



Exploring the UK's engineering biology companies

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Executive summary

Over 50% of the UK's high-growth engineering biology population is headquartered in the "golden triangle" (London, Oxford, and Cambridge). The University of Cambridge (85) is the top institution for engineering biology founders.

Engineering biology companies are predominantly concentrated in southern regions. The East of England accounts for 23.5% of the engineering biology population, closely trailed by London (22.6%) and the South East (17%). These findings can be attributable to the presence of renowned academic institutions and dense business populations in the surrounding areas. The South East (38) stands out as the top hub for engineering biology spinout companies. Scotland (27) and London (27) are also prominent locations. The University of Cambridge (85) and the University of Oxford (68) account for the greatest number of engineering biology company founders—a testament to their excellence in scientific research. Engineering biology is a diverse and dynamic field, highlighted by the various subsectors operating in the industry. Companies working within pharmaceuticals (246) account for the majority of engineering biology businesses, complemented by research tools and reagents (130), and genomics (97).

There is a long way to go in reaching gender parity at company leadership levels in the engineering biology sector. Companies with an all-female founding team comprise the lowest proportion of active life sciences businesses in the UK (9.4%). The underrepresentation of women in senior leadership is also apparent in engineering biology—companies with an all-female founding team only represent 6.64% of the active

engineering biology population. Individuals aged 50-59 account for the greatest proportion of founders (28.4%). This aligns with the broader life sciences industry, where individuals within this age range represent (28.5%) of the founder population. These findings highlight engineering biology's propensity for later-stage entrepreneurship.

Since 2013, the number of active high-growth engineering biology companies has more than tripled, with a parallel rise in patent applications. The engineering biology sector has filed 71 patent applications on average per year between 2011 and 2021—and 28 (on average) have been granted. In 2023, engineering biology companies were awarded £96.1m in grant funding by Innovate UK (IUK), triple the amount awarded the previous year. Private investment, in contrast, has realigned with pre-2021 levels, with high-growth engineering biology companies collectively raising £785m and participating in 125 equity fundraising deals. Top deals include a £105m fundraising by London-based Ascend in May 2023. Scottish Enterprise leads as the top investor in engineering biology companies participating in 131 deals since 2013. Future Planet Capital (64) and Parkwalk Advisors (42) also lead in financing high-growth potential businesses in this area.

Introduction to engineering biology

Engineering biology is an interdisciplinary field of science that can be defined as the application of synthetic biological processes. It involves the utilisation of engineering and biology principles to develop and modify biological systems for specific purposes. Examples of engineering biology applications include gene therapy development, food production, and energy generation. Powered by a combination of artificial intelligence (AI), robotics, and computational biology, engineering biology is revolutionising the ecosystem's ability to predict and control biology with industrial precision.

Genetic engineering is an important subsector within engineering biology that involves the modification of an organism's genetic material to achieve a desired purpose. This is done through

techniques such as DNA manipulation, gene editing, and gene synthesis. The advancement of technologies such as clustered regularly interspaced short palindromic repeats (CRISPR) has significantly transformed the field of gene modification. CRISPR enables highly accurate genetic modifications, leading to a variety of applications. These include developing crops with enhanced resistance to environmental stresses and engineering synthetic organisms tailored for distinct industrial purposes. This revolutionary technology has been used to correct genetic defects such as cystic fibrosis or sickle cell disease.

Engineering biology requires organisations to have specific equipment and facilities, such as laboratories, fermentation plants, and biorefineries. The growth of this sector has highlighted the importance of infrastructure and the role it plays in attracting investment. Across the UK, numerous bio-clusters and support facilities are instrumental in this growth. A prominent example is Bristol, where a robust engineering biology ecosystem thrives, significantly bolstered by contributions from the University of Bristol, UK Research and Innovation (UKRI), as well as the existing infrastructure. UKRI has recently launched the £73.6m Engineering Biology Missions Hubs and Mission Awards, aimed at bolstering the UK's engineering biology sector. This initiative will set

up hubs to tackle specific field challenges, providing 60-month funding, in addition to shorter 24-month missions. The leading companies operating in this region include Open Bionics, known for its 3D-printed bionic limbs, and Imophoron, a University of Bristol spinout focused on developing an innovative, rapid-response vaccine platform.

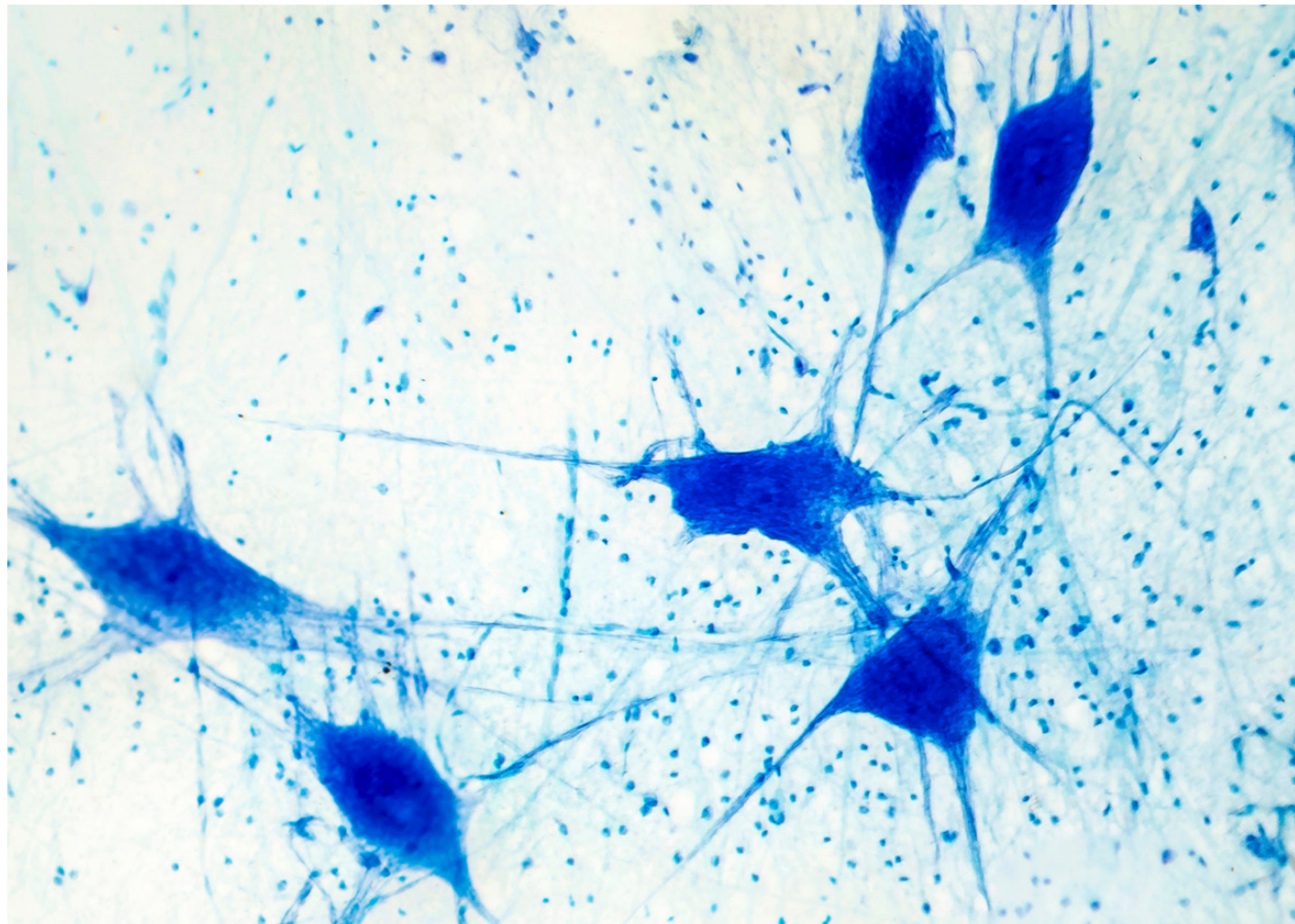
Due to the diverse range of applications, engineering biology is projected to have a direct annual economic impact of \$2-4 trillion over the next 20 years.¹ In the UK, the government is prioritising engineering biology as one of the five critical technologies aimed at bolstering the nation's ambition of becoming a science superpower. This focus is part of a broader strategy to harness cutting-edge scientific advancements to drive innovation.

Significant progress in this field has led to breakthroughs in healthcare, environmental sustainability, and bio-manufacturing. A crucial factor in this innovation has been the substantial reduction in DNA sequencing costs, coupled with its increased accessibility. These advancements are set to revolutionise various industries and address global challenges like disease management and famine. A prominent example of this impact is the development of messenger ribonucleic acid (mRNA) vaccines to

tackle COVID-19 by pharmaceutical companies, Pfizer-BioNTech and Moderna.

This report is focused on the 379 active or historically high-growth engineering biology companies in the UK. The definition of engineering biology utilised for classification purposes was provided by the Department for Science, Innovation, and Technology (DSIT) and is provided in the methodology section. The number of high-growth companies in this field has increased by 180% since 2013. The growth of companies within this classification signifies the importance of this sector in driving scientific advancement and economic development. The companies included in this report were based on a non-exhaustive list from DSIT. The original list contains over 1,300 EB operating both within the EB supply chain and as EB application companies.

¹ McKinsey & Company. "The Bio Revolution: Innovations Transforming Economies, Societies, and Our Lives." May 2020. [PDF](#).



Business demography

The East of England emerges as the top hub for active high-growth engineering biology companies, boasting the highest density of companies (76) in the field. The University of Oxford (35) and the University of Cambridge (20) have generated the most engineering biology spinouts, highlighting their robust entrepreneurial ecosystems and cutting-edge research capabilities. Pharmaceuticals (246) is the most populous subsector for high-growth engineering biology companies, followed closely by research tools and reagents (130) then genomics (97), illustrating the multifaceted nature of engineering biology.



Regional distribution

There are more than 300 active high-growth engineering biology companies in the UK, and the “golden triangle” (London, Oxford, and Cambridge) is home to over 50% of the engineering biology population. The East of England hosts the largest concentration of engineering biology companies, accounting for 23.5% of the active company population. London and the South- East follow behind, representing 22.6% and 17% of the total company population, respectively.

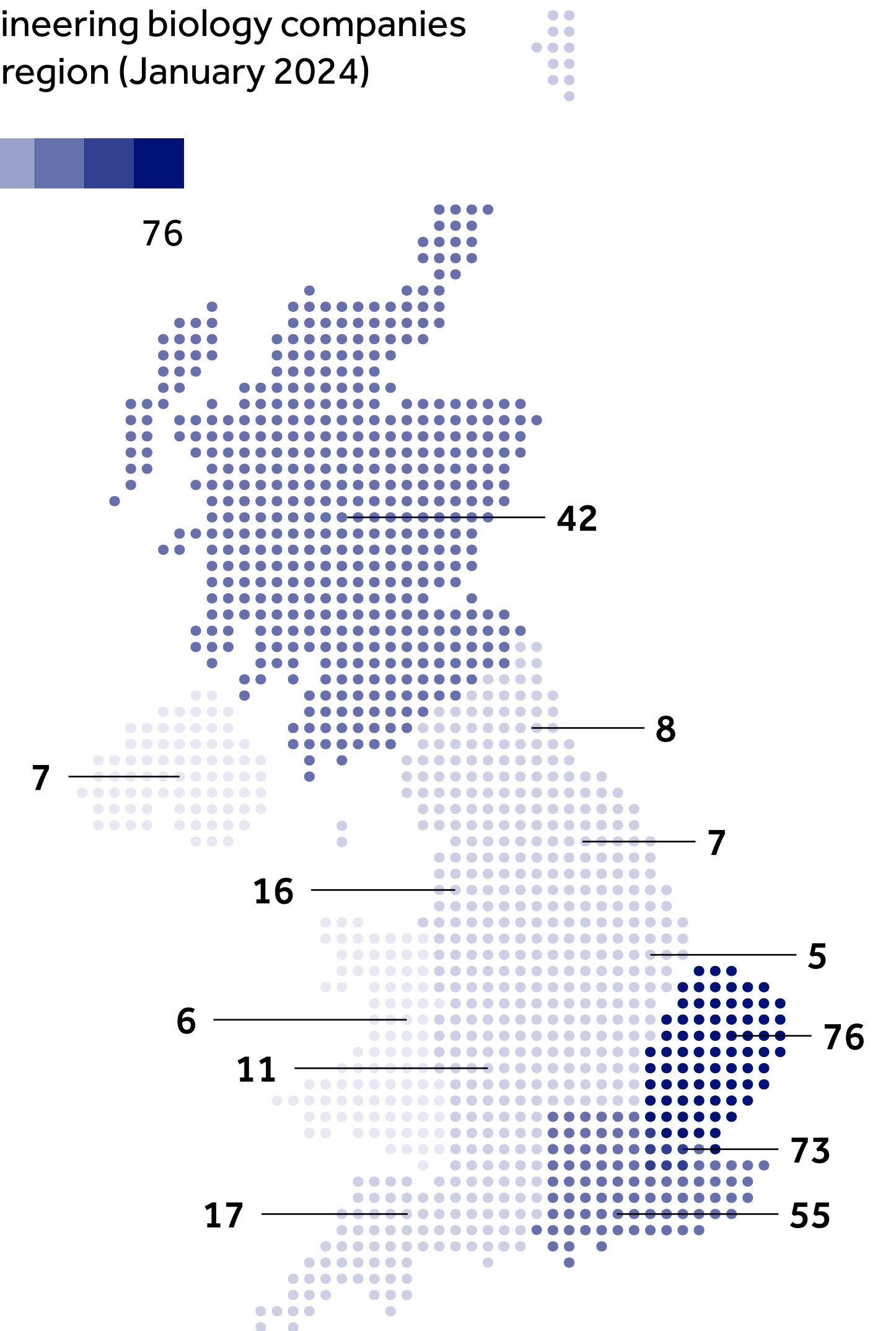
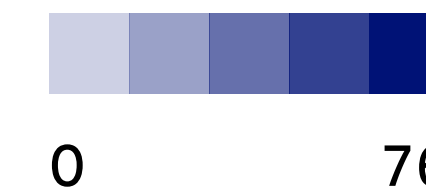
The areas surrounding Oxford and Cambridge are notable for their advanced life sciences ecosystem with top research institutions such as AstraZeneca’s Global R&D Centre (Cambridge). The density and diversity of the capital’s population also make it a prime location for engineering biology companies, particularly those working within biomedicine. MedCity supports this finding, asserting that London’s diverse population makes it easier and

faster to create complex trials within biomedical research and recruit the right types of patient groups for clinical trials. ²

Looking north, Scotland is home to a growing industrial biotechnology ecosystem. The number of active high-growth engineering biology companies in the nation has grown from 17 in 2013 to 42 as of January 2024. In 2023, Scottish engineering biology companies collectively raised £98.5m in investment, up from £3.84m in 2013. This signifies a major increase in investor sentiment towards high-growth companies operating in the engineering biology sector.

¹ McKinsey & Company. "The Bio Revolution: Innovations Transforming Economies, Societies, and Our Lives." May 2020. [PDF](#).

Number of high-growth engineering biology companies per region (January 2024)



Company spotlight: Colorifix

“The UK has one of the strongest individual bases for talent in synthetic biology, characterised by the numerous small-scale, innovative startups and companies originating within the country.” Addressing challenges such as inadequate funding and support networks could increase the retention of talent and potentially attract innovators to the UK. This would undoubtedly benefit the UK’s position in engineering biology,” says Orr Yarkoni, CEO and Co-Founder of Colorifix.

University of Cambridge spinout, Colorifix was founded in 2016 by Yarkoni and Chief Scientific Officer Dr. Jim Ajioka. Colorifix specialises in the development of sustainable dyes for the textile industry. The method developed by Colorifix mimics the natural

method of colouring and involves the utilisation of DNA sequencing. Once a colour is identified in nature, Colorifix identifies where in the organisms’ genetic code the colour is coded. This is then translated into an engineered microorganism to produce pigment. This process has reduced environmental impact—it utilises less water, and energy, and also eliminates the need for hazardous chemicals.

Colorifix has established strong partnerships with companies such as H&M and Pangaia through participation in the Fashion for Good accelerator. It has received £25m in equity over four fundraising rounds. Yarkoni notes, “We have received funding through a collaboration with the University of Cambridge and the Earlham Institute, amongst others. Our joint effort aims ambitiously to establish the UK as the market leader in sustainable textile dyeing”. This collaboration not only brings together academic and research expertise but also reflects a shared ambition to position the UK at the forefront of sustainable textile solutions and engineering biology.

Yarkoni, explaining key challenges in the sector, says “There is currently no shortage of great potential applications for engineering biology. The proof-of-concept level science is all there, and many, if not most, of the proposed ideas could work at scale. The biggest

bottleneck for the adoption of these applications is in the scaling step. There are currently no cost-effective ways to scale up biotech.” This statement highlights a critical hurdle in the engineering biology industry – the transition from concept to large-scale application. However, Yarkoni anticipates significant developments will be made: “I expect that over the next 5-10 years, there will be a surge in potential solutions to the issues currently hindering scaling. There will need to be a similar jump as there was within the IT industry.” Yarkoni’s prediction suggests optimism for the future of engineering biology.



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Top sub-sectors

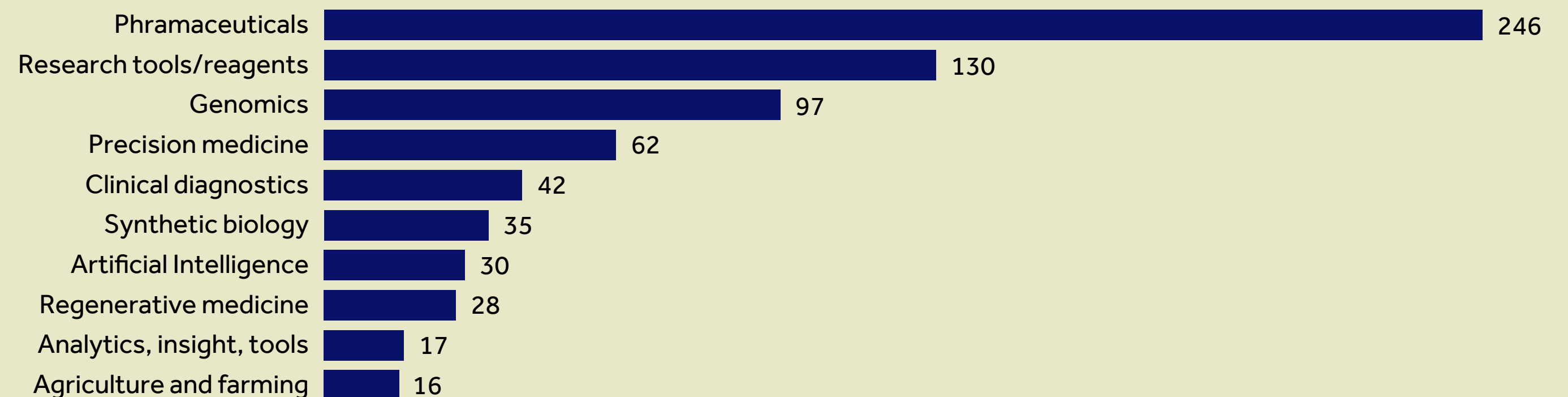
Pharmaceuticals are the leading subsector (246) for high-growth engineering biology companies. In this field, companies employ synthetic biology for the design of bespoke molecules and computational biology for accelerated drug discovery. This enables the creation of highly targeted medications that interact with biological pathways, creating more personalised and effective treatments. Immunocore, a notable company in this sector, creates artificial molecules that seek and destroy elusive cancer cells. Since launching in 2007 in Oxford, Immunocore has raised over £410m in equity finance via 12 funding rounds and was listed on the NASDAQ stock market in February 2021.

Research tools and reagents are the second most prominent subsector, boasting 130 companies. Businesses within this sector supply specialised instruments and reagents such as antibodies and DNA for scientific experiments. Genomics (97) and precision medicine (62) also stand out as top subsectors driving innovation in engineering

biology. Genomics involves the analysis of genetic information and the structure of biological products. It is applied across industries, including medical research, agriculture, and drug development. Precision medicine provides a more personalised approach to patient care through genetic analysis. These subsectors highlight a shift toward more targeted and efficient solutions in healthcare and biotechnology. A prime example of this is Axol Bioscience. Based in Midlothian, Scotland, the company operates at the nexus of genomics and precision medicine. It uses human-induced pluripotent stem cells to create safer and more effective drugs

that can treat neurodegenerative diseases such as Alzheimer's.

Top application sectors for high-growth engineering biology companies (January 2024)



Company spotlight: Roslin Technologies

“There is massive untapped potential in engineering biology. It is a good sign that the UK government recognises this and has put a £2b plan behind it,” says the CEO of Roslin Technologies, Ernst van Orsouw. Roslin Technologies is an Edinburgh-based biotechnology company that uses stem cell technology to create the precursor for cultivated meat.

Roslin Technologies spun out of the University of Edinburgh’s Roslin Institute, which is famously recognised for cloning **Dolly the sheep**. The

biotechnology company was launched in 2017 by founder Glen Illing and specialises in the production of pluripotent stem cells, capable of growing into various animal tissues. These cells are supplied globally to cultivated meat producers.

The cultivated meat industry is relatively young. Van Orsouw explains “The sector was only invented 10 years ago with the creation of the first cultivated burger. Today, roughly \$3b has been invested globally in technology.” Since its incorporation, Roslin Technologies has raised £24m in equity finance and received £1.32m in grant funding.

Van Orsouw highlights two main barriers to growth in the sector: technology and funding. “To make this technology work and be a viable alternative to a commodity product like meat, the production cost needs to decrease dramatically and more regulatory approvals have to be achieved. To bring the cost down, the sector needs better cells that grow faster and more efficiently.” In contrast to the US, the UK and the EU regulatory frameworks are more closely based on the precautionary principle—this makes it harder to get products such as cultivated meat approved quickly. While good regulatory regimes are important to ensure confidence in food, Van Orsouw stresses that it is also important to be “a bit more pragmatic.” As a result

of these challenges, Van Orsouw explains that more companies in the sustainable food production industry are targeting countries such as the US and Singapore which have adopted a more risk-based and science-based approach to regulation.

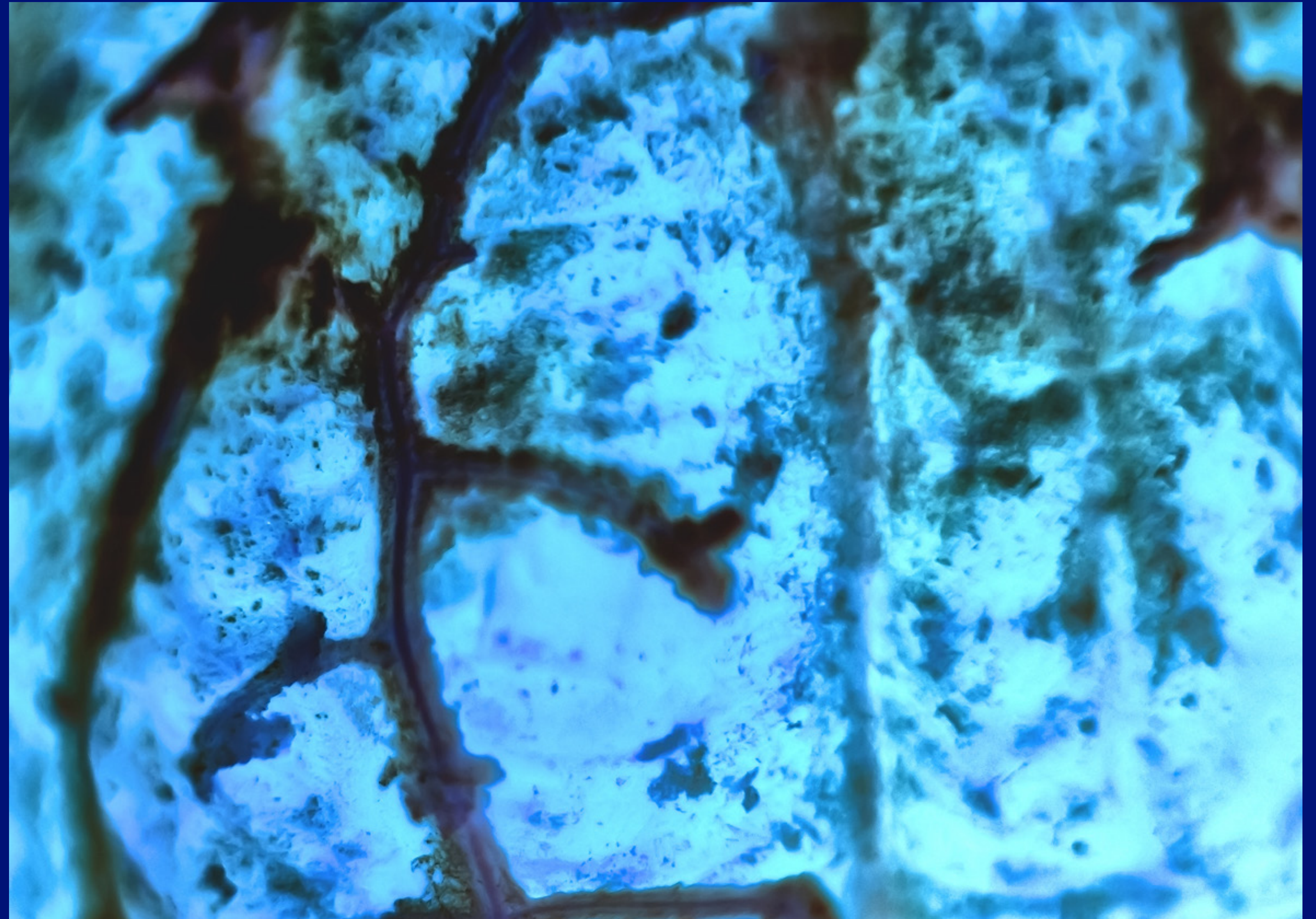
The UK’s engineering biology industry has great potential, Van Orsouw highlights that there is a “thriving ecosystem around Oxford, Cambridge, UCL with Edinburgh is playing a strong role also.” However, Van Orsouw explains that there are areas and less adverse to risks. The UK lags in entrepreneurial spirit. The required intellect and passion is there but entrepreneurs and investors are more risk averse.”



“The UK’s engineering biology industry has great potential, there is a thriving ecosystem around Oxford, Cambridge, UCL, and Edinburgh is playing a strong role also.”

Ernst van Orsouw
CEO, Roslin Technologies

For aspiring entrepreneurs in cultivated meat, Van Orsouw emphasises the importance of patient capital and securing backing from strong investors. For example, the company has received investment from Nova Holdings, the investment arm of the Novo Nordisk Foundation. The Danish pharmaceutical company is responsible for the development of semaglutide, a drug used to manage type 2 diabetes and weight management. "A lot of the food technology investors prefer plantbased or fermentation-based businesses because the products are often quicker to develop and market, thereby driving earlier returns. However, there are limited technical barriers and opportunities for Intellectual Property (IP) protection than in cultivated meat." The cultivated meat industry is technologically more challenging and gives startups opportunities to create greater differentiated and protected positions. Van Orsouw adds, "When looking for investors, biotech investors are more likely to have a longer-term vision, as they are used to longer R&D timelines and extensive clinical trials but also greater reward potential".



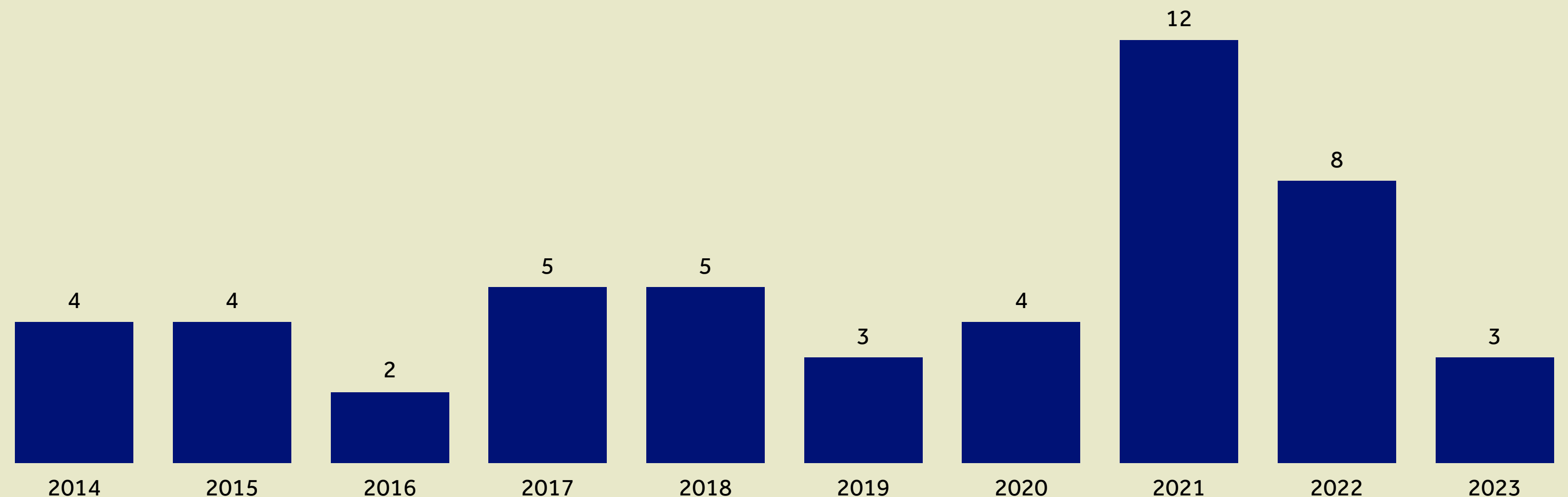
Exited companies

In the last decade, 50 high-growth engineering biology companies have exited the UK private market, either via an acquisition or an initial public offering (IPO). Exit activity in this field reached a peak in 2021 (12). The rise in exit activity in 2021 can be attributed to a global increase in mergers and acquisition (M&A) activity across industries. Arguably the COVID-19 pandemic may have influenced the surge in M&A activity. Inflated company valuations created a “seller’s market”—where businesses with strong financials competed to acquire high-potential enterprises.

IPOs represented 50% of exit activity in 2021, with high-profile offerings by companies such as DNA/RNA sequencing company Oxford Nanopore Technologies. In September 2021, the Oxford company was listed on the London Stock Exchange (LSE) with a market capitalisation of £3.37b, making it one of the largest UK IPOs that year.

In 2023, exit activity declined by 62.5%. Businesses across industries operated in tougher economic conditions at the start of 2023. Inflation, increased interest rates, and a higher cost of living contributed to a slowdown in exit activity, which led to a tighter financial market throughout the year.

Exits by high-growth engineering biology companies (2014-2023)

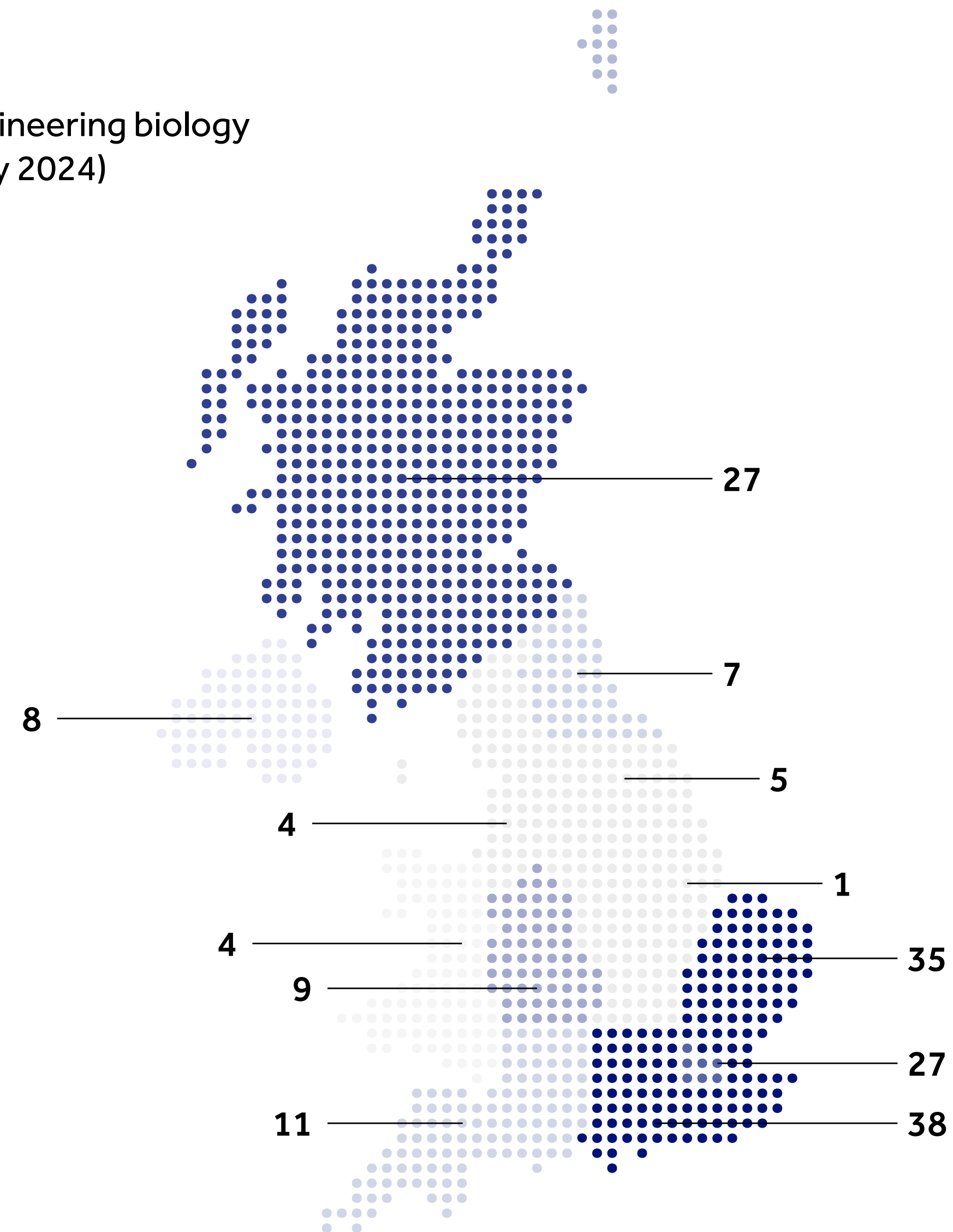
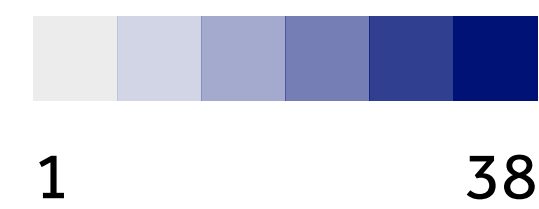


Spinouts

The South-East has the largest concentration of engineering biology spinout companies (38). This is reflective of the region's strong research institutions, accelerator programmes, and incubator support for entrepreneurs and high-growth businesses. The East of England (35), Scotland (27), and London (27) also emerge as prime hubs for engineering biology companies. The regional distribution of engineering biology companies illustrates the strength and attraction for businesses to have operations within the "golden triangle." Businesses based in London, Oxford, and Cambridge benefit from access to prestigious academic institutions, resources, and skilled talent.

The University of Oxford accounts for the largest proportion of high-growth engineering biology spinouts (35). Oxford is a leader in STEM-based subjects and has spun out high-profile engineering biology companies such as Oxford Immunotec and Vaccitech. The University of Cambridge (20) and University College London (13) also rank highly in producing engineering biology spinouts.

Regional distribution of engineering biology spinout companies (January 2024)



Company spotlight: Better Dairy

“By leveraging precision fermentation, we have built a sustainable food production platform that removes animals from the process and delivers products with great flavours, textures, and nutritional profiles,” says Jevan Nagarajah, the CEO of Better Dairy.

The London-based biotechnology company uses precision fermentation to create animal-free dairy products. Precision fermentation uses microbial organisms, such as yeast and bacteria, that contain specific DNA sequences to produce organic molecules like proteins. It builds from traditional fermentation processes such as beer brewing. The proteins produced through this method are molecularly identical to those found in milk. The

result is animal-free cheese with the same taste and texture as traditional cheese products. This alternative contains no lactose or hormones and is lower in cholesterol. By gradually replacing conventional dairy, starting with cheese, Better Dairy aims to reduce water consumption, lower greenhouse gas emissions, and entirely eliminate reliance on animals for dairy.

Better Dairy was co-founded in 2020 and since launching, it has raised £18m in equity investment via three fundraising rounds. The company raised £16.4m in its latest funding round held in February 2022. Better Dairy’s focus on sustainability and animal-free offerings has garnered international interest, helping it secure follow-on investment from backers such as US-based Stray Dog Capital and Hong Kong-based venture capital firm Happiness Capital (December 2020 and February 2022).

In light of Better Dairy’s rapid growth and success in recent years, Nagarajah shares advice on raising investment in the current market. “The fundamentals that make a company a good investment remain the same; namely, Are you building something that has the potential to generate significant value?” Understanding the capabilities and potential of your business is critical, according to Nagarajah. Highlighting the significant cost associated with engineering biology

advancements, he urges entrepreneurs to “Lean into grant funding or relocate to geographies like the UK that provide R&D benefits—for example, tax credits—as this will make equity investment go further.”

Nagarajah acknowledges the pivotal role of life sciences and technology in advancing the field of engineering biology in the UK.

He further explains that the UK’s edge lies in its “world-leading academic institutions that continue to build out their own engineering biology funnels.” His words highlight that universities play a critical role in cultivating talent and fostering collaboration



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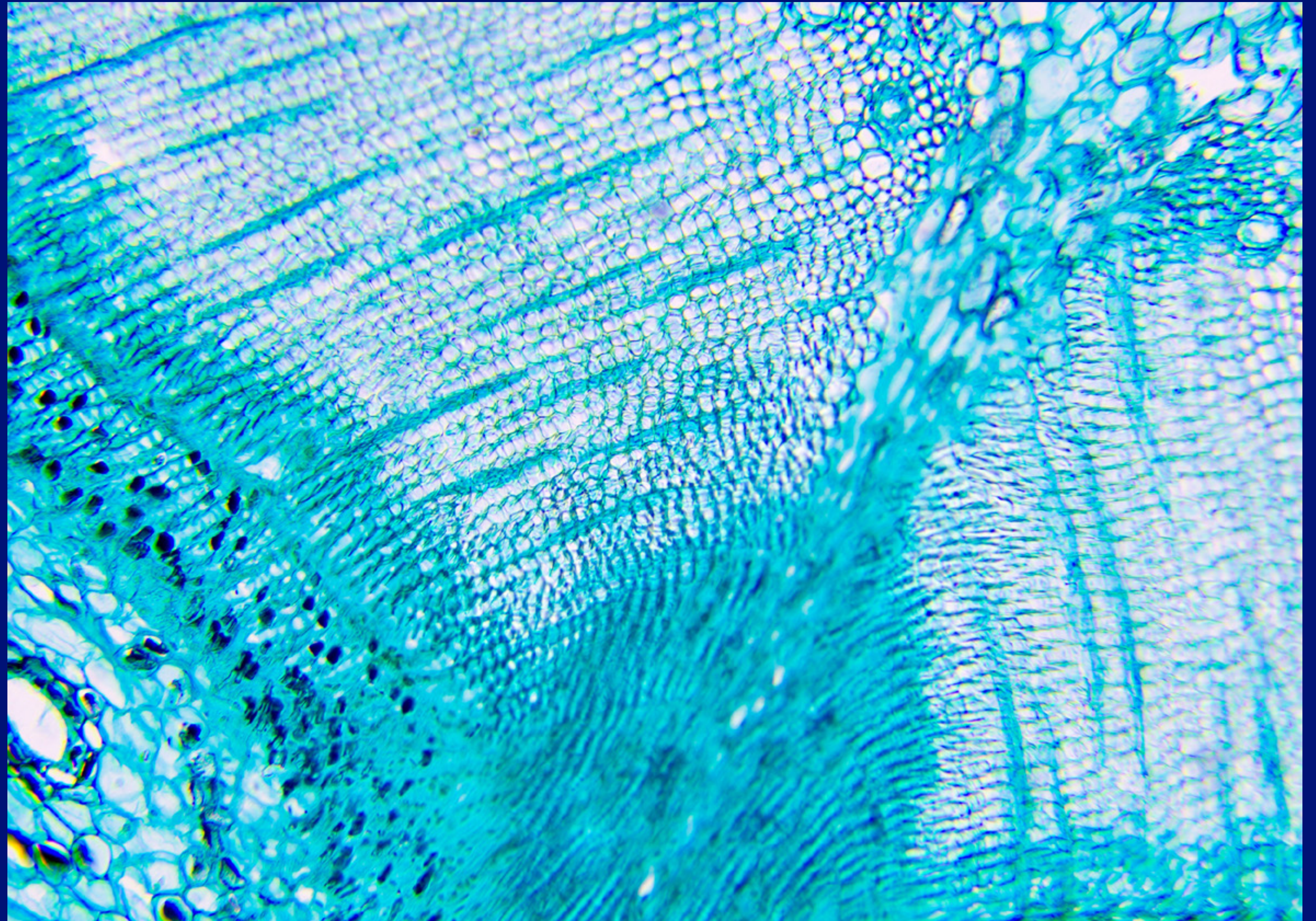
Jevan Nagarajah

CEO and co-founder, Better Dairy



between industries and academia. Nagarajah further elaborates on the transformative potential of the UK government's £2b investment in engineering biology. He emphasises the importance of deploying the capital pragmatically to ensure the UK remains a pivotal player in this rapidly evolving field.

Looking to the future, Nagarajah explains how less restrictive regulation in the animal-free industry will allow for greater innovation. "For longer-term success, the UK should consider regulatory reform to continue safeguarding the consumer but also allow room for innovation." Nagarajah notes that countries that invest substantially in engineering biology, such as the US, Singapore, and China, "seem to be making greater progress in this area." He further stresses the importance of educating the public about engineering biology, urging a shift from fear to a broader recognition of its possibilities and benefits to society.



Funding and innovation

Grant funding provided by Innovate UK tripled in value during 2023 up to £96.1m when compared to the previous year, 2022. This significant rise is largely attributable to a £71.9m grant awarded to The Cell and Gene Therapy Catapult which accounted for 74.8% of total grants awarded in that year. Notably, these companies collectively raised £785m in equity investment via 125 deals in 2023. This is a testament to the resilience and potential of engineering biology companies amidst a more challenging economic landscape. Scottish Enterprise leads the way, as the most active investor in high-growth engineering biology companies participating in 131 deals since 2013.

Public funding

Public funding is an important source of finance for early-stage companies. Through the provision of funding, the UK government aims to advance the nation's engineering biology industry in hopes of becoming a global science superpower by 2035. Innovate UK (IUK)—the UK's innovation agency—provides financial grants to support the development and commercialisation of intellectual property (IP) rich businesses. It is comprised of nine councils that work towards enhancing innovation across various industries. Its Biotechnology and Biological Sciences Research Council, for instance, allocates grants to companies advancing biological discoveries.

Innovate UK awarded 123 grants to engineering biology companies in 2020, worth a total value of £161m—a record high. The value of grant funding awarded in 2020 quintupled from the previous year. This rise can be attributed to various large grants awarded that year, including a £128m grant to the Cell and Gene Therapy Catapult (CGT Catapult).

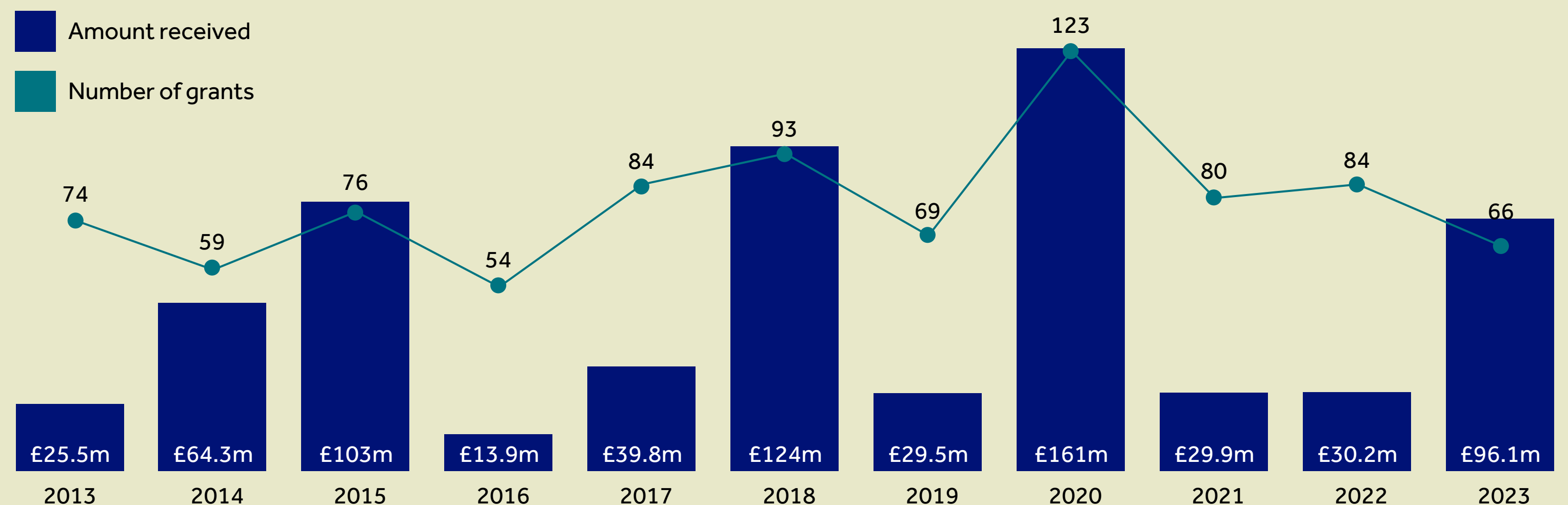
CGT Catapult is an independent innovation and technology organisation that specialises in the advancement of cell and gene therapies to treat or cure diseases.

High-growth engineering biology companies were awarded a total of £96.1m in grant funding by Innovate UK in 2023, a threefold increase from the previous year. The increase in grant funding is reflective of the growing recognition and investment in the promising field. It highlights the sector's potential to drive forward innovation, solve complex problems, and

advance cutting-edge technologies with significant societal and economic impact. Although the number and value of deals did not match the highs of 2020, year-end figures for 2023 signify that funding in this area remains a strong interest for the government.

One of the top recipients of IUK funding in 2023 was London-based Multus, a biotechnology company focused on the development of growth media for cultivated meat production. It received a £2.15m grant in January 2023 to support the development of a growth medium for cultivated meats.

Grant funding (IUK) secured by high-growth engineering biology companies (2013-2023)



Private funding

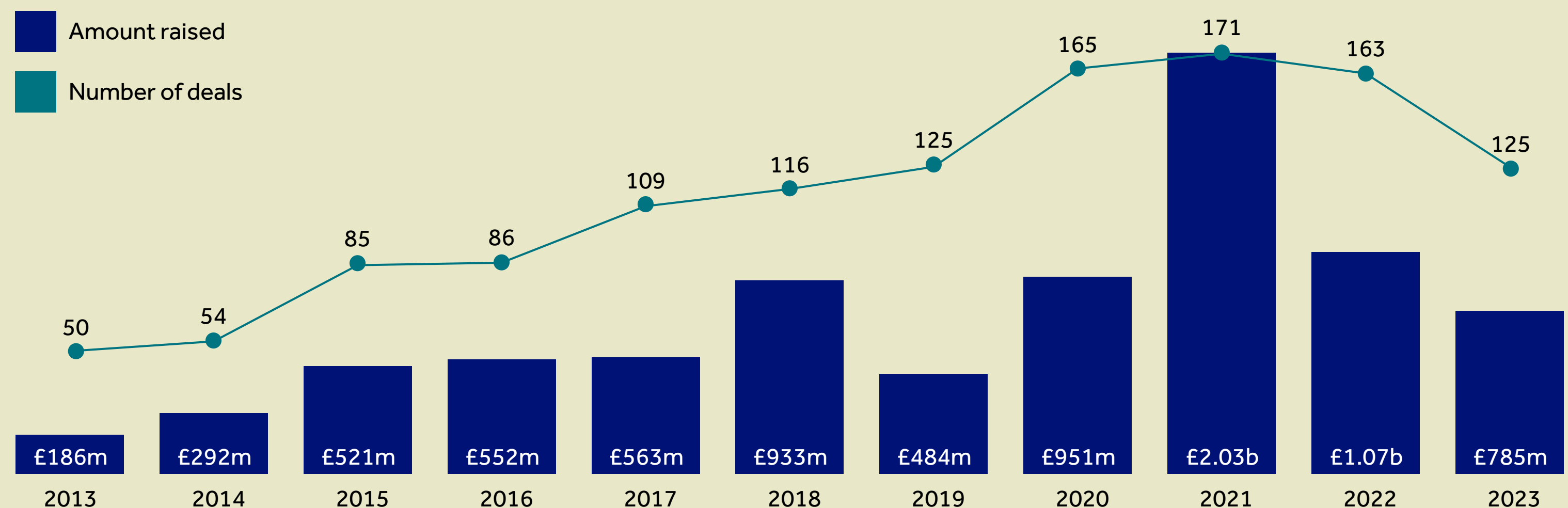
Engineering biology companies collectively raised £785m in 2023 and completed 125 fundraising deals. The year-end totals for 2023 reflect the macroeconomic challenges the UK economy and the high-growth ecosystem experienced with political uncertainty, inflation, and a cost-of-living crisis. Despite these challenges, the equity investment raised by engineering biology companies illustrates their resilience and signifies a potential return to more normal levels of investment following the exceptional peaks of 2021.

Investment in engineering biology companies increased tenfold between 2020 and 2021 to £2.03b—a record high. Before this, equity investment in high-growth engineering companies had been moving up in a steady upward trajectory from £186m in 2013 up to £933m in 2018. In 2021, investment into high-growth companies surged. This was largely driven by increased demand for technology during the COVID-19 pandemic, in addition to the rollout of economic stimulus

measures targeted at restoring the economy. These factors, incentivised investment into riskier assets during this time. Engineering biology companies, particularly those operating within biomedical sciences and genomics, were pivotal during the COVID-19 pandemic. As a result, investor appetite for high-potential businesses that could offer novel and innovative solutions to global challenges grew. In addition, 2021 saw multiple large fundraisings by companies such as Oxford Nanopore Technologies (£195m), Immunocore (£129m), and Vaccitech (£120m)—all of which have now exited via IPO.

Equity investment in this area declined by 47.3% in 2022 to £1.07b. The decrease witnessed in 2022, can be attributable to investors taking a more cautious approach towards investing, following more challenging economic conditions.

Equity investment secured by high-growth engineering biology companies (2013-2023)



Top investors

Scottish Enterprise, Scotland's national economic development agency, is the foremost investor in the engineering biology sector, participating in 131 deals since 2013. This commitment reflects Scotland's historical strength in life sciences. It invests in businesses through various funds including, the Scottish Venture Fund and the Scottish Co-investment Fund. Scottish Enterprise bridges the gap between funding rounds, supporting high-growth companies to commercialise their technology beyond research and development. Companies that have benefited from its support include Lanarkshire-based ILC Therapeutics, a specialised drug development company that received £1m in equity finance from the Scottish Venture Fund in 2022.

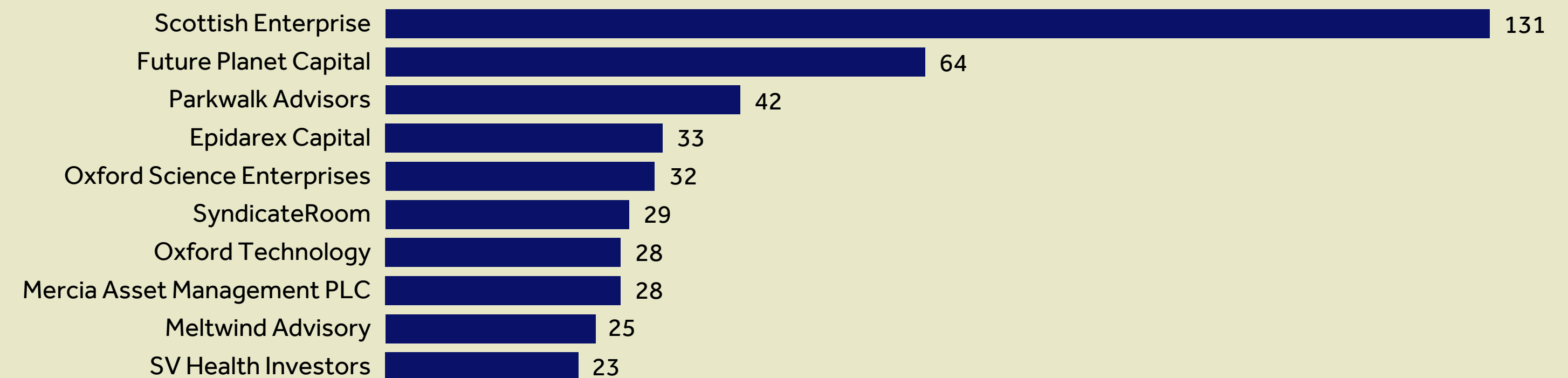
Future Planet Capital (FPC) has participated in 64 deals in engineering biology companies since 2013. It is a private network of investors, founders, and industry leaders, committed to fostering diversity amongst investors. Sustainable protein developer,

Roslin Technologies is a beneficiary of Future Planet Capital's investment initiatives. The fund has made two investments into the Edinburgh-based company, which has raised a total of £24m in equity finance via seven funding rounds since launching in 2017.

Engineering biology's foundation is deeply rooted in research, as evidenced by the investment activities of firms like Parkwalk Advisory, Syndicate Room, and Mercia, which are known for their focus on university spinouts. These investment firms are broadening their focus beyond the "golden triangle", increasingly

channelling funds into ventures emerging from top universities across the UK. This includes Locate Bio, a University of Nottingham spinout located in Derby, that received £18.7m in equity funding since its launch in 2001 via six rounds—Mercia participated in four of these rounds.

Top fund managers by number of equity deals into high-growth engineering biology companies (2013-2023)



Investor spotlight: Future Planet Capital

“Engineering biology is a powerful underlying technology that enables new products and manufacturing approaches in numerous vertical sectors. It drives a more sustainable approach to manufacturing, offering high-impact replacement products as well as those with truly novel functionality. “It is as transformative as AI,” explains Oliver Sexton, Investment Director at Future Planet Capital (FPC). “We back companies using engineering biology as a core part of our investment thesis as it strongly selects high impact, high growth entities competing with robust IP in very large markets with groundbreaking solutions.”

FPC is a global impact-led venture capital firm headquartered in London. FPC is focused on investing in high-growth businesses that contribute positively towards societal and environmental issues, as well as aligning with the UN Sustainable Development Goals. With a portfolio of 140 companies across the world, notable examples include 23andMe, a genetic testing company, and OxfordVR, specialising in virtual reality therapy for mental health. FPC has long backed the engineering biology sector and manages the UK Innovation and Science Seed Fund (UKI2S) which has a £33m sub-fund dedicated to engineering biology. This fund has supported a wide array of companies in sectors ranging from therapeutics and agritech, to clean biotech.

Whilst biology is complex, by applying engineering principles and breaking down pathways to key steps, it can be de-risked and also enhanced. Whilst this complexity means investors may face some worrying moments as technology develops it means the end solution is novel, highly functional and very differentiated. An engineering biology company isn’t going after incremental improvements, it will replace a product with a superior solution. FPC has a dedicated team to aid in the evaluation of technical innovation. “In the UK team, there are individuals with PhD and masters qualifications in STEM subjects to carry out

due diligence. We also utilise external consultants to help understand the science behind a company’s product. We couple this with discussions with potential customers to understand a product’s viability,” says Sexton.

Accelerator programmes can provide companies with useful exposure to investors and opportunities to secure investment and as importantly, training in planning, budgeting, and managing companies. FPC has co-invested alongside accelerator programmes and Sexton explains, “There are some programmes with very good reputations that have produced great things. We may invest in parallel whilst a business is



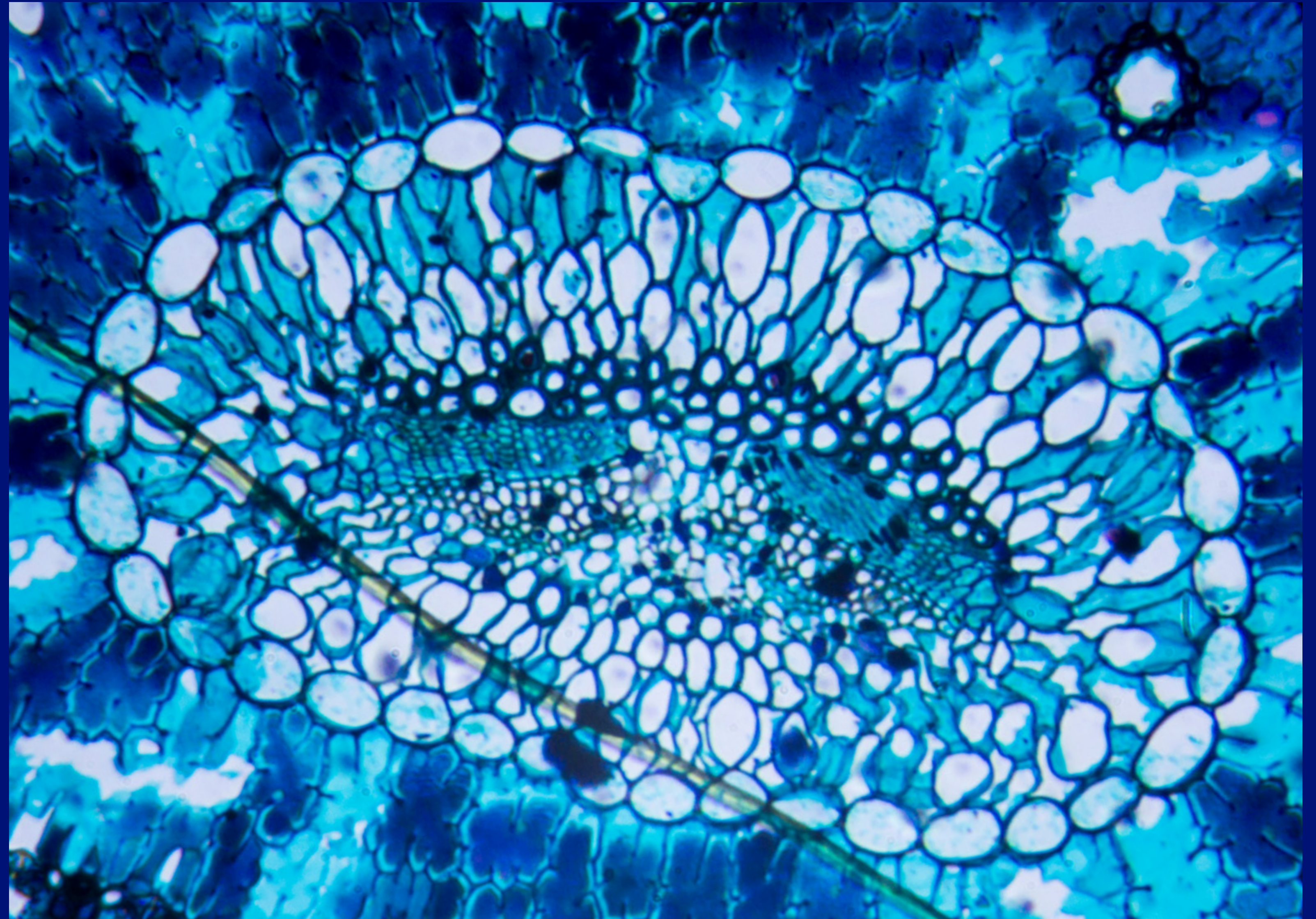
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Investment Director at Future Planet Capital (FPC)

participating in an accelerator programme. Often, the amount of equity provided by the accelerator is not sufficient, especially in biology," says Sexton.

Sexton explains how businesses benefit from FPC investment, "We have a rich network and dedicate time to helping teams focus their plans and business model. We try hard to introduce companies to other funds, to executives and board members. It is also not uncommon for us to provide connections and then invest in a business at a later stage as plans develop. FPC is also well connected to corporates. This allows us to help portfolio companies find corporate customers or potential corporate investment." Sexton highlights the importance of compatibility between entrepreneurs and investors: "Investing is more than equity. You need your investor to be supportive and helpful throughout the project. As you will be working together over time it's fundamental to make a good team."



Ascend

£105m

Amount raised

May 2023

Date

Ascend Gene & Cell Therapies (Ascend) offers a full suite of chemistry, manufacturing, and controls (CMC) services to assist biotechnology companies at various stages of development. A key strength of the company lies in its specialised production of tailored viral carriers for gene therapy. Its meticulous control over the composition of these carriers significantly lowers the risk of contamination. The London-based company was founded in 2021 by Tim Funnell and is now led by CEO Michele Scheggia. Since its launch, the company has expanded its reach internationally with presence in California and Munich. To date, Ascend has secured £116m in equity investment via two deals, with its latest deal in May 2023 totalling £105m.

Complement Therapeutics

£63.6m

Amount raised

April 2023

Date

Complement Therapeutics develops treatments for diseases linked to the complement system—an integral part of the immune system that defends against common pathogens. The London-based company specialises in macular degeneration, a progressive eye disorder commonly affecting older adults. To combat this condition, it employs gene therapies specifically designed to modify genes that malfunction in the complement system. The University of Manchester spinout was co-founded in 2020 by Professor Simon J. Clark, Professor Paul Bishop, and Dr Richard Unwin. It is currently led by CEO Dr Rafiq Hasan. Since its establishment, Complement Therapeutics has secured £68.8m in equity funding across three rounds, with the latest deal in April 2023 totalling £63.6m.



UK innovation

The high-growth engineering biology sector has, on average, filed 71 patent applications per year between 2011 and 2021—and 28 (on average) have been granted. Between 2013 and 2017, patent activity by engineering biology companies grew modestly, with an average of 41 patents being granted per year (during this period). The number of patent applications by the engineering biology sector hit a record high in 2017 (124); however, just 40.3% have been granted to date. The surge in patent activity during this period may be partly attributable to an increase in the population of active engineering biology companies within the UK, which soared tenfold from 112 in 2013 to over 200 companies in 2017.

Patent activity in the engineering biology sector declined significantly (50.9%) in 2018 and further declined (57.1%) in 2019. The number of patent applications also declined from 83 in 2018 to 69 in 2019—a 16.9% decrease. Findings by the Intellectual Property Office (IPO) reveal that there were early

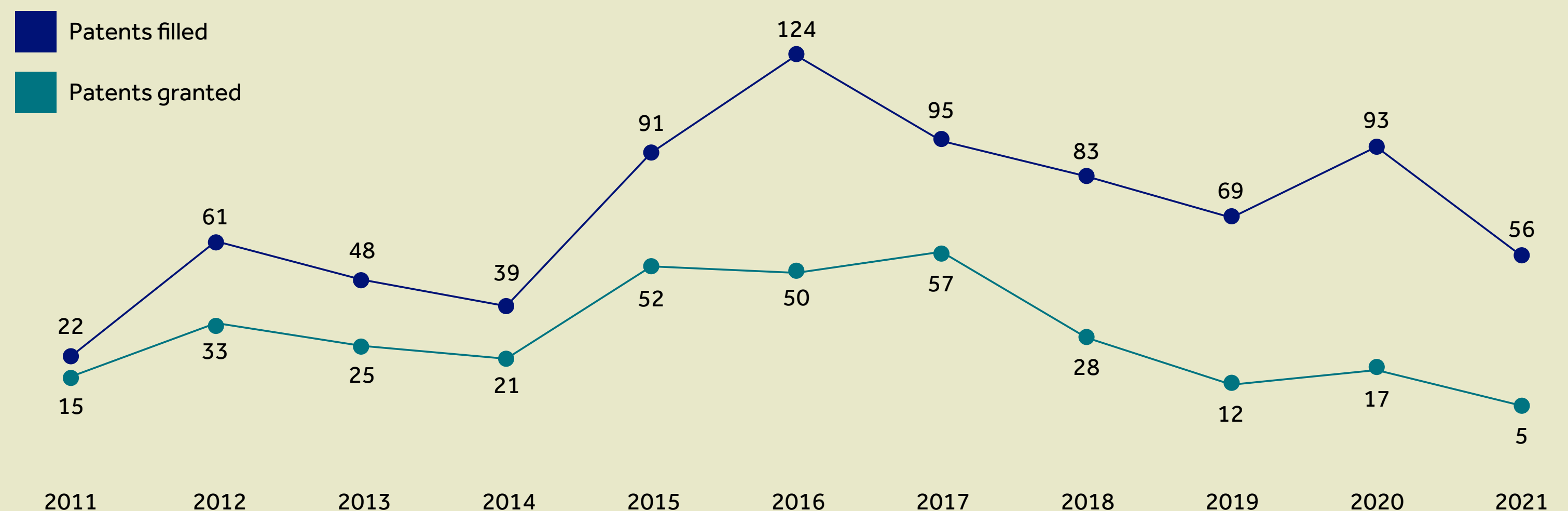
indications that Brexit and the COVID-19 pandemic may have affected patent applicant behaviour.³ Beauhurst data shows that patent activity in the engineering biology sector increased in 2020. The number of patent applications filed in this sector grew by 34.8%, and those granted rose by 41.7% in 2020. This aligns with the IPO's findings which show that overall UK patent applications increased by 7% between 2019 and 2020.⁴ The IPO further suggests that this rise may have indicated more economic certainty following the UK's official withdrawal from the European Union.⁵

³ Intellectual Property Office, "The changing profile of users of the UK patent system," Supporting the innovation ecosystem: Building the evidence base on the drivers of IP, August 2021

⁴ Intellectual Property Office, "The changing profile of users of the UK patent system," Supporting the innovation ecosystem: Building the evidence base on the drivers of IP, August 2021

⁵ Intellectual Property Office, "The changing profile of users of the UK patent system," Supporting the innovation ecosystem: Building the evidence base on the drivers of IP, August 2021

Patent activity by high-growth engineering biology companies (2011-2021)



Investor spotlight: Archangels

"Archangel Investors invest in Scotland's best early-stage businesses with high growth potential. Our core focus is on disruptive technology with protectable IP, which is difficult for competitors to replicate. We look for motivated teams who have a credible and realistic plan," explains Sarah Hardy, Director and Head of New Investment at Archangels.

Established in 1992, Archangels Investors (Archangels) is one of the longest-running angel syndicates in the UK. It has more than 100 investor members and typically invests more than £10m per year in early-stage Scottish companies.

Archangels' investment portfolio is diverse,

encompassing businesses ranging from software development and photonics to medical devices and bionics. Archangels has made significant investments in engineering biology companies such as Bioliberty. The Edinburgh-based company received £2.2m in 2023 for the advancement of its soft robotic glove for hand rehabilitation. Midlothian-based biotechnology company Cytomos has received a total of £9.17m in investment since 2014 from Archangels to aid in the development of real-time, cell analysis technology. Other portfolio companies include Edinburgh-based BioCaptiva, which aims to transform liquid biopsy testing for enhanced cancer detection, and Integrated Graphene, whose pure 3D graphene foam is being used to create biosensors.

Archangels leverages its extensive network and expertise to support the development and scaling of startups. Hardy adds, "In addition to equity, we utilise our extensive international network in life sciences to help our portfolio companies scale and thrive. We encourage peer-to-peer support between our portfolio companies by organising training and networking events, as we understand many founders are facing similar challenges." By aligning with co-investors such as British Business Investments, Scottish Enterprise, and the Scottish National Investment Bank, Archangels ensures that investees

have all the resources and guidance needed to grow.

"Our experience with engineering biology startups such as Cytomos, who aim to disrupt the cell analysis sector, has highlighted that it's crucial to understand the challenges faced by your target audience and to ensure you are developing a solution to meet the needs of that market," says Hardy. This approach ensures the development of innovative, market-aligned products that precisely address real-world challenges.

Archangels' due diligence process is thorough and involves consulting sector experts to gain a deep



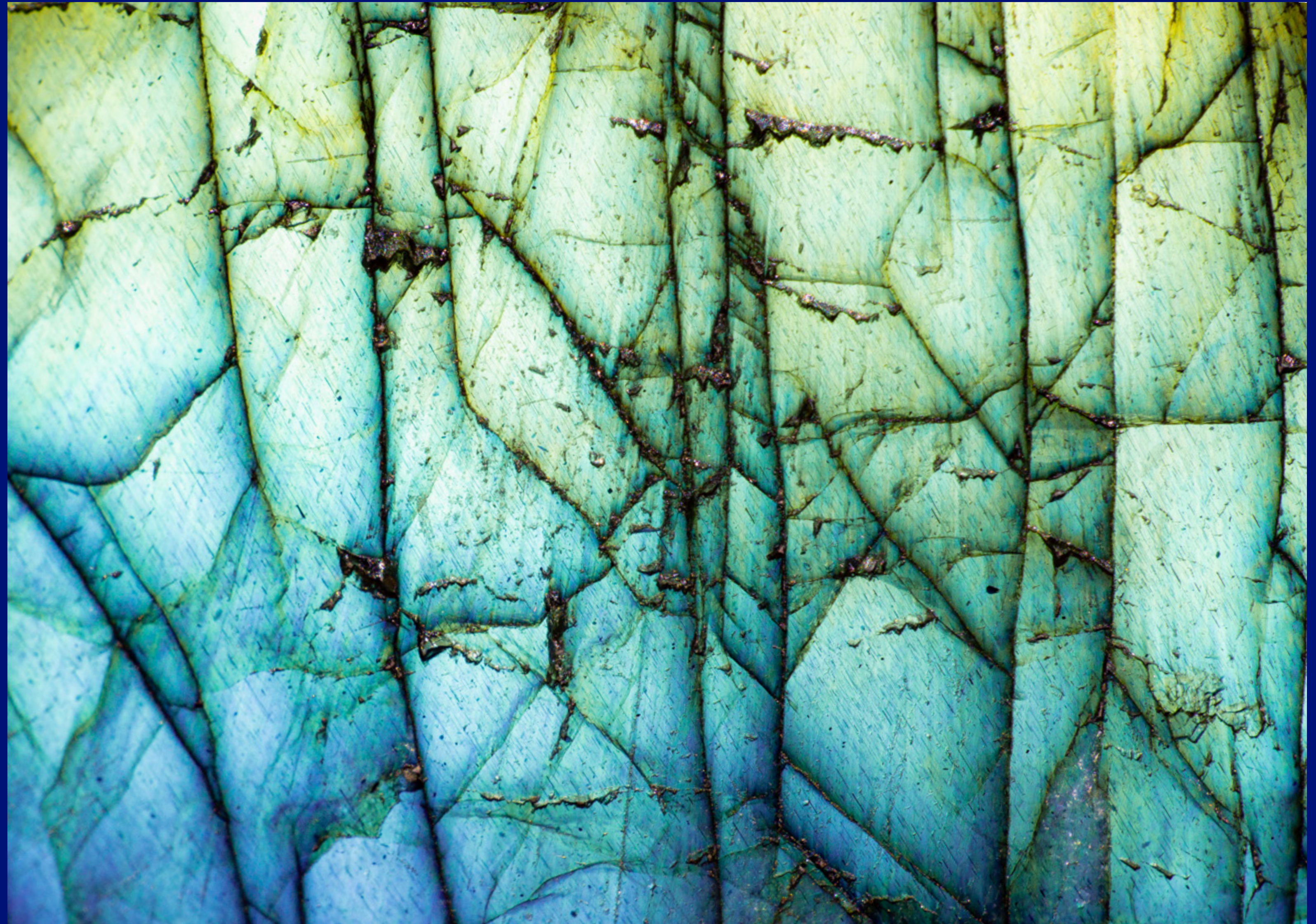
"When downstream capital is scarce, having a differentiated offering and market pull is essential in picking tomorrow's winners."

Sarah Hardy

Director and Head of New Investment, Archangels

understanding of the market landscape and Archangels' due diligence process is thorough potential pitfalls. Hardy explains: "Diligence checks, including a thorough review of protectable IP, are crucial towards understanding an investment opportunity. With engineering biology ventures, it's important to consider the time and cost of getting to market, possible regulatory hurdles, and the time to generate revenue. When downstream capital is scarce, having a differentiated offering and market pull is essential in picking tomorrow's winners."

Hardy offers advice to entrepreneurs in the engineering biology field, emphasising the complexities in transforming ideas: "Developing an idea into an investable, scalable opportunity will always be more challenging than you think. Particularly when the business involves an engineering device for healthcare applications, as this may require varying levels of regulatory approval. It is key to seek out help and advice early on from people who have experience in taking similar products or services to market."



Founders

European and international founders constitute 15.3% and 12.3% of the UK's high-growth engineering biology company population, respectively. Beauhurst data shows that individuals aged 50-59 make up the largest proportion (28.4%) of founders within this cohort, suggesting that accumulated knowledge and experience are significant factors for business founders in this discipline. Naturally, for a highly technical field, the majority of engineering biology founders (99.5%) hold advanced academic credentials, ranging from bachelor's degrees to master's and PhDs.



Founder diversity

Companies with an all-female founding team account for 6.64% of the active high-growth engineering biology population. The disproportionate number of women in senior leadership positions within engineering biology may be attributable to a lack of women entering STEM subjects and studies at higher education—leading to a larger proportion of men heavily dominating STEM-based industry sectors.

Findings by Women in STEM support this view, revealing that in subjects such as mathematics and computer sciences, female enrollments accounted for 37% and 23% of students, respectively, for the 2022-23 academic year.⁶ In engineering and technology-based subjects, female enrollment represented 21% of the cohort.⁷

Following those aged 50-59 (28.4%), founders aged between 60-69 (22.4%) and 30-39 (19.6%), represent the next highest proportions within the engineering biology sector. Founders aged 20-29 account

for the smallest proportion of founders (3.83%). Considering the research-intensive nature of engineering biology, it is unsurprising that younger founders make up a smaller proportion of the overall company population. Several factors, including industry knowledge, experience, and more time to save up personal finances, may influence an individual's decision to launch a business later in life.

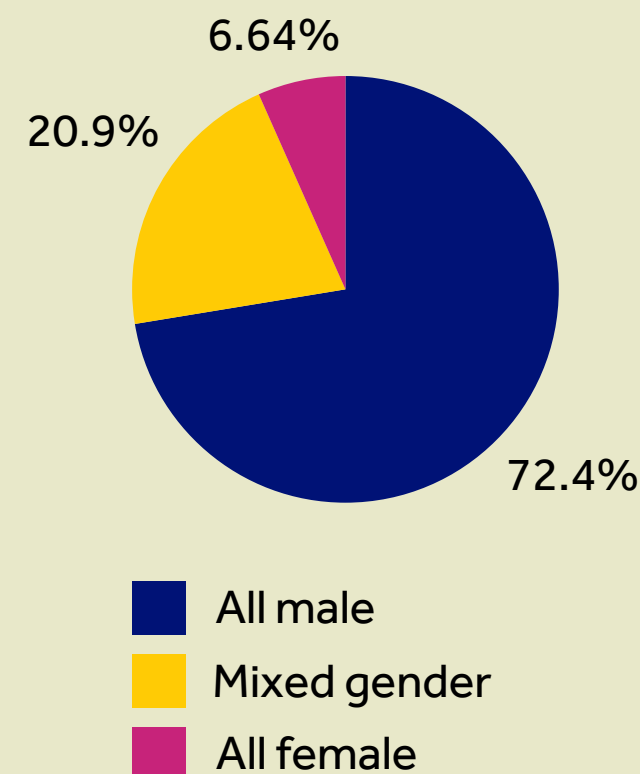
⁶ Women in STEM Statistics: Progress and Challenges." STEM Women. Accessed December 18, 2023.

<https://www.stemwomen.com/women-in-stem-statistics-progress-and-challenges>.

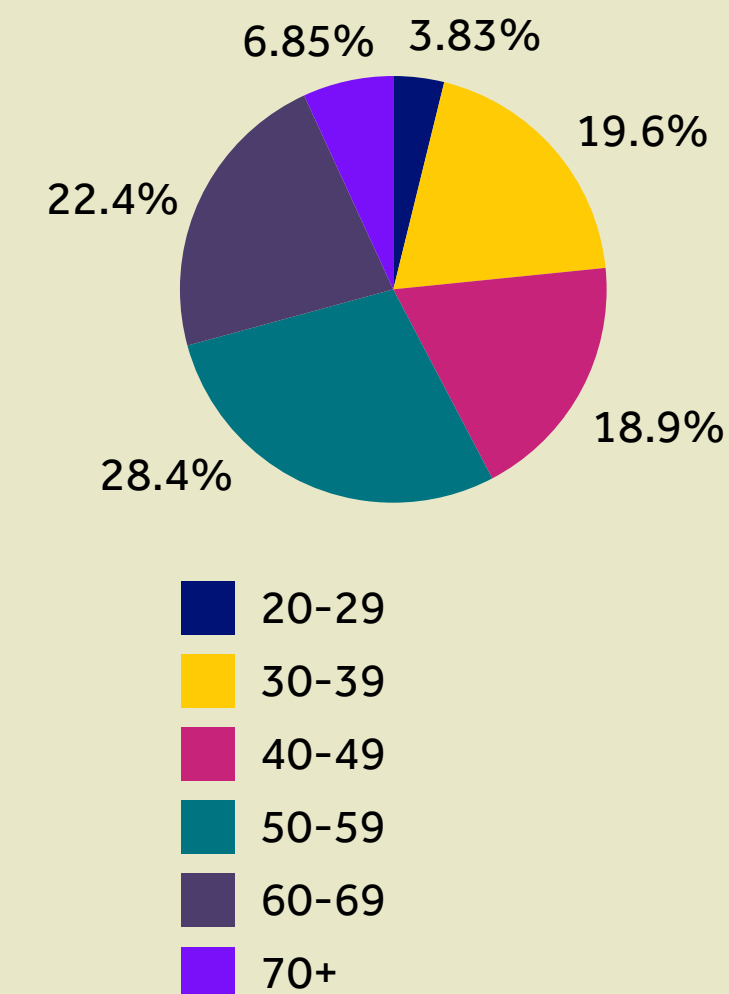
⁷ Women in STEM Statistics: Progress and Challenges." STEM Women. Accessed December 18, 2023.

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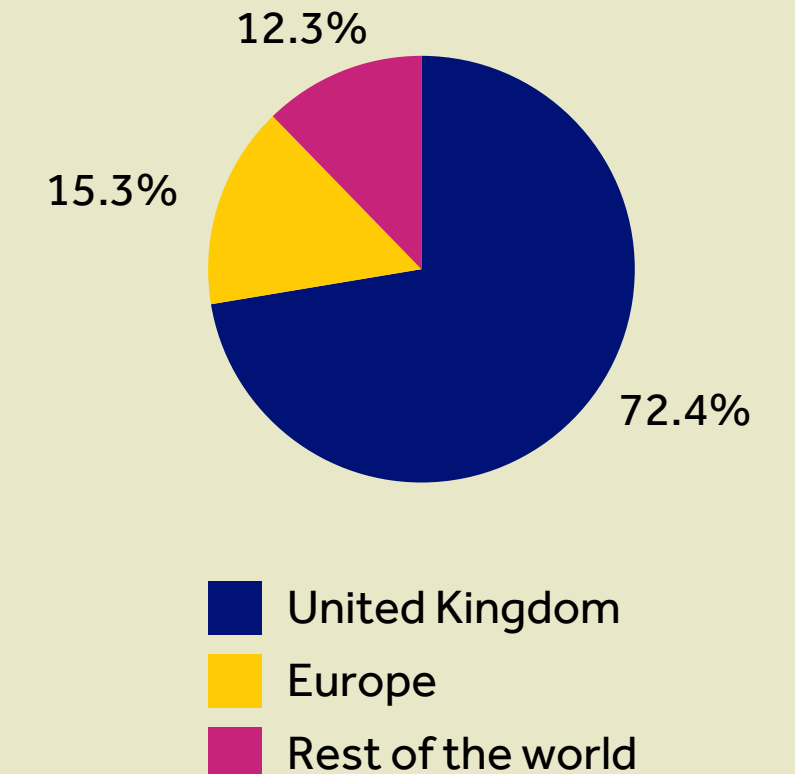
Gender composition of engineering biology company founders (January 2024)



Age composition of engineering biology founders (January 2024)



Nationality composition of engineering biology founders (January 2024)



Founder/leader educational backgrounds

Of the founders reviewed, 99.5% have obtained either a bachelor's, master's, or PhD degree as their highest level of education. Specifically, 39.2% for bachelor's degrees, 31.4% for master's degrees, and 28.9% for PhDs. This reflects the high educational attainment among founders in this sector. This finding highlights engineering biology's complex and specialised nature, typically requiring a thorough understanding of biological and engineering principles. A degree provides founders with the necessary expertise and skills in research, problem-solving, and innovation, which are key for entrepreneurship within this sector.

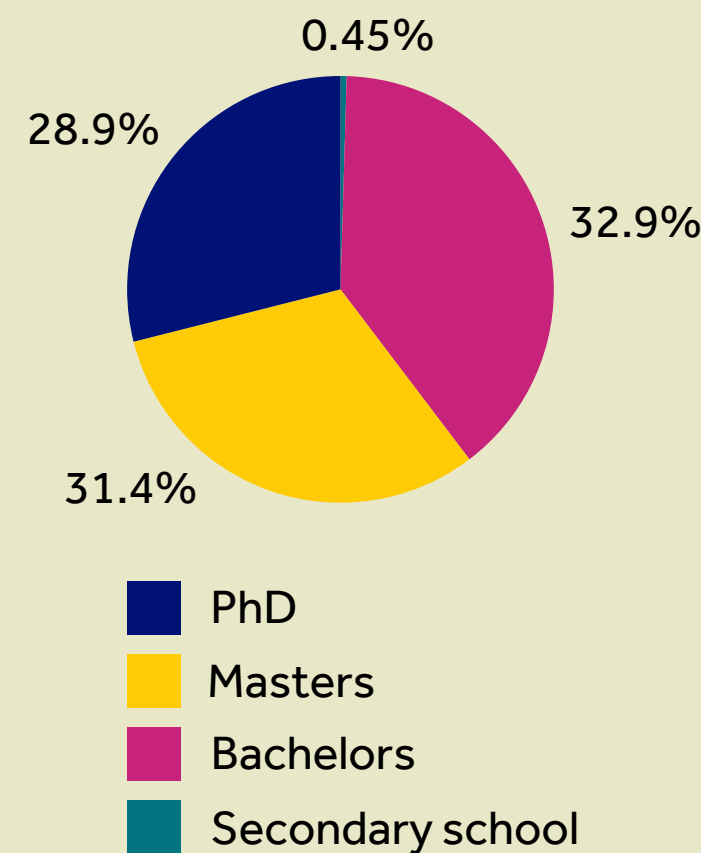
The University of Cambridge and the University of Oxford stand out as leading academic hubs in the field of engineering biology, with 85 and 68 founders, respectively. Their prominence is likely linked to their

extensive research programs in engineering biology. Following closely behind are Imperial College London (59), University of Bristol (31), and University College London (26).

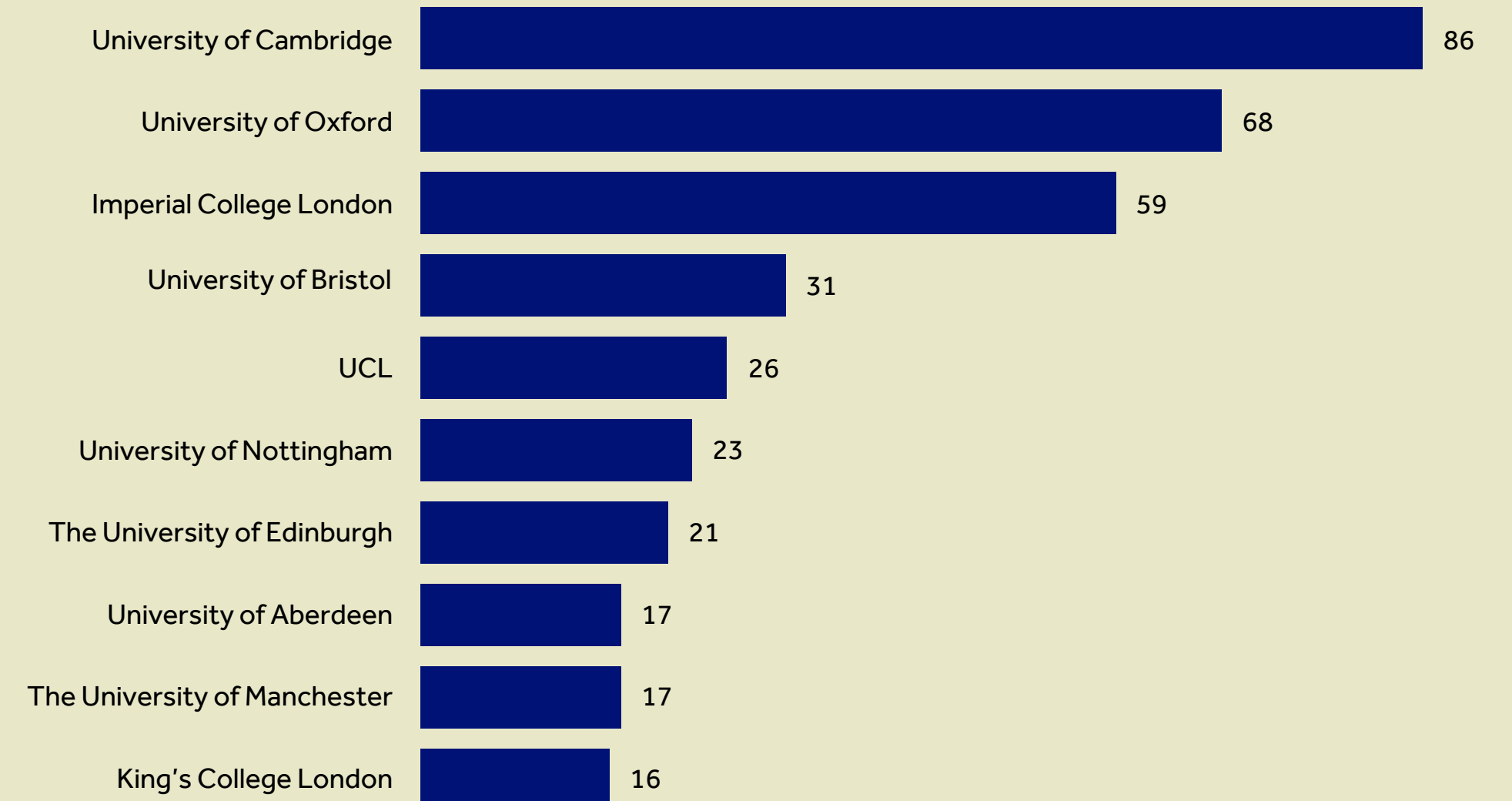
The distribution of founders from UK-based universities might reflect regional advantages such as access to talent, opportunities for research partnerships, and funding opportunities.

The significant numbers reflected from these universities highlight the important role of higher education establishments, and the academic ecosystem in nurturing entrepreneurs within the field of engineering biology.

Educational attainment of engineering biology founders (January 2024)



University ranking by number of engineering biology founder attendances (January 2024)



Methodology

Defining startup and high-growth companies

Beahurst identifies high-growth startup companies using eight triggers (outlined on this page) that it believes suggests a company has high-growth potential. More detail on Beahurst's tracking triggers is available via its website.

Active companies

'Active' companies refers to companies that are at the seed, venture, growth or established stages of evolution by Beahurst analysis. The term excludes companies that are zombie or dead, or have exited via an IPO or acquisition.

Defining engineering biology

Engineering biology describes the application of engineering principles to biology, enabling the construction of new or redesigned biological systems.

¹ Engineering biology applications is an umbrella for a number of application sub-sectors including agriculture, food, health and life sciences, the creation of high-value compounds and bio-energy & carbon capture. The companies included in this report were based on a non-exhaustive list provided by DSIT which contained over 1,300 companies. The report focuses solely on the 600+ application companies, of which 379 were classified as "high-growth" companies.

Equity investment

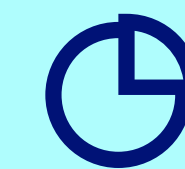
Equity investment refers to the purchase of shares within a company. This type of investment means buying into the equity (ownership) of the company rather than its debt. It is a common investment approach across various company types and stages, attracting a diverse range of investors. Venture capital firms typically engage in equity investments in early-

stage startups, providing capital to fuel their growth. On the other hand, growth investors and private equity firms often target later-stage or more established companies, with private equity investors sometimes acquiring large, or even controlling, equity stakes.

To be included in our analysis, any investment must be:

- Some form of equity investment
- Secured by a UK company
- Issued between 1 January 2013 and 31 December 2023

High growth triggers



Equity investment



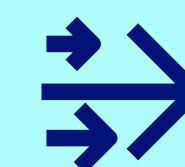
Academic spinouts



Scaleups



High-growth lists



Accelerator attendances



Major grant recipients



Management Buy-outs/
Buy-ins



Venture debt

Barclays Eagle Labs

Barclays Eagle Labs is a growing national network that provides business incubation, dedicated growth programmes, mentoring as well as co-working, and office space for ambitious high-growth businesses.

By cultivating a community of like-minded entrepreneurs and providing a collaborative work environment, access to peers, and opportunities to maximise growth through digital connections and growth programmes, curated events, and funding opportunities, Eagle Labs is able to help startups to grow at pace.

Eagle Labs also specialises in positively disrupting key industries by bringing together key corporate players, industry bodies, leading universities, and startups to enable rapid innovation and investment, by asking them to collaborate and currently have dedicated lawtech, healthtech, energytech and agritech industry-aligned programmes.

With various Eagle Labs dotted all across the UK and many more in the pipeline, our focus is to help to connect, educate, inspire, and accelerate ambitious UK businesses and entrepreneurs.

Find out more at labs.uk.barclays.

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We have pulled together the resources in this document for you to help with your independent research and business decisions. This document contains opinions from independent third parties and link(s) to third party websites and resources that we (Barclays) are not providing or recommending to you.

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Beaurost

Beaurost is a searchable database of the UK's high-growth companies.

Their platform is trusted by thousands of business professionals to help them find, research and monitor the most ambitious businesses in Britain. They 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.

Beaurost's data is also used by journalists and researchers who seek to understand the high-growth economy, and powering studies by major organisations – including the British Business Bank, HM Treasury and Innovate UK – to help them develop effective policy.

For more information and a free demonstration, visit beaurost.com

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