# Genomics nation

## A benchmark of the size and strengths of the UK genomics sector

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BIA UK BioIndustry Association

CATAPULT Medicines Discovery

wellcome sanger institute

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# Forewords

**Steve Bates OBE**
Chief Executive Officer,
BioIndustry Association

The UK's strength in life sciences – and genomics in particular – has never been more evident. Our genomic surveillance of the SARS-CoV-2 virus, cornerstoned by the world-leading Wellcome Sanger Institute, has led the way worldwide throughout the pandemic. With the emergence of new variants in the UK and elsewhere, the importance of strong genomic capabilities has escaped few.

Beneath the high-profile headlines however, there is a hive of activity developing new innovations that extend far beyond COVID-19 and promise to change healthcare as we know it. These innovations are driven by the UK's rapidly growing genomics ecosystem: start-ups and SMEs; scaling companies; active investors; world-leading academics; a strong skills-base; unique data resources; leading research institutes; and the NHS, all joined together by their mission to improve patients' lives.

The ecosystem builds on the UK's long legacy in genomic research, but we would not be where we are today without long-term public investment into the sector by successive governments. Major initiatives such as the 100,000 Genomes Project and the UK Biobank are fundamental pillars of the UK's genomics ecosystem today. The Government is right to continue building on our global competitive advantage both through new world-leading initiatives such as Our Future Health, and through strategies such as Genome UK and the newly launched Life Sciences Vision.

The Vision recognises that the UK is in a unique position to leverage the capabilities in our genomics ecosystem to drive economic growth as the country recovers from the pandemic. The new £200m Life Sciences Investment Programme is a sign of the Government's commitment to this agenda, and it has already helped attract an £800m commitment to UK life sciences from the Abu Dhabi sovereign wealth fund Mubadala. This wave of new public and private investment promises to unlock a new era of genomic innovation and economic growth. As this report shows, start-ups and SMEs are the key drivers of this innovation and growth, and are essential partners to truly delivering the promise of genomic technologies.

The BioIndustry Association (BIA), as the UK's trade association for innovative life science organisations, the Medicines Discovery Catapult (MDC), as the UK's catapult centre for medicine research and innovation, and the Wellcome Sanger Institute, as the UK's leading genomics research institute, are proud to celebrate our genomics sector together by publishing this report. It shows the shape and size of the UK's genomics sector, describes the foundations that are key to its success, and outlines the tremendous opportunity that the sector represents for the wealth and health of the UK.

I hope it will serve to inform and excite potential new investors and the policy makers that are key to the ongoing growth of genomics in the UK, and I hope you all enjoy reading it.

**Professor Chris Molloy**
Chief Executive Officer,
Medicines Discovery Catapult

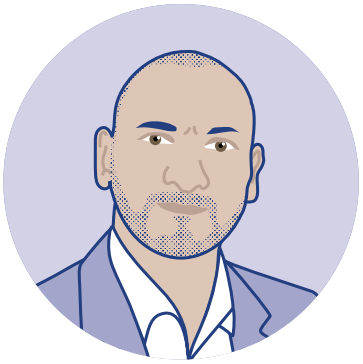
Genomics is a foundation stone of modern Medicines Discovery. Our ability to identify disease linkages, select cohorts of potential patients and validate new drug targets is now unprecedented.

The UK has deployed these powerful tools at scale across academia and the NHS. We have the opportunity to learn, apply and benefit from these deployments to drive wealth and health across the UK. We also have the responsibility to use them safely and efficiently, recognising their limitations and enabling other techniques to follow a path into widespread clinical and industry use.

We have the responsibility to make consented and relevant linked datasets and bio samples available to those who can create material benefit for patients by driving better diagnostics and drugs, founded on relevant genetic information. From its HQ in the North West, MDC continues to industrialise and drive the adoption of new multi-omic technologies for the benefit of drug discovery innovators, patients and technology firms nationwide.

Emblematic of this has been its role in the co-ordination of the Lighthouse Lab network of PCR COVID-19 labs as part of the UK's pandemic response. This has brought together the NHS, academia and industry to deliver the largest diagnostics lab project in UK history; deploying a clinically relevant, genomically-driven patient testing system at massive pace and scale – and passing all positives smoothly into sequencing at the Wellcome Sanger Institute. It is a high-profile example of how the UK can team up and benefit from technology when there is a collective goal, with shared expertise, purpose and perspective.

MDC's core ability to translate tools and techniques into products and services helps to achieve this and provides much-needed access to these early-stage tools for biotechs, drug-hunting academics, diagnostics companies and technologists.
We should celebrate the progress made and opportunities created, whilst remaining relentless in our pursuit of further progress in order to do more for the patients and innovators who rely on us.



**Adrian Ibrahim**
Head of Technology Transfer and Business Development, Wellcome Sanger Institute

The UK has a peerless heritage as a genomics pioneer. The work of Watson and Crick at Cambridge – building upon Maurice Wilkins' and Rosalind Franklin's X-ray diffraction studies at King's College London – led to the elucidation of the DNA double-helix structure. John Sulston's vision to map the human genome, initially applying technology developed by Fred Sanger, led to the establishment of the Wellcome Sanger Institute which was the single largest contributor to the Human Genome Project, mapping a third of the entire genome.

The UK continued to lead the world with its vision to generate whole genome sequences in the hundreds of thousands, and subsequently millions, through the formation of Genomics England, exploiting the massively parallel sequencing technology developed by Shankar Balasubramanian and colleagues. Most recently, the UK has demonstrated its world-leading capabilities through the astounding achievements of the COVID-19 Genomics UK Consortium (COG-UK), which is mobilising public, private and charitable research sectors to pioneer large-scale, real time whole-genome sequencing of SARS-CoV-2 to understand viral transmission and evolution, and to inform public health responses and vaccine development.

We have, however, lagged our academic peers in major research hubs such as California and Boston when it comes to converting our exceptional research into the discovery, development and ultimately commercialisation of genomic technologies. We are now beginning to redress this imbalance.

At Sanger, we continue to drive large scale genomics research such as the Human Cell Atlas, which aims to create comprehensive reference maps of all human cells and has the potential to impact almost every aspect of biology and medicine. Through a combination of public and private investment, the UK has grown an impressive base of genomics SMEs with Europe's largest genomics cluster based at the Wellcome Genome Campus and many other companies distributed across the UK. Additionally, we have seen successful scaling of UK genomics companies, supported by growing investor appetite – though more needs to be done in this space.

The current wave of innovation across sequencing, quantum computing, disease modelling, artificial intelligence and genome manipulation creates ever more opportunities to grow the UK's position as a genomics powerhouse. Our world leading academia, a heightened focus on entrepreneurship, exceptional genomics data infrastructure, governmental support for the life science sector, increasing availability of risk capital and of course, our exceptional NHS, collectively create a unique and enviable platform for the UK to exploit technology advances and drive economic growth through disruptive innovation in the genomics sector. Alignment across our capabilities will ensure that our genomics industry is regarded as world leading, and that the UK is the preferred destination for genomics investments.

# Key takeways

## Features of the UK genomics ecosystem:

**Strong legacy in genomics** – from the solving of the DNA double helix structure in 1953 to the completion of the 100,000 Genomes Project in the 2010s

**World-leading research institutes and academia**, including the renowned Wellcome Sanger Institute

**Unique data resources**, such as the UK Biobank and Our Future Health

**The National Health Service** (NHS) – the largest united healthcare system in the world, uniquely positioned to deliver genomic innovations to patients

**Active industrialisation** of new techniques and technologies through Catapult centres

**A thriving community of entrepreneurs**, scaling SMEs, global companies and an active investor base, working in collaboration with academia and the NHS

## The UK genomics sector:

**154** companies

**5119** employees

**5bn+** market cap

**£3.3bn** private investment raised since 2011

**£151m** public R&D grants since 2011

**£2bn** in IPOs since 2011

**Projected market cap** of over £50bn by 2040

"The United Kingdom is a global hub for life sciences and for genomic medicine in particular, thanks in part to our long-life sciences legacy – from the work of Darwin and then Franklin, Crick and Watson a century later, to the likes of Illumina, Oxford Nanopore and Genomics England. The unique structure of the NHS and early investments in initiatives such as the 100,000 Genomes Project is allowing us to harness advances in genomic research capabilities at scale and pace for patient benefit. That means that patients now have access to predictive, preventative and personalised care on the NHS, free of charge. Ours is the first national healthcare system in the world to embed genomics into front line healthcare in this way. For many patients, this means an improved quality of life that would be unimaginable without the concentration of clinical and research capability we have at our fingertips here in the UK."

**Nicola Blackwood, Chair of Genomics England and former Minister for Innovation**

# The UK genomics ecosystem

**The UK excels in genomics. The long legacy in genomics stretches from the elucidation of the DNA double helix structure by Francis Crick and James Watson in Cambridge in 1953, through the first sequencing of a genome by Frederick Sanger in the 1970s, the establishment of the renowned Sanger Institute (the single largest contributor to the Human Genome Project) in the 1990s, to the launch and completion of the 100,000 Genomes Project in the 2010s and today's rapidly growing genomic sector.**

The growth of the sector is driven by a thriving community of entrepreneurs, scaling SMEs, global companies and an active investor base. This community is nurtured by academic excellence at scale, research institutes, the NHS, government support, and unique data resources such as the UK Biobank and Genomics England. Together, they form the UK genomics ecosystem.

**"The UK has always held a leadership position in genomics, from the academic community to our world leading programmes on population genomics and cancer. The response from the genomics community during the COVID-19 pandemic has highlighted the strength of the existing ecosystem.**

**"At Oxford Nanopore, we have always collaborated deeply with the genomics community to provide the fastest in-market improvements of our sequencing platform possible, and to ensure that scientists can exchange best practice and we can expand the applications for which our technology offers benefits to those scientists. Without the spirit of innovation in the UK, and indeed the global genomics community, we would not have been able to make the progress that we have. Our grounding in the UK genomics ecosystem will allow us to continue to expand our global footprint into a company that enables the analysis of anything by anyone, anywhere."**

**Gordon Sanghera, CEO, Oxford Nanopore Technologies**

Growing the sector further and enabling patient access to genomic technologies and treatments are high on the Government's policy agenda. Through the publication of the *Life Sciences Vision* in Summer 2021, the Government launched the Life Sciences

Investment Programme, bringing £1bn in new public and private funding to the UK's most promising life sciences companies. The *Vision* identifies genomics as a key priority and commits building the most advanced and integrated genomic ecosystem in the world. These commitments build on the publication of *Genome UK: The future of healthcare* in 2020, which aims to enable genomics to greatly improve the mental and physical wellbeing of the UK population and millions more worldwide. As part of the commitment in the NHS Long Term Plan to harness the power of genomic testing to rapidly diagnose rare diseases, whole exome sequencing is provided to critically ill babies and children. The recent introduction of the NHS Genomic Medicine Service (GMS) aims to integrate genomic medicine into routine NHS care by 2025.

The COVID-19 pandemic has further demonstrated the strength of the UK's genomic capabilities. The Lighthouse Labs – the biggest diagnostic lab network in British history – was set up at pace utilising volunteers from across the scientific community and is now employing several thousand diagnostic scientists, operating 24/7, to inform and enable to Government's response to the pandemic. The COVID-19 Genomics (COG) UK Consortium is delivering large-scale, rapid whole-genome sequencing of SARS-CoV-2 to public health agencies, the NHS and the Government. Through COG-UK, the UK sequences a significant amount of the SARS-CoV-2 genomes worldwide, thereby leading the world in early variant detection.[1]

**"We quickly recognised the value of using rapid, large-scale genome sequencing to understand SARS-CoV-2 transmission and evolution, and inform public health responses and vaccine development. With rapid funding from the UK government and Wellcome Sanger Institute, we assembled an innovative partnership of academic institutions, public health agencies and testing laboratories. With a largely voluntary membership, COG-UK focussed on pace over perfection, and built on the UK's history of sustained funding for genomics and bioinformatics, and strong skills base. Having provided the knowledge, expertise, and facilities to set up SARS-CoV-2 genome sequencing and analysis at an unprecedented UK-wide scale, we are now passing this know-how on to the UK Health Security Agency to facilitate the creation of a sustainable long-term national pathogen genomics service."**

**Sharon Peacock, Executive Director and Chair, COG-UK**

Genomics has applications beyond healthcare too. With a growing global population and escalating climate change, there is an urgent need to utilise the power of genomics to address the challenge of food security and monitor our natural environment to protect biodiversity. Esteemed UK research institutes are at the forefront of this research. For example, the Earlham Institute in Norwich use genome analysis to catalogue and mine genetic diversity of crops and livestock to improve production and resilience of our food supply.

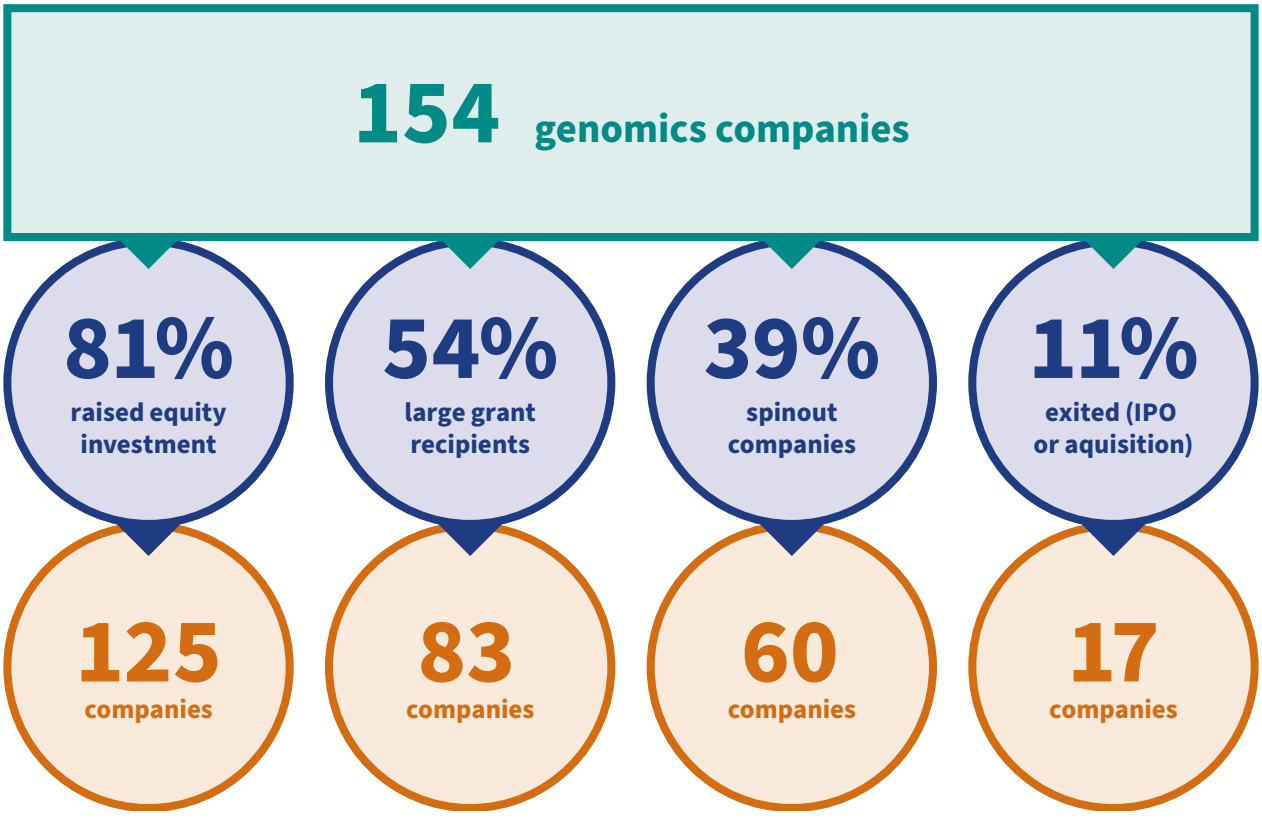
Altogether, the UK genomics ecosystem is leading the way for a healthier and more sustainable world.

1 See GISAID for up-to-date figures on sequence entries: www.gisaid.org/index.php?id=208

# The UK's genomics sector

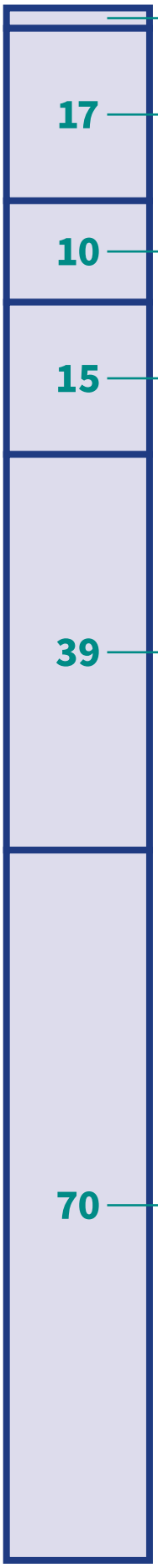
**Genomics companies play a crucial role in the UK's genomics ecosystem. These companies translate early innovations into medicines, diagnostics and services that can transform patients' lives, and drive economic growth through the creation of highly skilled jobs and by attracting private investment.**

The BIA, MDC and the Wellcome Sanger Institute have identified 154 genomics companies in the UK. They have been identified as UK genomics companies through three key criteria: they are headquartered in the UK, develop or deliver clinically accredited products and services, and genomics is a core aspect of their business. After identifying the 154 companies, we commissioned Beauhurst, a searchable database of the UK's high-growth companies, to analyse the dataset presented in this report.[2]




2 See page 26 for our full method.

## Stage of evolution




**"At Cambridge Innovation Capital, we consider the field of genomics as providing a rich source of investment opportunities. A significant proportion of the advances in medical care and public health over the next couple of decades will derive from a better understanding of the genetic impact on disease. The UK's heritage in academic genomic research provides a strong foundation to capitalise on the substantial growth in applications within the field facilitated by the dramatic reduction in the cost of sequencing and efficiencies in data storage and analyses. All areas of therapeutics, diagnostics and personalised medicine will benefit from progress, but in particular we see opportunities around better understanding the heterogeneity of diseases, patient stratification and improved target identification."**

**Robert Tansley, Partner, Cambridge Innovation Capital**

The UK genomics sector has achieved an average of 12% year-on-year growth in company numbers between 2011 and 2020. A significant number of these companies have been spun out of academic institutions; spinouts account for 39% (60 companies) of the total genomics population as of May 2021. By comparison, spinouts only account for 3% among the UK's high-growth companies across all sectors, indicating the significant role that academic institutions play in the development of genomics companies.

Another notable aspect of genomics companies is that most of them are very early-stage companies. Seed-stage companies account for 45% of the genomics companies, whereas the general high-growth population is only 36% seed stage. This indicates the relative youth of the UK's genomics sector.

**"Illumina Accelerator is the world's first business accelerator focused on enabling & catalysing an innovation ecosystem for the genomics industry. Our vision is to help founders and start-ups build breakthrough, VC-backable genomics companies. We remain committed to continuing to invest in the UK life science industry. Through Illumina Accelerator and by working with a wide range of stakeholders, we aim to support entrepreneurs who are passionate about bringing disruptive technologies to meet unmet needs, that build on and complement our mission, to improve healthcare by unlocking the power of the genome."**

**Anya Roy, Head of Illumina Accelerator Cambridge, UK**

With a current market capitalisation of less than £10bn, Beauhurst's conservative projection suggests that the total market capitalisation of UK genomics sector in 2040 will be over £50bn. The chart on page 11 includes a conservative total market capitalisation of the genomics companies based on equity-transaction derived valuations. It uses the mean valuation of companies in any given year based on equity

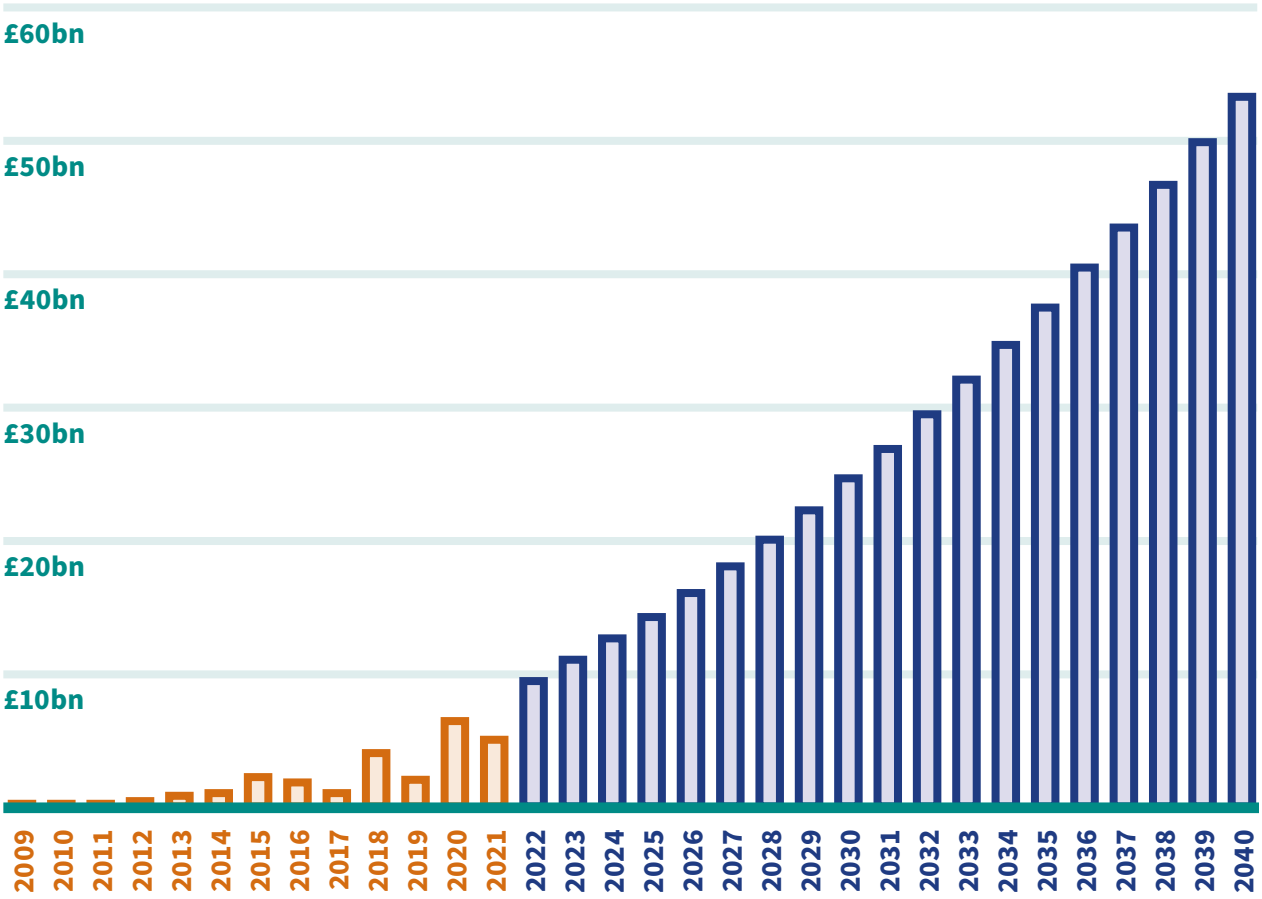
transactions combined with the predicted number of deals at live companies to project the market capitalisation over time.

**"The microbiome is the on-ramp to the BioRevolution – the impending integration of biological sciences across industry value chains that will drive trillions of dollars in annual economic opportunity. Harnessing microbiome science will enable large enterprises to tackle today's grand challenges, from functional foods that can improve metabolic health to soil remediation to combat climate change. Eagle Genomics is driving this revolution by providing the essential tools to analyze, explore and exploit complex microbiome data. The e[datascientist]™ platform leverages network science, AI and hypergraph technologies to place data at the heart of innovation. The platform transforms the scientist's journey to insights, unifying constellations of complex, multi-dimensional data (the 'data fabric') to explore and extract signals and networks of relationship otherwise undetectable by humans alone."**

**Anthony Finbow, Chief Executive Officer, Eagle Genomics**

## Equity transaction derived market capitalisation

**Recorded / Projected**



# Equity investment

**UK genomics companies have raised a significant proportion of the total equity investment received by companies in the pharmaceutical and life sciences sector since 2011. Genomics companies are disproportionately successful at attracting investment; they have raised 34% of the total investment in the sector while only accounting for 20% of the equity-backed companies.**

**£3.3bn**
total fundraisings secured by UK genomics companies since 2011

**£7.0m**
average deal size

**£26.0m**
average total amount raised by a company

**£9.8bn**
total fundraisings secured by UK pharma and life sciences companies since 2011

**£4.3m**
average deal size

**£12.5m**
average total amount raised by a company

This is reflected in the high average deal size of £7m for genomics companies compared to the £4.3m average raised by pharmaceutical and life sciences companies. The high deal size and high average total amount raised by genomics companies may reflect the capital-intensive nature of the emerging industry as well as investor enthusiasm for the space.

Private equity and venture capital investors are the most common investors in genomics companies by a significant margin. They have backed 118 deals worth £1.7bn since 2011.

The next most common group is business angels and angel networks with 85 deals. This group plays an important role in supporting the very earliest stage businesses with relatively small investments which explains the low total value of £312m.

At the other end of the spectrum are corporate investors. While this investor type only accounts for 16 deals, the average value of the investment is £21m compared to around £14m for private equity and venture capital and just under £4m for business angels and angel networks. Corporate investors are often prepared to make larger investments into later-stage businesses to secure strategic access to new technologies.

**"We are excited by the explosion of innovation in diagnostics, devices and digital technologies that support the identification, monitoring and management of health risk. These innovations will transform healthcare and industries such as our own. The leading global position of the UK in some of these areas, such as genomics and AI, as well as the depth of academic and clinical expertise and increasing availability of health data, make this sector very attractive for investment. We are keen to play our part in this growing sector, particularly at scale up stage, an area where capital has historically been in short supply."**

**Dr Sam Roberts, Managing Director, Health & Care, Legal & General**

| Investor type | Number of deals backed since 2011 | Total value of deals backed since 2011 |
|---|---|---|
| Business angels and angel networks | 85 | £312m |
| Private equity and venture capital | 118 | £1.7bn |
| Government (central, regional, or local) | 51 | £92m |
| Corporate | 16 | £331m |

# Public investment

**Genomics companies have secured a higher proportion of UK grant funding compared to the wider life sciences sector. Since 2011, genomics companies secured £151m in grants, which is equivalent to 26% of the total grant funding awarded to pharmaceutical and life sciences companies. The genomics companies that raised grant funding are only 13% of the total population of pharmaceutical and life sciences companies that have received grant funding.**

Again, this is reflected in the higher average grant size of £420k and the average total amount secured of £1.4m. The overrepresentation of genomics companies and the larger sums of money received demonstrates the quality of companies in the sector, and suggests that the Government has recognised the increasing importance of cutting-edge genomics projects, channeling more public funding into the sector. For example, in April 2021, the Government announced £37m worth of new investments for genomics projects and data-driven initiatives to drive the vision set out in *Genome UK*.

**£151m**
total grants secured by UK genomics companies since 2011

**£589m**
total grants secured by UK pharma and life sciences companies since 2011

**£420k**
average grant size

**£1.4m**
average amount secured by a company

**£302k**
average grant size

**£955k**
average amount secured by a company

# IPOs and acquisitions

**While 10 genomics companies have been acquired since 2011, only one of these transactions disclosed the acquisition price. Oxitec, which was using genetics to help combat dengue fever, was acquired by US-group Precigen (formerly known as Intrexon) for £103m in 2015.**

Orchard Therapeutics, Freeline Therapeutics and MeiraGTx top the IPO chart by market capitalisation at the time of IPO. These three companies demonstrate the commercial value of gene therapy; they collectively account for 87% of the total value in genomics IPOs over the last 10 years. The expected IPO of Oxford Nanopore on the London Stock Exchange in the second half of 2021 will significantly boost these figures.

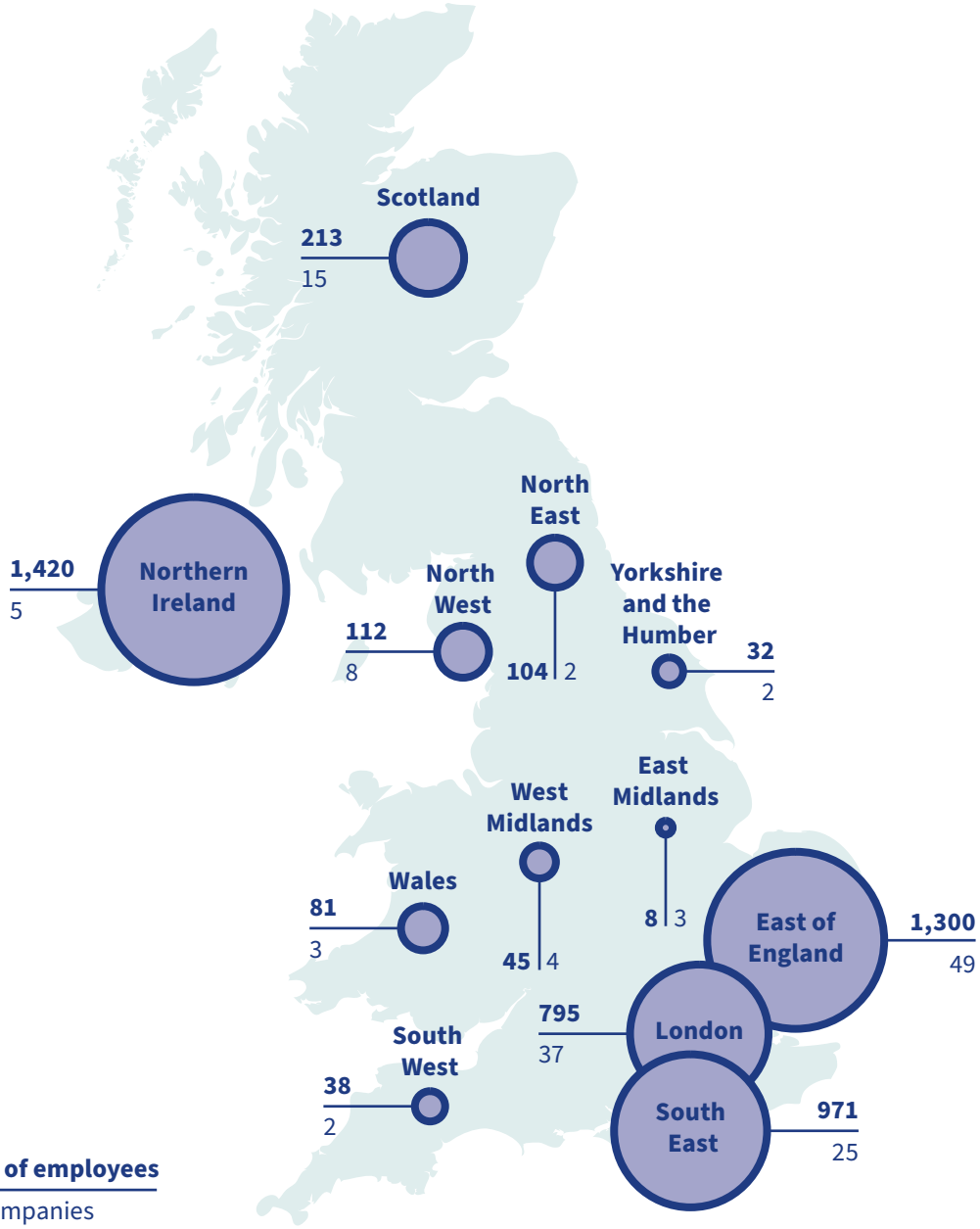
| Company name | Market capitalisation (at time of IPO) |
|---|---|
| Orchard Therapeutics | £950m |
| Freeline Therapeutics | £476m |
| Meira GTx | £304m |
| Oxford BioDynamics | £136m |
| Horizon Discovery | £121m |
| **Total of the top five genomics IPOs** | **£1.96bn** |

# Genomic hotspots

**Genomics companies are most prevalent in the East of England, London and the South East, with these three regions accounting for 72% of the UK's active genomics company population.**

However, Northern Ireland has the single highest number of employees in the genomics sector due to the presence of Randox in County Antrim. Randox develops clinical diagnostics and provides reagents and laboratory equipment.

The 15 genomics companies in Scotland employ an estimated 213 people. Edinburgh and Glasgow each play host to four active genomics companies.



"As a global molecular diagnostics group listed on London Stock Exchange's AIM, Yourgene Health is headquartered in Manchester. Manchester has a vibrant molecular diagnostics community and being located on the Manchester Science Park means we are close to both the Manchester University NHS Foundation Trust and Manchester University. We benefit greatly from our location as it enables close engagement with academics and clinicians to advance diagnostic science and our links with the University enables us to recruit local talented scientists and bioinformaticians."

**Joanne Mason, Chief Scientific Officer, Yourgene Health**

"For decades, genomics has accelerated research and therapeutic development, but the pandemic has shown the importance of the industry on a whole new level. In the past year, our magnetic bead products have enabled more than 120 million COVID-19 PCR tests worldwide. We have doubled manufacturing capacity to meet ongoing needs. Our long heritage in Cardiff lets us collaborate with local academic centres and network through our relationship with MediWales and Life Sciences Hub Wales. We support emerging genomics companies from proof-of-concepts to scale-up and our R&D teams advance the science in novel fields such as liquid biopsies and single-cell analysis."

**Gabriel Fernandez de Pierola, General Manager Genomics & Diagnostic solutions, Cytiva**

"Genomics is not just transforming healthcare but also how we do biology. The Earlham Institute is a national centre for genomics and data-driven science. Our research pushes the boundaries of what is currently measurable, testable, and knowable – teasing apart microbiomes and deconstructing traits for future sustainable crops, finding the molecular basis of disease, and driving new applications of synthetic biology.

Earlham Institute scientists study the most complex species, environments, and biological questions. They are leading the way in sequencing, assembling and annotating genomes, and the challenge of integrating and analysing huge datasets. Crucially, they are using this expertise and infrastructure to train the next generation of life scientists."

**Anthony Hall, Head of Plant Genomics, Earlham Institute**

Manchester

Norwich

Cambridge

Cardiff

"PetMedix is developing antibody-based therapeutics for use in companion animals, transforming the health and welfare of our beloved pets. I strongly believe that we are successful because by being part of the Cambridge ecosystem, we have access to world-class scientists, venture capital and a myriad of support services – together a vibrant community of experienced talent. This has allowed us to scale rapidly and secure an early partnership deal with Boehringer Ingelheim, the second largest animal health company in the world."

**Tom Weaver, Chief Executive Officer, PetMedix**

# Subsectors

**We have broken up the genomics sector into six subsectors. Diagnostics is the biggest sub-sector and collectively these companies employ an estimated 1,952 people. Again, this estimated employment figure will include the more than 1,400 people employed by Randox.**

However, companies in the Therapeutics subsector have secured significantly more capital via more deals. The relatively nascent Artificial Intelligence & Machine Learning subsector has also attracted considerable attention over the last 10 years. The ability of these technologies to significantly reduce the capital requirements of activities like drug discovery make them attractive to investors.

In particular, functional genomics has the potential to revolutionise drug discovery. This rapidly growing field uses genomic data to study gene and protein expression and function on a global scale, which enables scientists to better understand the true mechanisms of disease and more accurately identify novel drug targets. Companies and investors alike are therefore increasingly investing in functional genomics. The UK Government has also recognised the promise of functional genomics, and is developing a UK Functional Genomics Initiative to drive research and to meet the needs of the genomics sector with the potential to attract high-value investment in genomic-validated target discovery and drug development.

| Subsector | Number of companies | Estimated number of employees | Number of deals since 2011 | Amount raised since 2011 |
|---|---|---|---|---|
| Hardware* | 20 | 749 | 48 | £927m |
| Sequencing service providers | 6 | 94 | 21 | £65m |
| Genomic tools | 22 | 833 | 95 | £147m |
| Therapeutics | 39 | 773 | 118 | £1.2bn |
| Diagnostic** | 43 | 1,952 | 110 | £374m |
| Artificial intelligence & machine learning | 29 | 718 | 95 | £574m |

* The Hardware subsector includes companies such as sequencer producers and chip designers.

** The Diagnostics subsector includes biomarkers, pharmacogenomics, and clinical decision support.

**"One way in which AI/machine learning can be applied to drug discovery is through functional genomics. At GSK we are investing in this field because of its profound potential to transform medicine discovery and improve healthcare. The powerful combination of genetics, genomics and AI/machine learning means that we can pinpoint causes of disease with greater accuracy and speed, and deliver more genetically validated targets, which are twice as likely to become medicines.**

**Given its strong foundations, the UK is well-placed to compete in the global effort to maximise these technologies for patients. Key to the UK's leadership will be driving secure, integrated research access to related datasets and enhancing the UK's capabilities to enable an expansion of commercial research. The Government's announcement that it will develop a new UK Functional Genomics Initiative is recognition of this opportunity and a positive first step, which needs to be delivered at pace to unlock the UK's potential in this cutting-edge field."**

**Tony Wood, SVP Medicinal Science & Technology, GSK**

In addition to the individuals employed by the UK's genomics companies, there are many highly skilled scientists working in the broader genomics ecosystem in academia, charities, research institutes, the NHS and public diagnostics labs. The Lighthouse Labs Network alone employs around 2100 people, who are working nationwide as part of the UK's COVID-19 testing programme. Many of these employees are highly trained young scientists at the start of their careers. Together, they represent a once-in-a-generation opportunity to leverage their skills to drive the UK's growing post-pandemic diagnostics sector to new heights.

**"The Sanger Institute's mission is to use information from genome sequences to advance understanding of biology and improve health. We tackle some of the most difficult challenges in genomic research. This demands science at scale; a visionary and creative approach to research that pushes the boundaries of our understanding in ever new and exciting ways. The Institute plays a globally leading role in the understanding and application of genome science in a cutting-edge academic atmosphere, coupled with our exceptional facilities and resources, provides a unique training environment. Our leadership in genomics has been exemplified through sequencing and analysing thousands of COVID-19 genomes in real time to monitor for new variants and inform public health measures."**

**Julia Wilson, Associate Director, Wellcome Sanger Institute**

# The NHS

## As the largest united healthcare system in the world, the NHS is uniquely positioned to partner with the UK genomics ecosystem at scale and pace to ensure patients benefit from healthcare innovations.

The NHS Long Term Plan promised greater focus on prevention to help people stay healthy and ease the burden on the health service. The early detection of disease, rather than merely the diagnosis and treatment of illness, will be critical to achieve this objective. The NHS Genomic Medicine Service (GMS), launched in 2018, provides a single, national coordinated approach to genomic testing and genomic research in the NHS. Building on the 100,000 Genomes Project between the NHS and Genomics England, the GMS will sequence 500,000 whole genomes by 2023/24, and is committed to integrating genomic medicine into routine care by 2025.

**"Genetics is a major risk factor for all common diseases and cancers. Polygenic Risk Scores (PRS) now provide a way to quantify this risk. Genomics plc has developed proprietary algorithms for PRS and their combination with non-genetic factors to provide powerful estimates of future risk across a population. This empowers a new approach to healthcare, called Genomic Prevention: individuals at high risk for a particular disease can be put into appropriate pathways to prevent it or catch it early. We are piloting this approach in the NHS for cardiovascular prevention in 2021, and our wider offer will cover the most common cancers, type 2 diabetes, and several other conditions."**

**Professor Sir Peter Donnelly, Founder & CEO, Genomics plc**

A key example of how the NHS is adopting new innovations for patient benefit is the pilot study of an innovative blood test that may spot more than 50 types of cancer. The Galleri blood test, developed by GRAIL, can detect early-stage cancers through a simple blood test and will be piloted with 165,000 patients in a world-first deal struck by NHS England. While research on patients with signs of cancer has already found that the test can identify many cancer types that are difficult to diagnose early, the NHS programme will further show whether the test works for people without symptoms. If the test works as expected, it will be rolled out to become routinely available, potentially saving thousands of lives. The programme is but one example of why it is essential to ensure that the NHS is able to translate new advances through to rapid development, assessment, and access to innovative treatments and diagnostics for patients.

**"Given the pivotal, pioneering contributions that UK scientists have made to global advances in genomics over decades, it would be fitting if the UK population could be the first to benefit at national scale from one of the most exciting and profoundly important applications of genomics – the earlier detection of cancer."**

**Sir Harpal Kumar, President, Grail Europe**

The use of PCR testing and sequencing to inform vaccine development and the UK's public health response throughout the COVID-19 crisis has been critical. Deploying this at pace and scale in the UK has been transformative to the pandemic response, but also to the future of diagnostics-driven healthcare.

The Lighthouse Labs – the biggest diagnostic lab network in British history and the foundation of the UK's COVID-19 testing capacity – is another example of the strength of the UK's health and science base. Set up at record speed and industrially led, with close partnership with the NHS and academia, the Lighthouse Lab network has now become a 75 million test per year diagnostics engine that can augment the UK testing capability across the NHS and private sector into the future and underpin the UK's burgeoning diagnostics industry.

**"The infrastructures and behavioural changes made in the year of the pandemic have accelerated thinking and ambition by a decade. It will be unconscionable to return to pre-pandemic approaches now. The NHS and industry once again have the shared purpose to co-create a new diagnostic ecosystem, in which genomics and mass testing combine to improve the health of citizens. Multi-omics approaches to derive high-value datasets can drive growth of the UK's biotech system and create the next wave of more personalised healthcare innovations."**

**Professor Peter Simpson, Chief Scientific Officer, Medicines Discovery Catapult**

The UK Government, the NHS and industry are actively working together to join up pathways across the health system, enable better utilisation of real-world data and update assessment methodologies. By building on the power of the NHS and the UK's genomics ecosystem, healthcare could be changed forever.

# The data landscape

**The UK has a rich data infrastructure that augments genomic discoveries and enables companies to validate their technologies. This section gives an overview of four key resources. Together with the NHS, these resources provide a strong foundation for the genomics ecosystem.**

## UK Biobank

UK Biobank is a large-scale biomedical database and research resource that is enabling new scientific discoveries to be made that improve public health. The resource contains in-depth genetic and health information from 500,000 UK volunteer participants. Accredited researchers from around the world, whether they are from academic, commercial or charitable organisations, can access the resource to improve understanding of the prevention, diagnosis, and treatment of a wide range of serious and life-threatening illnesses. The database is regularly augmented with additional data, including SARS-CoV-2 infection data on its participants to enable research into the possible long-term health impacts of the virus.

In 2019, the Whole Genome Sequencing (WGS) project was launched. The £200m project, involving the Government, a charity, researchers and four leading pharmaceutical companies, will sequence the whole genomes of all 500,000 UK Biobank participants. After a short exclusive access period of nine months, the data will then be made available to all other approved UK Biobank researchers.

**"At Johnson & Johnson Innovation we operate on the principles of partnership and collaboration to deliver meaningful impact in healthcare and we know the biggest scientific challenges cannot be solved in isolation. Johnson & Johnson, along with Amgen, AstraZeneca and GlaxoSmithKline, came together with the Wellcome Trust and UK Research and Innovation to fund the Whole Genome Sequencing project. Sequencing the complete genetic code of 500,000 UK Biobank volunteers is the single most ambitious sequencing programme in the world undertaken as a public-private initiative. It represents a major potential advance for public health and reinforces the UK's position at the forefront of genomics, and inter-industry collaboration."**

**Letizia Goretti, Senior Director, Transactions & Alliances, Genomics and Nano-Electronics, Johnson & Johnson Innovation**

# Genomics England

Genomics England was first set up by the Government in 2013 to deliver the 100,000 Genomes Project. The pioneering project sequenced 100,000 whole genomes from NHS patients with rare diseases and cancers. The project, which was completed in 2018, helped to build the infrastructure in the NHS to deliver genomic medicine, with thousands of diagnoses made which previously would not have been possible. By allowing researchers in industry, academia and the NHS to access its unique data sets, Genomics England also enables the data to be continually analysed and new biomedical discoveries to be made. Genomics England is now building on the 100,000 Genomes Project to enable faster, deeper genomic research and bringing genomic healthcare to all who need it.

**"Genomics England's vision for the future is a bold one: we see a world where genomics improves everyone's health and wellbeing, based on the latest scientific discoveries. Therefore, having demonstrated through the 100,000 Genomes Project how genomic insights can help clinicians and patients across the NHS, we are now expanding our impact. We are working with patients, doctors and scientists to improve genomic testing in the NHS and helping researchers access the health data and technology they need to make new medical discoveries and create more effective, targeted medicines. This means working with the NHS to deliver and continually improve genomic testing to help doctors and clinicians diagnose, treat and prevent illnesses, like rare diseases and cancer. It also means providing the health data and advanced technology researchers need to make new medical discoveries and create more effective medicines for patients and their families."**

**Chris Wigley, Chief Executive Officer, Genomics England**

# Health Data Research UK

HDR UK has brought together 50 of the UK's leading healthcare and research organisations into a single alliance and has made key datasets safely available via the Health Data Research Innovation Gateway (the 'Gateway') – the UK's single front door to health data discovery and access management. The Gateway is at the heart of making open science a reality; so far with 640 datasets in its catalogue, which any researcher or innovator can use to search and discover data. Datasets listed on the Gateway include the UK's largest link health data research asset covering 54 million people in England, led by the CVD-COVID-UK consortium and the COG-UK Viral Genome Sequence dataset, which provides large scale data on whole-genome virus sequencing of over 170,000 strains and is enabling the identification of the most virulent COVID-19 strains. The Gateway also lists datasets held by Genomics England.

HDR UK's network of eight Health Data Research Hubs offer expertise, data, tools, and scientific knowledge for innovators and researchers. With a mix of industry, academic, charity and healthcare partnerships, the Hubs are improving the quality and utility

of data, informing UK policy decisions, supporting research across a range of disease areas and creating tools to improve health and care services.

**"At HDR UK we are uniting the UK's health data to enable discoveries that are improving people's lives. We are delivering advances in data and infrastructure for health research that are enabling scientific breakthroughs and benefits to patients across the UK and internationally. We work in close partnership with industry, NHS, academic, charity and government colleagues, and we encourage companies to use the Gateway to source data for research and to work with the Hubs for expert research services. All our work at HDR UK is guided by input from patients and the public to ensure we are working safely and appropriately with their data."**

**Caroline Cake, Chief Executive Officer, Health Data Research UK**

# Our Future Health

Our Future Health (previously the Accelerating Detection of Disease challenge) will be the UK's largest ever health research programme, driving discoveries that will help people live healthier lives for longer. It is an ambitious collaboration between the public sector, charities and companies, that will work closely with the NHS and public authorities across all UK nations. Our Future Health aims to recruit a cohort of 5 million people that truly reflects the UK population, helping to discover and test more effective approaches to prevention, earlier detection and treatment of diseases. It will collect and link multiple sources of health and health-relevant information, including genetic data, with biological samples collected to enable genomic analysis. Our Future Health will allow researchers to undertake discovery studies on early indicators of disease and to re-contact participants on a risk-stratified basis for secondary studies. The programme began pilot activities in 2021 to optimise recruitment channels, moving to full-scale recruitment in 2022.

**"Our Future Health aims to be the UK's largest ever health research programme, bringing people together to develop new ways to detect, prevent and treat diseases. Genomics research programmes have previously faced challenges in recruiting diverse populations which means it's not always clear how widely findings apply for different groups.**

**Our Future Health is committed to building a resource that truly reflects the UK population, so that we can identify differences in how diseases begin and progress in people from different backgrounds. By ensuring that a diverse range of people join Our Future Health, we can make discoveries that benefit everyone."**

**Andrew Roddam, Chief Executive Officer, Our Future Health**

# UK genomics – the future

**In 1765, James Watt perfected earlier designs of the steam engine and in doing so set the Industrial Revolution in motion. What that innovation did for manufacturing and living standards, Frederick Sanger's innovation in sequencing technology could do for healthcare and life expectancy.**

This report shows that the UK is at the cutting edge of the genomics revolution that is shaping the 21st Century. High-growth companies, ambitious state-backed initiatives and world-leading institutions are being combined in the UK to create a truly unique opportunity.

The scope and breadth of these advances are impossible to predict or value. The £50bn market capitalisation of the sector projected by 2040 in this report is only a small indication of what can be achieved. With continuing investor and government support, the confidence in and capabilities of the UK's genomics sector are growing to the point when it will be able to deliver great dividends to investors, the economy and patients nationally and internationally.

**"Congenica is delivering a future where clinical genomics is fully integrated in healthcare to transform the lives of patients. Our market leading genomic analysis software and data system has been designed to enable the delivery of personalised medicine at scale – with the capability of handling hundreds to thousands of genomes per week – that can be integrated into existing systems and infrastructure. Development of the platform has required Congenica to operate at the cutting edge of bioinformatics, clinical sciences, data analytics and software and database engineering. Our recent Series C financing will support Congenica's goal of scaling and building a global business. Our foundations are firmly built on UK science and our proving ground has been with Genomics England in the NHS. This high-quality history is appealing to international investors and is seen as a sign of quality."**

**David Atkins, Chief Executive Officer, Congenica**

# Methodology

## Definition of genomics companies

The BIA, Medicines Discovery Catapult and the Wellcome Sanger Institute collaborated to build a dataset of high-growth UK genomics companies. After a thorough refinement process, Beauhurst was commissioned to analyse the dataset that is presented in the report.

The following criteria were used to determine what companies were in scope:

- UK head-quartered companies
- Developing or delivering clinically accredited products and services
- Genomics as a core aspect of their business

By extension, the following companies were regarded as out of scope:

- Multinationals with a UK satellite activity
- Consumer genomics/lifestyle genomics companies
- Companies which incorporate genomics as a non-core aspect of their business, e.g. many traditional drug discovery companies

## High-growth triggers

Beauhurst identifies ambitious businesses using eight triggers that suggests a company has high-growth potential. More detail on Beauhurst's tracking triggers is available via the company's website.

- Equity investment
- Scale-ups
- Accelerator attendance
- MBO/MBI
- Academic spinouts
- High-growth lists
- Major grants recipients
- Venture debt

# Equity investment

To be included in Beauhurst's analysis, any investment must be:

- Some form of equity investment
- Secured by a non-listed UK company
- Issued between January 2011 and May 2021

# Announced and unannounced fundraisings

An unannounced fundraising is an investment made into a private company that is completed without press coverage or a statement from the recipient company or funds that invested. These transactions are an integral part of the UK's high-growth economy, accounting for around 70% of all equity transactions.

Unfortunately, where deals are unannounced, Beauhurst cannot identify the fund type of the investors involved in the transactions. For this reason, Beauhurst has only included announced deals in any of the analysis that includes investor types.

# About Beauhurst

Beauhurst

Beauhurst is a searchable database of the UK's high-growth companies. Our platform is trusted by thousands of business professionals to help them find, research and monitor the most ambitious businesses in Britain. We collect data on every company that meets our unique criteria of high-growth; from equity-backed startups to accelerator attendees, academic spinouts and fast-growing scaleups. Our data is also used by journalists and researchers who seek to understand the high-growth economy, and powers studies by major organisations including the British Business Bank, HM Treasury and Innovate UK to help them develop effective policy.

## About the BioIndustry Association

Established over 25 years ago at the infancy of biotechnology, the BioIndustry Association (BIA) is the trade association for innovative life sciences in the UK. Our goal is to secure the UK's position as a global hub and as the best location for innovative research and commercialisation, enabling our world-leading research base to deliver healthcare solutions that can truly make a difference to people's lives. Our members include biotechnology start-ups and SMEs, pharmaceutical and technology companies, universities, research centres, and a wide range of life sciences service providers.

## About the Wellcome Sanger Institute

The Wellcome Sanger Institute is a world leading genomics research centre. We undertake large-scale research that forms the foundations of knowledge in biology and medicine. We are open and collaborative; our data, results, tools and technologies are shared across the globe to advance science. Our ambition is vast - we take on projects that are not possible anywhere else. We use the power of genome sequencing to understand and harness the information in DNA. Funded by Wellcome, we have the freedom and support to push the boundaries of genomics. Our findings are used to improve health and to understand life on Earth. In the last 15 years, Sanger's science has given birth to successful, market leading companies such as Kymab, Congenica and Microbiotica.

## About Medicines Discovery Catapult

Medicines Discovery Catapult (MDC) is reshaping the UK's medicines discovery industry. Part of a network of Catapults established by Innovate UK, MDC is an independent, not-for-profit organisation that industrialises and drives the adoption of new tools and technologies for the sector. MDC's not-for-profit status enables it to take the risks that are needed to pioneer the next generation of approaches and technologies on behalf of the medicines discovery industry.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