics companies

The genomic data lifecycle:
Patients, data banks and genomics companies

The genomic data lifecycle is a circular journey, beginning and culminating with the patient and the NHS. This journey underscores the importance of patient data in driving genomic innovations, personalised medicine, and in delivering improved health outcomes back to the patient.

Data drives innovation and patient benefit

Complementary diagnostics
Support for launch of new products and effective therapy selection

Clinical diagnostics
Better, more predictive and adoptable tests for complex diseases

Prediction and prevention
Earlier diagnosis of 'at-risk' patients to enable better monitoring, lifestyle changes and therapies

Better patient outcomes, lower cost of care

Patient populations
Consented for genomics and follow-ups with longitudinal EHR/RWD, prescriptions and outcomes

TechBio / AI / genomics
New methods for analysing more diverse patient datasets

Drug repositioning
Identifying new uses for existing drugs to address unmet medical needs

Clinical trials rescue
Retrospective analysis of Phase III trials to improve clinical trials success (efficacy) by finding patients who will benefit

Clinical trials design
Getting the right patients onto clinical trials for more targeted, faster and more successful clinical development

Novel target and drug discovery
Choose better novel targets with causal evidence, prevalence, MoA, biomarkers and multi-indication potential

Better disease insights
Identifying key patient subgroups and the specific mechanisms causing their disease

HEALTHCARE · BIOPHARMA · PATIENT DATASETS · Patient data

At the outset, patients, in collaboration with the NHS, provide invaluable genetic and medical data. This data is the lifeblood of genomic research. However, before this data can be effectively utilised, it needs to undergo several crucial processes.
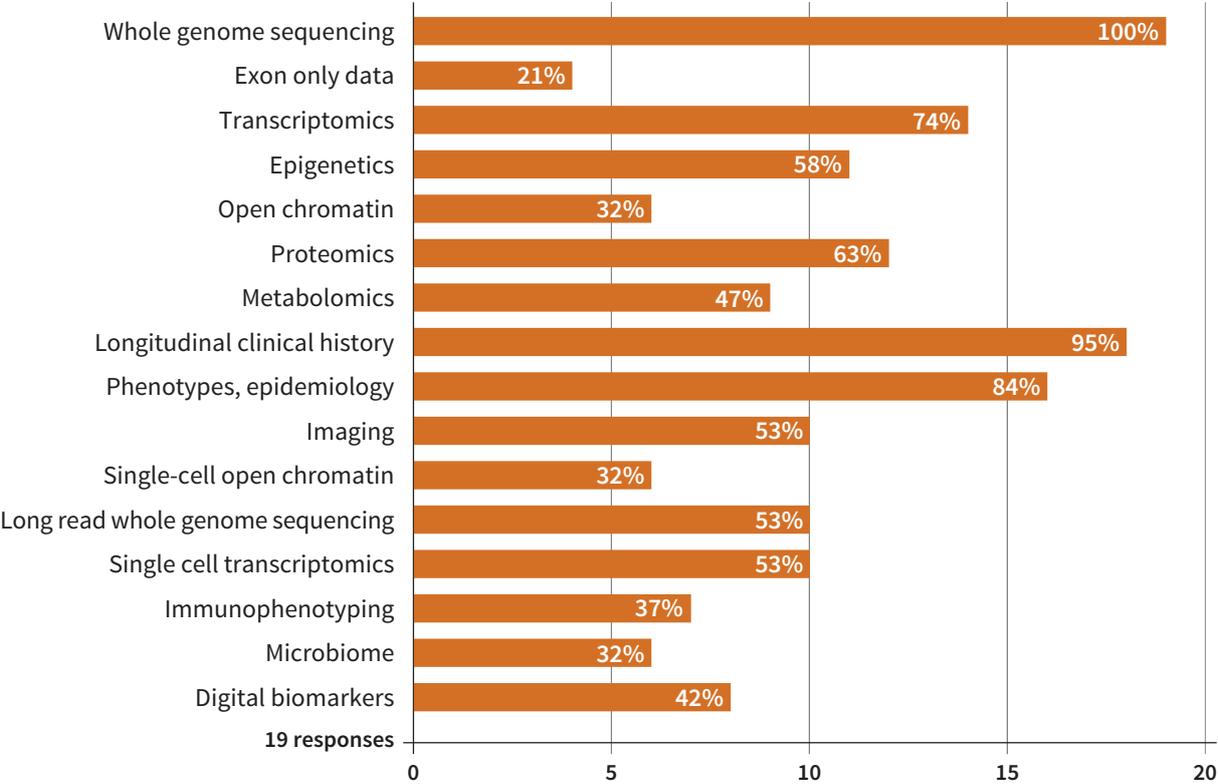
Health data banks and assets play an essential role in ensuring that patient data is collated, curated, and maintained at the highest quality standards. Additionally, they are guardians of patient privacy, ensuring that data is anonymised and consent is appropriately managed. They ensure that data remains reliable, consistent, and ethically gathered.

Genomics companies then engage with these data banks. Companies must navigate intricate processes of data access negotiations, sifting through vast datasets to find the precise data they require, and agreeing on terms that respect patient privacy, the objectives of the research, and commercial considerations.

From this data, genomics companies analyse, probe, and interpret genetic patterns and anomalies, striving to unearth new knowledge. The insights they derive pave the way for the development of innovative products and services. Whether it's novel therapeutic

interventions, improved drugs, or strategies for personalised medicine, these products and services are then channelled back to the starting point of our lifecycle: the NHS and its patients.

Types of datasets genomics SMEs would like to have access to[14]

Dataset	Percentage
Whole genome sequencing	100%
Exon only data	21%
Transcriptomics	74%
Epigenetics	58%
Open chromatin	32%
Proteomics	63%
Metabolomics	47%
Longitudinal clinical history	95%
Phenotypes, epidemiology	84%
Imaging	53%
Single-cell open chromatin	32%
Long read whole genome sequencing	53%
Single cell transcriptomics	53%
Immunophenotyping	37%
Microbiome	32%
Digital biomarkers	42%

19 responses

Source: Survey of 19 CEOs from genomic companies represented in the BIA's Genomics Advisory Committee, BIA, September 2023

The culmination of this data journey is the provision of improved health outcomes for patients. Through the products and services derived from their own data, patients benefit from more precise treatments, drugs tailored to their genetic makeup, and a more personalised approach to medicine.
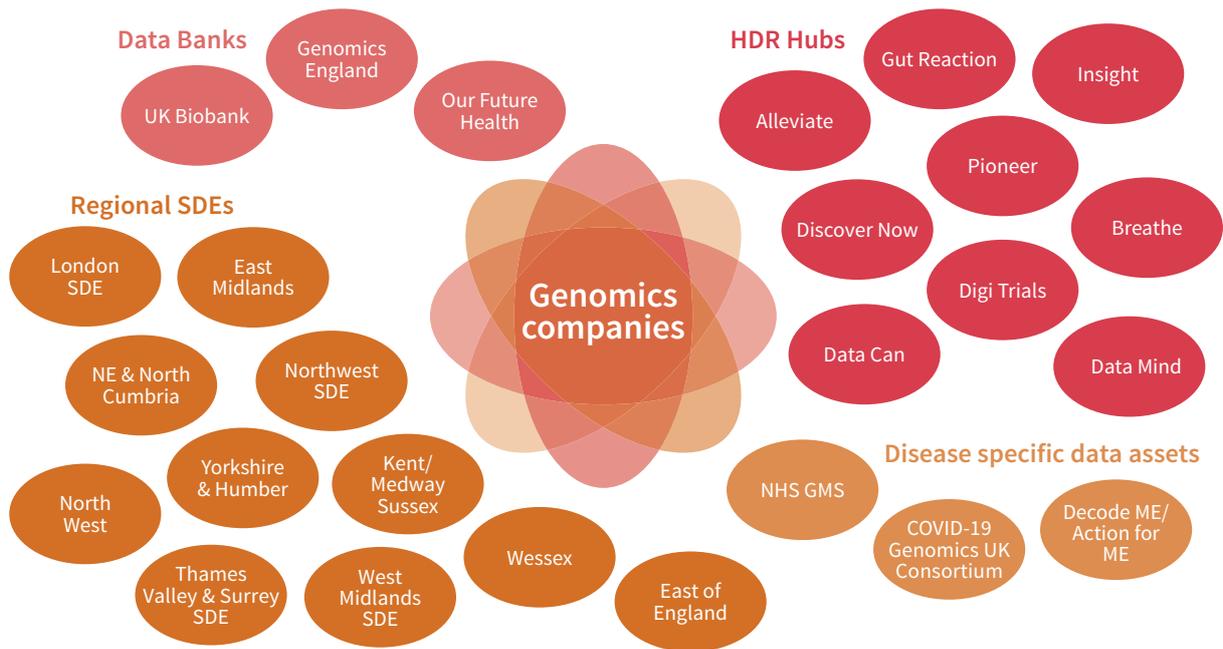
For a comprehensive list of health data assets, please see Appendix.

The current landscape of health data assets in England

Genomics companies are increasingly reliant on health data for a variety of purposes, including drug discovery, safety testing, patient stratification and diagnostics development. The UK has a strategic opportunity to become a world leader in the analysis, sequencing and producing positive health outcomes based on data thanks to its national cradle-to-grave NHS health system.

The challenge for the UK is threefold: to make these vast datasets harmonised, joined-up and accessible, to ensure patient consent and privacy, and to build this upon existing legacy structures.
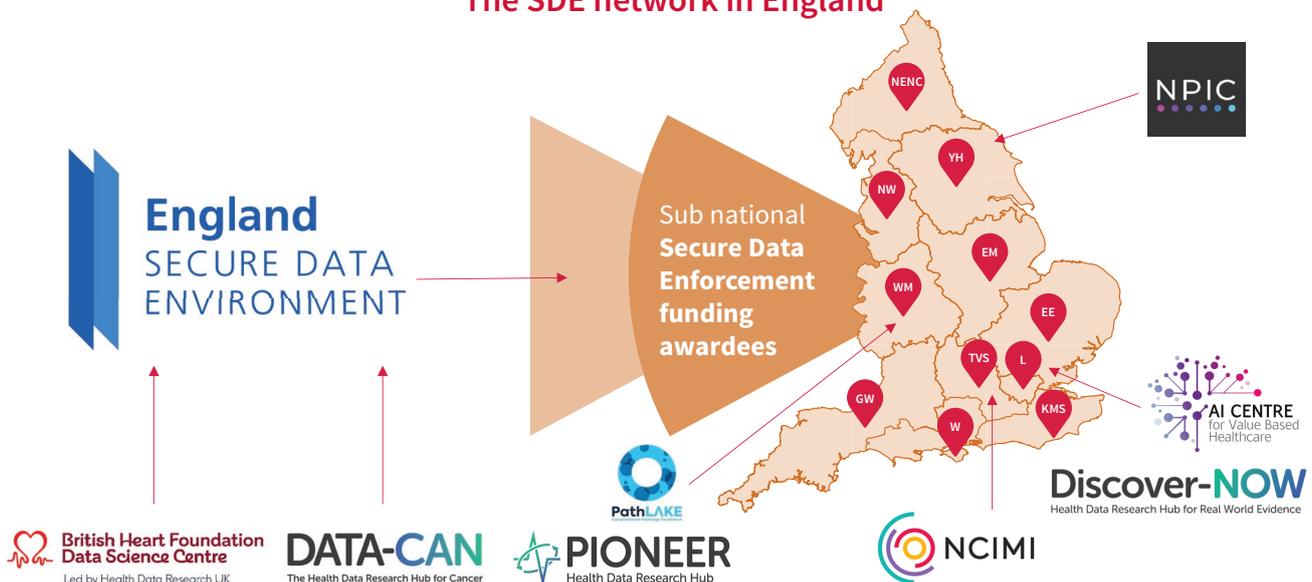
The current landscape of data assets in England

Data Banks
- Genomics England
- UK Biobank
- Our Future Health

Regional SDEs
- London SDE
- East Midlands
- NE & North Cumbria
- Northwest SDE
- North West
- Yorkshire & Humber
- Kent/Medway Sussex
- Thames Valley & Surrey SDE
- West Midlands SDE
- Wessex
- East of England

Genomics companies

HDR Hubs
- Gut Reaction
- Insight
- Alleviate
- Pioneer
- Discover Now
- Breathe
- Digi Trials
- Data Can
- Data Mind

Disease specific data assets
- NHS GMS
- COVID-19 Genomics UK Consortium
- Decode ME/Action for ME

The current landscape in England in terms of data assets comprises:

- **11 sub national NHS-led Secure Data Environment (SDEs)**, collectively covering the whole of England. SDEs give approved researchers access to NHS data. SDEs are digital platforms built to enable the highest standards of privacy and security of health and care data. They allow approved users to access and analyse data without the data leaving the environment, for research, analysis, service evaluation and improvement purposes.
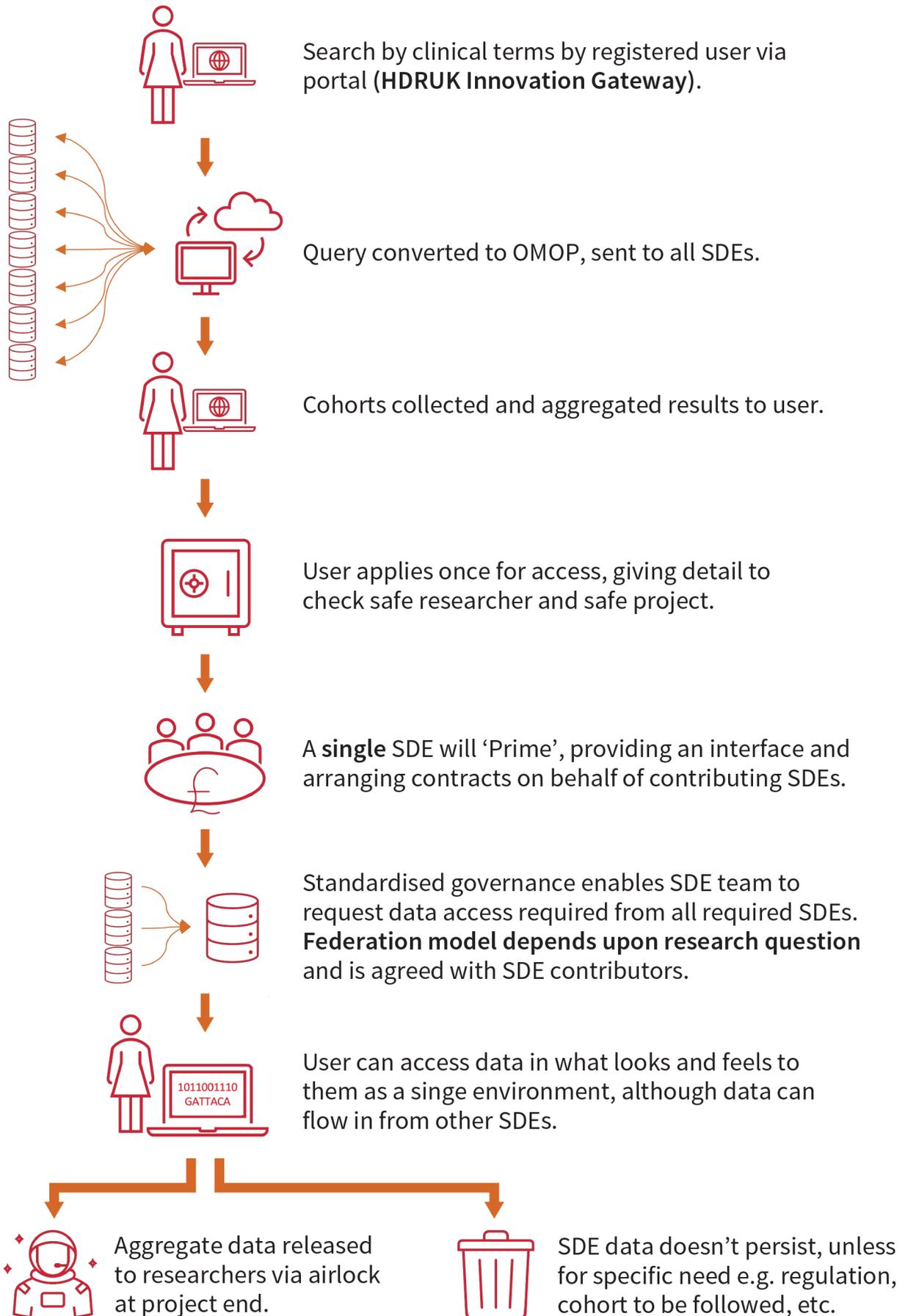
  These sub national SDEs cover populations of five million people on average. The eleven regions are: East of England, East Midlands, Great Western, Kent, Medway and Sussex, London, North East and North Cumbria, North West, Thames Valley and Surrey, Wessex, West Midlands, and Yorkshire and Humber.

The SDE network in England


Source: Courtesy of NHSE

How SDEs work in practice

Search by clinical terms by registered user via portal (**HDRUK Innovation Gateway**).

Query converted to OMOP, sent to all SDEs.

Cohorts collected and aggregated results to user.

User applies once for access, giving detail to check safe researcher and safe project.

A **single** SDE will 'Prime', providing an interface and arranging contracts on behalf of contributing SDEs.

Standardised governance enables SDE team to request data access required from all required SDEs. **Federation model depends upon research question** and is agreed with SDE contributors.

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User can access data in what looks and feels to them as a singe environment, although data can flow in from other SDEs.

Aggregate data released to researchers via airlock at project end.

SDE data doesn't persist, unless for specific need e.g. regulation, cohort to be followed, etc.

Source: Courtesy of NHSE

- **Nine Health Data Research Hubs**, which are collaborations of leading universities, NHS Foundation Trusts and other non-academic partners that use their tools knowledge and expertise to facilitate the use of health data for beneficial research purposes. Each Hub is a centre of excellence supporting researchers to maximise the insights and innovations developed using this data.

The Hub Network was established by HDR UK, the national institute for health data science. Its mission is to harness the power of health and administrative data to improve people's lives, ensuring that data is used responsibly and effectively for public benefit.

The Hub Network[15]
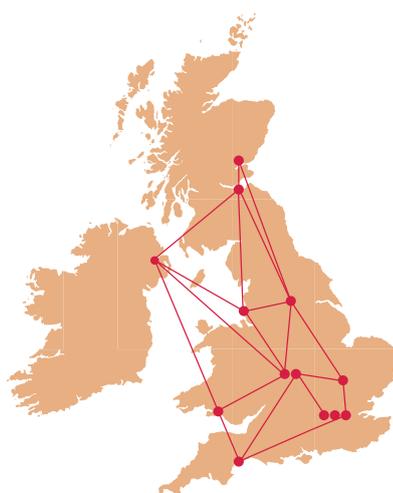
Domain expertise: Pain

Domain expertise: Linked real world data

Domain expertise: Inflammatory Bowel Disease

Domain expertise: Respiratory

Domain expertise: Eye health

Domain expertise: Cancer

Domain expertise: Acute Care

Domain expertise: Clinical Trials

Domain expertise: Mental Health

Source: HDR UK

- **Large Data Banks**, such as the UK Biobank, Our Future Health, or Genomics England (GEL).

Genomics England

GEL provide approved researchers with secure access to genomic data, and their work can lead to scientific discoveries in rare conditions and cancer. In turn, those insights can enable more precise diagnoses and personalised interventions for NHS patients.

Analysis continues on the data from the 100,000 Genomes Project, the original source of GEL's genomic data. In addition, GEL launched 3 initiatives in 2022.

Cancer 2.0 – Uses new technology to enable faster and more accurate diagnoses. Combines imaging, genomic and clinical data to build the world's largest multimodal cancer research platform.

Diverse Data – Conducts research and communicates with minoritised communities to ensure that genomic healthcare can benefit everyone, regardless of their geographic or ancestral background.

Plans to sequence the genomes of 15,000 participants from minoritised communities.

Newborn Genomes Programme – Explores the benefits, challenges and practicalities of sequencing and analysing the genomes of newborns.

Is an NHS-embedded research study – the world's first publicly funded newborn genome programme at a national scale.

<div style="background:orange;color:white">Case study</div>

Identifying variants known to cause cancer

Oxford Nanopore Technology is working in collaboration with Genomics England across many areas including their Cancer 2.0 programme, which uses Oxford Nanopore's DNA sequencing technology in the ongoing proof-of-concept project to evaluate the clinical and research applications of rapid and comprehensive genomic analysis of cancer. Following the successful completion of an initial phase of the project, where Genomics England generated and analysed nanopore sequence data on several hundred tumour samples from across its cancer programme, the current phase is focusing on more depth and at a larger scale on haemato-oncology, sarcoma and brain tumours.

Oxford Nanopore's technology is well suited to serve Genomics England's aim of developing cancer genome analyses that rapidly and accurately identify the full range of the challenging variants known to cause cancer. The ability to sequence any-length fragments of DNA – and as a result to elucidate more genetic variation – has exciting potential to provide clinicians and researchers with a completer and more actionable picture of an evolving cancer genome. Methylation is also known to be important in cancer, and nanopore sequencing can characterise methylation in real time. Broader access to sequencing technology, with easier-to-use, smaller but powerful devices, will potentially be a significant advantage in future applications, especially in some cancer types where turnaround time and fast results are crucial.

UK Biobank

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 and has enabled several scientific discoveries that improve human health.

<div style="background:orange;color:white">Case study</div>

Half a million whole human genomes sequenced in UK Biobank major milestone

Together with deCODE in Iceland, the Wellcome Sanger Institute has sequenced its share of 500,000 whole human genomes for the UK Biobank project, contributing to the world's largest single set of sequencing data. This major milestone is set to drive the discovery of new diagnostics, treatments and cures and is available to approved researchers worldwide, via a protected database containing only de-identified data.

The project has taken five years, more than 350,000 hours of genome sequencing, and over £200 million of investment and is the world's largest-by-far single set of sequencing data, completing the most ambitious project of its kind ever undertaken. The project has been funded by Wellcome, UKRI and four biopharmaceutical companies; Amgen, AstraZeneca, GSK and Johnson & Johnson.

This abundance of genomic data is unparalleled, but what cements it as a defining moment for the future of healthcare is its use in combination with the existing wealth of data UK Biobank has collected over the past 15 years on lifestyle, whole body imaging scans, health information, and proteins found in the blood.

Our Future Health

Our Future Health is the UK's largest-ever health research programme, aiming to recruit up to 5 million people. It is a collaboration between the public, charity and private sectors, and is designed to help people live healthier lives for longer through the discovery and testing of more effective approaches to prevention, earlier detection and treatment of diseases.

Our Future Health has the potential to revolutionise the way we prevent, detect and treat diseases. By combining health data from millions of people, researchers will be able to identify new risk factors for diseases, develop more accurate diagnostic tests, and design more personalised treatments. This could lead to a significant reduction in the number of people who die from or suffer the long-term effects of chronic diseases.

Here are some examples of the specific things that Our Future Health is trying to achieve:
- Develop new ways to prevent disease, such as vaccines and lifestyle interventions.
- Detect diseases earlier, when they are more treatable.
- Develop more effective treatments for diseases, including personalised treatments that are tailored to the individual patient.
- Improve the quality of life for people with chronic diseases.

Representing the diversity of the UK population

Our Future Health and industry collaboration

Our Future Health is an ambitious public health project aiming to be the 'largest ever health research program' in the UK that will genotype and collect health information from 5 million participants. Its mission is to help people live healthier lives for longer, using data to develop new ways to detect diseases at an earlier stage, and even prevent them from occurring in the first place.

An important drive for the program is to collect data that are representative of the diversity of the UK population and build a resource that benefits everyone in the UK. The scale of the ambition is enabled by bringing together synergies and funding from government, charities, the NHS and its AI Laboratory and industry.

Currently, 16 industry partners are founding members in Our Future Health including Illumina, ThermoFisher, Roche, GlaxoSmithKline, Janssen, AstraZeneca, and Amgen. The industry founding members provide more than funds to support the initiative, they bring expertise and guidance on the scientific and technical aspects of its development to build a resource that will enable the discovery and testing of more effective approaches to prevention, earlier detection, and treatment of diseases.

- **Disease-specific and academic hubs, such as the COVID-19 Genome Consortium or the NHS GMS**

The COVID-19 Genomics UK Consortium

The COVID-19 Genomics UK Consortium dataset, together with the ~2 million additional genomes sequenced subsequently in the UK, has been used by public health workers and scientists to analyse and understand COVID-19, and has fed into more than 100 publications by COG-UK members over the last three years.

Importantly, as the SARS-CoV-2 genomes sequenced in the UK can be linked with epidemiological, clinical, and human genetic data, the resulting rich dataset will provide an invaluable resource for scientists studying COVID-19 for decades to come.

NHS Genomic Medicine Service

The NHS GMS aims to be the first national health care system to offer whole genome sequencing as part of routine care. They will attempt to:

- Sequence 500,000 whole genomes by 2023-2024 and help transform healthcare for maximum patient benefit, including for all children with cancer or children who are seriously ill with a likely genetic disorder.
- Extend access to molecular diagnostics and offer genomic testing routinely to all people with cancer.
- Offer early detection and treatment of high-risk conditions including expanding genomic testing for Familial Hypocholesterolaemia.
- Link and correlate genomic data to help provide new treatments, diagnostic approaches and help patients make informed decisions about their care.

The current landscape of health data assets in Wales, Scotland and Northern Ireland

Wales – SAIL Databank

Funded by the Welsh Government's Health and Care Research Wales, the Secure Anonymised Information Linkage (SAIL) is a 'Wales-wide research resource focused on improving health, well-being and services'. Based at Swansea University Medical School, the databank holds anonymised person-based, population-scale records, bringing in data from across healthcare, social care, housing, and education. SAIL has achieved 100% coverage for secondary care and 85% in primary care, making it one of the richest population data sources in the world. Since first being piloted in 2007, SAIL now has over 100 staff and played a central role in the 'One Wales'[16] response to COVID-19.

The databank has enabled hundreds of publications[17] since 2007, including a report on the impact of COVID-19 on those shielding[18] and research into vaccination inequalities[19] throughout Wales. As a secure data environment (SDE), SAIL's data has also proved valuable for clinical trials,[20] providing secure data access to researchers.

NHS RESEARCH SCOTLAND

Scotland – Data Safe Havens, SHARE, Generation Scotland

In addition to its collaboration with UK initiatives, including hosting one of the six HDR UK sites,[21] Scotland has its own health data assets. As set out in the Scottish Government's 'Health and social care: data strategy',[22] NHS Scotland runs five Data Safe Havens,[23] with SDEs in Aberdeen, Dundee, Edinburgh, Glasgow, and a national SDE run by Public Health Scotland. This work is complemented by Research Data Scotland (RDS),[24] a charitable organisation funded by the Scottish Government to bring together academic institutions and public bodies to oversee health data access.

Some specific Scottish health data assets include:

- The Scottish National Safe Haven (NSH),[25] established as a single entry point for the research community to request access to NHS Scotland datasets. Established in 2013, the NSH is now hosted at the University of Edinburgh's EPCC.

- SHARE[26] (The Scottish Health Research Register and Biobank), which has over 260,000 registered users. The SHARE Biobank collects consented blood samples, holding surplus bloods from over 74,000 individuals. One ongoing study at SHARE is DecodeME,[27] the world's largest ever Myalgic Encephalomyelitis (ME) / Chronic Fatigue Syndrome (CFS) research project aiming to see if the disease is partly genetic. The SCOT-HEART 2[28] trial, run in collaboration with the British Heart Foundation, aims to determine the best way of preventing heart attacks.

- Generation Scotland,[29] which has 7,000 families and 24,000 members registered and is based at the University of Edinburgh. By combining questionnaires, genetic testing, and NHS health records, researchers are looking to reshape public health with new insights into diseases including cancer, heart disease, and depression. Generation Scotland's pilot started in 2001, with further crucial funding received from the Wellcome Trust in 2019.

HSC Business Services Organisation
Honest Broker Service

Northern Ireland – Honest Broker Service

Northern Ireland's Health and Social Care (HSC) system funds an SDE known as the Honest Broker Service[30] (HBS), providing access to de-identified health data for the population of Northern Ireland. Established in 2014, HBS sits within an arms-length body: the HSC Regional Business Services Organisation (BSO). Data can be accessed via a Safe Haven at the BSO's headquarters in Belfast or through the UK Secure e-Research Platform (UK SeRP). There are currently thirty active research projects running within the SDE, granted access to inpatient and outpatient data,[31] in addition to emergency department, maternity systems and lab data.
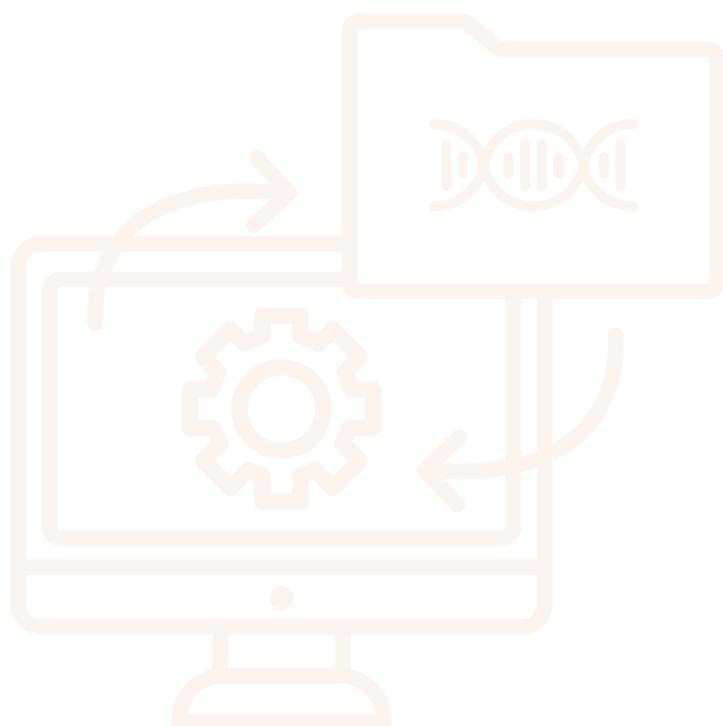
5. Collaborating for impact

Success stories from the genomics industry and its ecosystem

Genomics companies do not operate in a vacuum. Their success is reliant on collaboration with other actors within its ecosystem: the NHS, academia, data assets, pharma, other genomics companies, and government bodies.

In this section, we will showcase some of the cutting-edge collaborations that have taken place within this ecosystem and the positive health outcomes they created.

Health data, genomics and AI

The UK Government recognises the importance of AI and genomics to the UK economy and society. One of its stated aims is to become 'the most advanced genomic healthcare system in the world', and lists AI as one of five 'critical technologies' that can make the country a scientific superpower.[32]

Major scientific challenges are already being tackled by AI and genomics, for example, using genomic sequencing to identify new COVID-19 variants or using machine learning AI to accurately predict the structure of proteins.

Collaboration with players outside of the traditional life science realm are also emerging. Ambitious initiatives are apitalising on the synergies emerging between big tech and biotech. AlphaFold for example[33] is the result of Google DeepMind and the research institute EMBL-EBI in Cambridge joining forces to solve the "50-year-old challenge" of predicting a protein structure from the sequence of individual amino acids that the protein is made from.

This powerful resource can now accurately predict the 3D structure of nearly all known proteins, i.e., approximately 200 million protein structures. It represents an exceptional collaborative breakthrough that will accelerate drug discovery as well as impact every area of biology research.[34]

Some pharmaceutical companies, including GSK, adopted AI and functional genomics early and developed strong in-house capabilities.[35,36]

The field has also seen multiple pharma partnerships and the impact of these collaborations are emerging. For example, Oxford-based Exscientia reported starting their first in-human study for an AI-designed molecule developed in collaboration with BMS.[37]

AstraZeneca entered a multi-year target identification partnership with BenevolentAI which was expanded to new disease areas in January 2022 and recently published preclinical validation of a first target.[38]

AI-centric collaboration is not limited to industry, however.

Genomics England has developed an unparalleled biodata resource of almost 150,000 whole genomes with corresponding phenotypic data from NHS patients with rare diseases or cancer. It is collaborating with the AI company Insitro to integrate histological information into its genomic and clinical datasets and create a powerful new "multimodal cancer data environment".[39]

## Charting the depths of the metagenomic protein world with AI

Proteins play essential roles across living organisms. Their understanding, especially in the realm of the microbiome – the diverse ecosystem of bacteria, fungi, and viruses in living beings – is central to new biological innovations. Eagle Genomics is venturing into this vast metagenomic protein space, aiming to better understand how organisms interact with their microbiomes.

Modern digital analysis, like Google's Proteinfer and DeepMind's AlphaFold, use advanced machine learning to discern protein functions or structures directly from their basic building blocks, the amino acids. Meta's ESMFold, a cutting-edge AI model, has substantially sped up this analysis, making accurate predictions for an astounding 600 million proteins from varied sources, including soil, the deep ocean, and human microbes.

Many treasures in metagenomic data remain undiscovered. Knowing both a protein's function and its origin can unearth proteins that withstand extreme conditions, such as intense heat or the vacuum of space. In support of this research, the European Nucleotide Archive offers vast metagenomic datasets, with the MGnify resource at EMBL-EBI analysing and making this information public.

Eagle Genomics' groundbreaking platform, the e[datascientist], harnesses these enriched databases. Utilising network science and innovative AI techniques, this platform dives deep into data, extracting invaluable insights about proteins and their environments. Eagle Genomics is not just answering fundamental scientific questions but is also paving the way for impactful innovations that benefit humans, animals, and our planet's overall health.
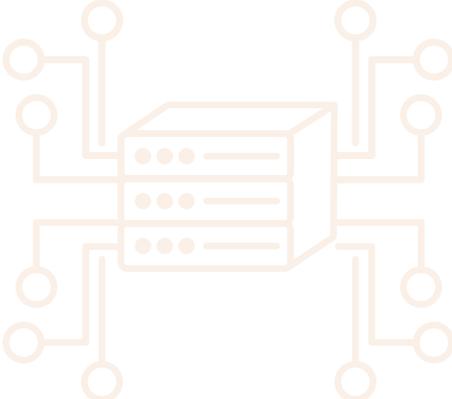
Revolutionising pet therapeutics with AI and genomics

PetMedix harnesses a blend of genome engineering, advanced sequencing, and AI to design therapeutic antibodies specifically for dogs and cats. The process begins by modifying mouse genomes to incorporate genes of dog or cat antibodies. This is achieved with the cutting-edge sequential recombinase-mediated cassette exchange (S-RMCE) technique, ensuring pinpoint accuracy without unintended effects.

After genetic engineering, the mice are exposed to dog or cat antigens, prompting their immune systems to produce mature antibodies. Following sequencing, AI tools, particularly DeepMind's AlphaFold2, are employed to predict the 3D structure of these antibodies – a crucial aspect dictating their function and compatibility.

PetMedix's innovative approach marries the innate abilities of the mouse immune system with AI's analytical prowess. Utilising AI, the company evaluates antibody structures to determine their viability for therapeutic use, examining aspects such as their development potential and antigen binding diversity.

PetMedix was swift to adopt AlphaFold2, being the first to predict 3D structures for dog antibodies shortly after its public release. This synergy of genomics and AI has positioned PetMedix at the forefront of discovering potent therapeutic antibodies for various pet ailments.
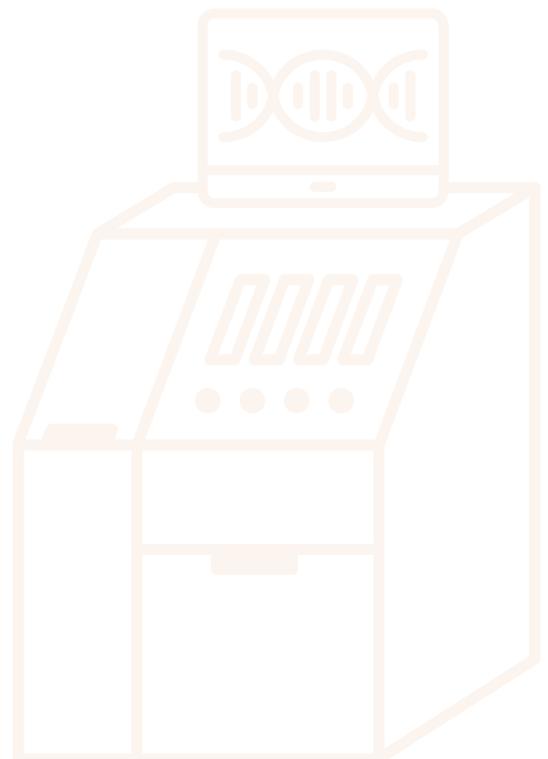
Medical charities, health data assets, genomics companies and universities

The confluence of medical charities, health data assets, genomics companies, and academia is creating new pathways to groundbreaking medical advancements. These stakeholders, each bringing unique strengths and expertise to the table, are merging patient-driven data, cutting-edge genetic analytics, and academic institutional knowledge.

Such collaborations are a critical component of the 21st century biomedical revolution, not only amplifying research capabilities but also enabling more personalised, targeted therapies for a host of health conditions. By harnessing vast data repositories, pioneering computational methods, and academic insights, these entities are redefining how we understand, diagnose, and treat diseases that impact countless lives.

The case of the "Ice Bucket Challenge" – PrecisionLife's collaborative endeavours in unearthing novel treatment avenues for ALS – serves as a testament to the transformative potential of these synergistic partnerships.

Tackling ALS

PrecisionLife analyses multiple genomic datasets such as UK Biobank, HDR UK, MND Collections, and DecodeME to drive precision medicine into complex chronic diseases such as neurodegenerative, psychiatric, cardiovascular, metabolic, autoimmune and respiratory disorders. These affect billions of people and account for >80% of healthcare spending. PrecisionLife uses its unique combinatorial analytics platform to uncover the deepest insights into disease biology and mechanistically stratify patient subgroups in disorders that are caused by a more complex interplay of genes and biological factors.

PrecisionLife is finding better, more personalised treatment options for patients with unmet medical needs. This is only possible thanks to the patients who offer their health data for research. For example, in motor neuron disease (MND/ALS), a devastating condition with almost no effective therapy options, PrecisionLife collaborated with genomic data partners including the MND Association and King's College London, to identify 33 novel drug targets for ALS. Several of these demonstrated disease modification potential and are partnered with LifeArc and biotech companies for novel drug development programs.

PrecisionLife uses these insights in over 50 chronic diseases – in drug discovery to identify new drug targets for treating disease, in clinical development to increase the probability of a treatment demonstrating efficacy in patients, and in the clinic to improve disease diagnosis and inform the selection of the most effective medicines for individual patients.

Making research easier while respecting patient privacy

Biomedical data has the power to drive scientific discoveries and deliver health benefits to people worldwide. However, the challenge is enabling secure access and use of this highly sensitive data, which is stored in disconnected locations, for research and innovation without compromising patient privacy.

Lifebit, a London-based biotechnology company, is solving this challenge by enabling organisations to transform how they securely leverage biomedical data for scientific research through its patented, federated data platform.

Through a partnership with Genomics England, Lifebit's platform is enabling highly sensitive patient and participant genomic and COVID-19 data to be made securely available for vital research.

The data stored on the platform never leaves Genomics England's highly secure environment but allows authorised researchers to access it. Much like the use of apps on a smartphone, researchers can introduce cutting-edge analytical tools of their choice, link those tools securely with their in-house data, and conduct research in a way that is protected and controlled by Genomics England's strict information governance policies.

Lifebit is also working with Genomics England to transform and standardise data to common data models, enhancing the usability and interoperability of clinical data.

Tackling gut disease

Cytiva has joined forces with the Cambridge Stem Cell Institute to develop 3D models of the human intestinal tract. Prof. Matthias Zilbauer's team at the University of Cambridge has successfully cultivated over 1000 of these 3D structures, known as organoids, from human tissue samples.

To enhance the quality and consistency of these organoids, Cytiva introduced the VIA-Extractor™. This specialised equipment ensures high-quality tissue processing, leading to more reliable research outcomes.

The significance of these 3D organoid models is profound. They provide a pivotal tool for understanding diseases like intestinal inflammation, serving as a bridge between lab research and real-world applications. By refining the methods used to study these organoids, researchers can more effectively pinpoint disease mechanisms and potential therapeutic targets.

The collaborative venture between Cytiva and the University of Cambridge helps scientists understand diseases like inflammation of the gut better. This partnership not only bolsters scientific understanding but also paves the way for the development of innovative treatments, offering immense therapeutic potential for patients.

Genomics companies, health data assets and pharma: a new generation of vaccines R&D

Beyond a direct impact on diagnostics or therapeutics discovery and development, it might be on vaccine R&D that the rise of genomics has triggered the most spectacular evolution. Rapid open access to genetic sequence information of the SarsCoV2 virus accelerated vaccine design and the parallel effort of multiple vaccine companies and diversity of approaches increased the "shots on target", ultimately saving millions of lives during the COVID-19 pandemic.[40]

Furthermore, ongoing genomic surveillance of emerging variants is a powerful tool to predict and monitor the efficacy of marketed vaccines and could, in the future, underpin the rapid design of the next generation of vaccines. The UK's leading position in genomics and initiatives such as the Cancer Vaccine Launch Pad led by Genomics England and NHS England is attracting innovative vaccine companies to the UK.

For example, BioNTech will establish an R&D hub in Cambridge, intending to provide up to 10,000 UK cancer patients with personalised immunotherapies by 2030.[41] SMEs built on a genomics foundation are emerging and driving innovation in cancer vaccines. Achilles Tx, for example, is using genomics analysis of tumor and bioinformatics to identify neoantigens that could be targeted by a vaccine.

Strategic partnership between Moderna and the UK Government

In April this year, Moderna commenced construction of its Moderna Innovation and Technology Centre (MITC) at the Harwell Science Campus, Oxfordshire.[42] The MITC is part of Moderna's ten-year strategic partnership with the UK Government, which aims to boost vaccine manufacturing and research capabilities in the UK as part of the government's "100 Days Mission" to reduce the impact of future pandemics.[43]

The MITC will consist of a manufacturing facility and Moderna's only Clinical Biomarker Laboratory outside the US, which will test how well the vaccines are working and is critical to the drug development process.[44]

Once operational, the manufacturing facility will have the ability to produce up to 250 million mRNA vaccines a year for the UK population, providing onshore supply chain resilience in case of a pandemic, while also ensuring endemic supply during a normal winter season.[45]

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6. Summary and conclusion

UK genomics holds immense promise and is undergoing dynamic growth. The UK has shown itself to be a global leader in the field, standing on the pillars of public investment, academic acumen, innovative breakthroughs, and an ever-growing number of pioneering SMEs.

This report has shown that UK genomics is growing ever deeper roots. Our map of the ecosystem illustrated the varied and ever-growing diversity of the work of genomics companies. As documented in section on data assets and genomics companies, this R&D is powered by the UK's strong data assets, the bedrock of good genomics. This provides a picture of a flourishing sector; a national cluster of genomics expertise that feeds on its momentum, rivalling any cluster across the Atlantic.

Investment has the potential to drive the sector's expansion still further. For instance, the unlocking of pension funds through the Mansion House Compact will provide a new avenue for institutional investment to reach scaling companies. Financial resources of this kind are pivotal for empowering genomics businesses, nurturing their progression from innovative start-ups to fully-fledged global competitors. The cultivation of an investment-friendly environment is therefore essential for the sustainable growth of the genomics industry in the UK.

Data quality and accessibility are two key factors shaping the future of genomics. The UK's health data is a treasure trove for genomics, but there is a pressing need to enhance its accessibility to innovative SMEs. Strengthening our data infrastructure will not only aid in improving disease diagnosis and treatment but could also spark new waves of innovation within the sector.

Interdependence underscores the advancement of genomics, a sentiment that transcends the field to encourage collaborations with the tech sector. In particular, the emergence of AI-enabled Large Language Models (AI LLMs) for life sciences has introduced an exciting new dimension to genomics. By "reading" biology, AI LLMs can garner deeper insights from genetic information, uncovering hitherto unknown approaches to human health and disease.

At the intersection of genomics and technology lies functional genomics, an exciting new frontier for our field. By focusing on the dynamic aspects of the genome, functional genomics promises to unravel the complexities of gene interactions and their implications on patients' lives. Linking genotype to phenotype in this way could have a transformative impact, paving the way for a genomics-enabled NHS providing personalised medicine.

Reflecting on the state of UK genomics in 2023, the road ahead should involve capitalising on growth opportunities, ensuring data accessibility, and promoting cross-sector collaboration. We stand on the cusp of a new era in genomics, propelled by emerging technologies, investment, and a maturing industry ripe for growth. The UK is not just a genomics nation – it is a nation poised to redefine the boundaries of genomics and healthcare, with a future that promises an integrated role for functional genomics and AI-powered insights.

- Alleviate
- Barts Health NHS Trust
- BREATHE
- British Heart Foundation Data Science Centre
- British Regional Heart Study (BRHS)
- Cambridge University Hospitals NHS Foundation Trust
- Clinical Practice Research Datalink (CPRD)
- Cystic Fibrosis Trust
- DATA-CAN
- DataLoch
- DATAMIND
- Dementias Platform UK
- Discover-NOW
- Generation Scotland
- Genomics England
- Gloucestershire Hospitals NHS Foundation Trust
- Grampian Data Safe Haven (DaSH)
- Great Ormond Street Hospital for Children NHS Foundation Trust (GOSH)
- Gut Reaction Health Data Research Hub
- Guy's and St Thomas' NHS Foundation Trust
- Health and Social Care Northern Ireland (HSCNI)
- Health Informatics Centre – The University of Dundee
- Healthcare Quality Improvement Partnership (HQIP)
- Human Fertilisation and Embryology Authority Register (HFEA)
- IBD Registry Ltd
- Imperial College Healthcare NHS Trust
- INSIGHT
- Intensive Care National Audit & Research Centre (ICNARC)
- Lancashire & South Cumbria NHS Foundation Trust
- Lancashire Teaching Hospitals NHS Trust (LTHTR)
- Leeds Teaching Hospitals NHS Trust
- Manchester University NHS Foundation Trust
- Moorfields Eye Hospital NHS Foundation Trust
- MRC Brain Bank Network

- MRC Unit for Lifelong Health and Ageing – UCL
- National Consortium of Intelligent Medical Imaging (NCIMI)
- National Institute for Health and Care Research (NIHR) BioResource
- National Pathology Imaging Co-operative (NPIC)
- Neonatal Data Analysis Unit (NDAU) – Imperial College London
- Newcastle upon Tyne Hospitals NHS Foundation Trust
- NHS DigiTrials Health Data Research Hub
- Norfolk and Norwich University Hospitals NHS Foundation Trust
- Northern Care Alliance NHS Foundation Trust
- Nottingham University Hospitals NHS Trust
- Nottinghamshire Healthcare NHS Foundation Trust
- Optimum Patient Care
- Our Future Health
- Oxford Health NHS Foundation Trust
- Oxford University Hospitals NHS Foundation Trust
- Parkinson's UK
- PathLAKE
- PIONEER Health Data Research Hub
- Public Health Scotland
- QResearch
- Research Data Scotland
- Royal Devon & Exeter NHS Foundation Trust
- Royal Free London NHS Foundation Trust
- SAIL Databank
- South London and Maudsley NHS Foundation Trust
- The Brain Tumour Charity
- The Industrial Centre for Artificial Intelligence Research in Digital Diagnostics (iCAIRD)
- The London Medical Imaging & Artificial Intelligence Centre for Value Based Healthcare
- The Royal Marsden NHS Foundation Trust
- UK Biobank
- UK Dementia Research Institute (UKDRI)
- UK Longitudinal Linkage Collaboration (UK LLC)
- UKCRC Tissue Directory Coordination Centre
- University College London Hospitals NHS Foundation Trust
- University Hospitals Birmingham NHS Foundation Trust
- University Hospitals Bristol and Weston NHS Foundation Trust (UHBW)
- University Hospitals Coventry and Warwickshire (UHCW)
- University Hospitals of Leicester NHS Trust

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About BIA

The BioIndustry Association (BIA) is the voice of the innovative life sciences and biotech industry, enabling and connecting the UK ecosystem so that businesses can start, grow and deliver world-changing innovation. We are an award-winning trade association representing more than 550 member companies including:

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- Pharmaceutical and technological companies

- Universities, research centres, tech transfer offices, incubators and accelerators

- A wide range of life science service providers: investors, lawyers, IP consultants and IR agencies

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About Medicines Discovery Catapult

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Medicines Discovery

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MDC's vision is to reshape drug discovery for patient benefit by transforming great UK science into better treatments through partnership.

MDC supports drug discovery innovators by making world-class expertise, facilities, complex technologies and advanced analytics accessible. We connect the life sciences ecosystem, driving a global focus on barriers to innovation in areas of unmet patient and technological need.

By industrialising new technologies to drive the adoption of new scientific tools and techniques, MDC enables successful medicines discovery.

Learn more at md.catapult.org.uk

About the Wellcome Sanger Institute

wellcome sanger institute

The Wellcome Sanger Institute is a world leader in genomics research. We apply and explore genomic technologies at scale to advance understanding of biology and improve health. Making discoveries not easily made elsewhere, our research delivers insights across health, disease, evolution and pathogen biology. We are open and collaborative; our data, results, tools, technologies and training are freely shared across the globe to advance science.

Funded by Wellcome, we have the freedom to think long-term and push the boundaries of genomics. We take on the challenges of applying our research to the real world, where we aim to bring benefit to people and society. In the last 15 years, Sanger's science has given birth to successful, market leading companies such as Kymab, Congenica, Microbiotica, Mosaic Tx or Quotient Tx. .

Learn more at sanger.ac.uk

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