Industry in Focus

PwC Life Sciences

Future50

October 2023

pwc

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We help our clients develop future focused business strategies and to implement the time critical programmes and procedures essential to success within worldwide regulatory frameworks.

Our multi-disciplinary teams and global reach mean we are well placed to provide wide-ranging support – wherever you need it, at home and abroad, whatever the size of your organisation.

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Foreword

As the UK sets its sights on an ambition to be a Life Sciences Superpower, harnessing the talent and capabilities from across the UK's ecosystem has never been more critical.

The UK and its academic powerhouses have created an environment where scientists are able to push the boundaries of research to create breakthrough science in areas such as biopharmaceuticals, artificial intelligence, digital health, diagnostics and devices. At the forefront of this vision for the UK is how we can enable new companies to form and set them on a path to late stage development and commercialisation.

I am delighted to celebrate and showcase, in the Future50 Life Sciences report, some of the most innovative and groundbreaking companies operating in the UK life sciences sector today. The applications in therapeutic areas previously seen as unreachable for drug development, are truly awe inspiring.

This report is the culmination of months of interviews and research across the UK life sciences ecosystem. We are immensely grateful for the time and effort that so many contributors have invested in helping us to produce this report. A massive thanks to the Future50 companies and their management teams, and to the many investors and other market participants who provided their insight and support in the creation of this report.

In compiling this outlook into the future landscape, we have grown a sense of confidence that with the right support in a number of areas, many companies within the UK ecosystem can help to transform what is undoubtedly a global leader in academic research into a global superpower. This will allow them to compete at the highest level, to create products and services that deliver patient outcomes that we can but dream of.

However, we are living in a time of geopolitical unrest and economic uncertainty that has tempered recent sector performance. Despite such promise from the sector during the COVID-19 pandemic, the industry's public market performance since has flattered to deceive. Nevertheless, we know that the life sciences sector is not a short term play, and the results of today's endeavours must be judged not just in a quarter, but in the longer term delivery of patient outcomes. The group of Future50 companies have a laser focus on delivering significantly improved outcomes, whether that is in drug discovery, cell and gene therapy manufacturing, or healthcare services.

Our wider ability to nurture and grow the Future50 companies and the many more businesses from across the UK will determine whether we can transform this strategic sector for the UK, into the global Life Sciences Superpower that we know it can be.

Stephen Aherne

Pharmaceutical and Life Sciences Leader, PwC UK

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Our £94 billion life sciences sector is critical to our plans to grow the economy, improve public health and cement the UK’s status as a science superpower. These 50 companies exemplify how the sector delivers highly-skilled jobs and drives investment into clusters right across the country, from Bristol to Belfast.

For UK life sciences to continue to thrive, it is essential that the sector’s leaders are able to make informed decisions. Reports like this one are vital – and I am delighted to see how it shines a light on the sector’s Great British success stories, from digital health to drug discovery.”

George Freeman MP,
Minister of State at the Department for Science, Innovation and Technology

About

PwC's UK Life Sciences Future50 includes a selection of companies that illustrate the breadth and depth of world-class science and innovation by life sciences businesses in the UK, but is neither exclusive nor exhaustive. The company information has been derived from publicly available sources and discussions with management, with a cut-off date of 31 July 2023. PwC has not independently verified any of the company information. Where statistics or research has been discussed in the company profiles, these have been sourced from company websites or information in the public domain.

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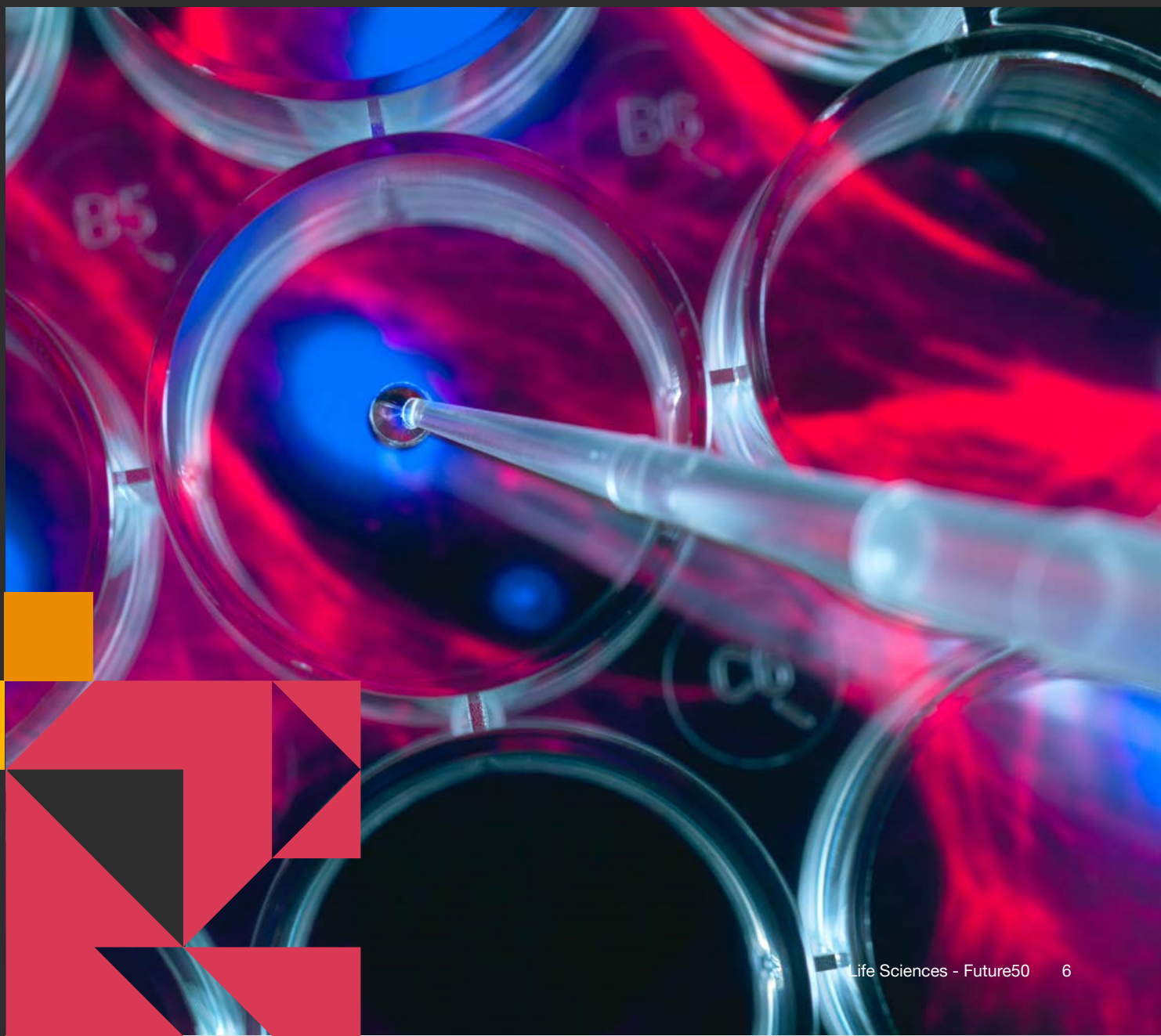
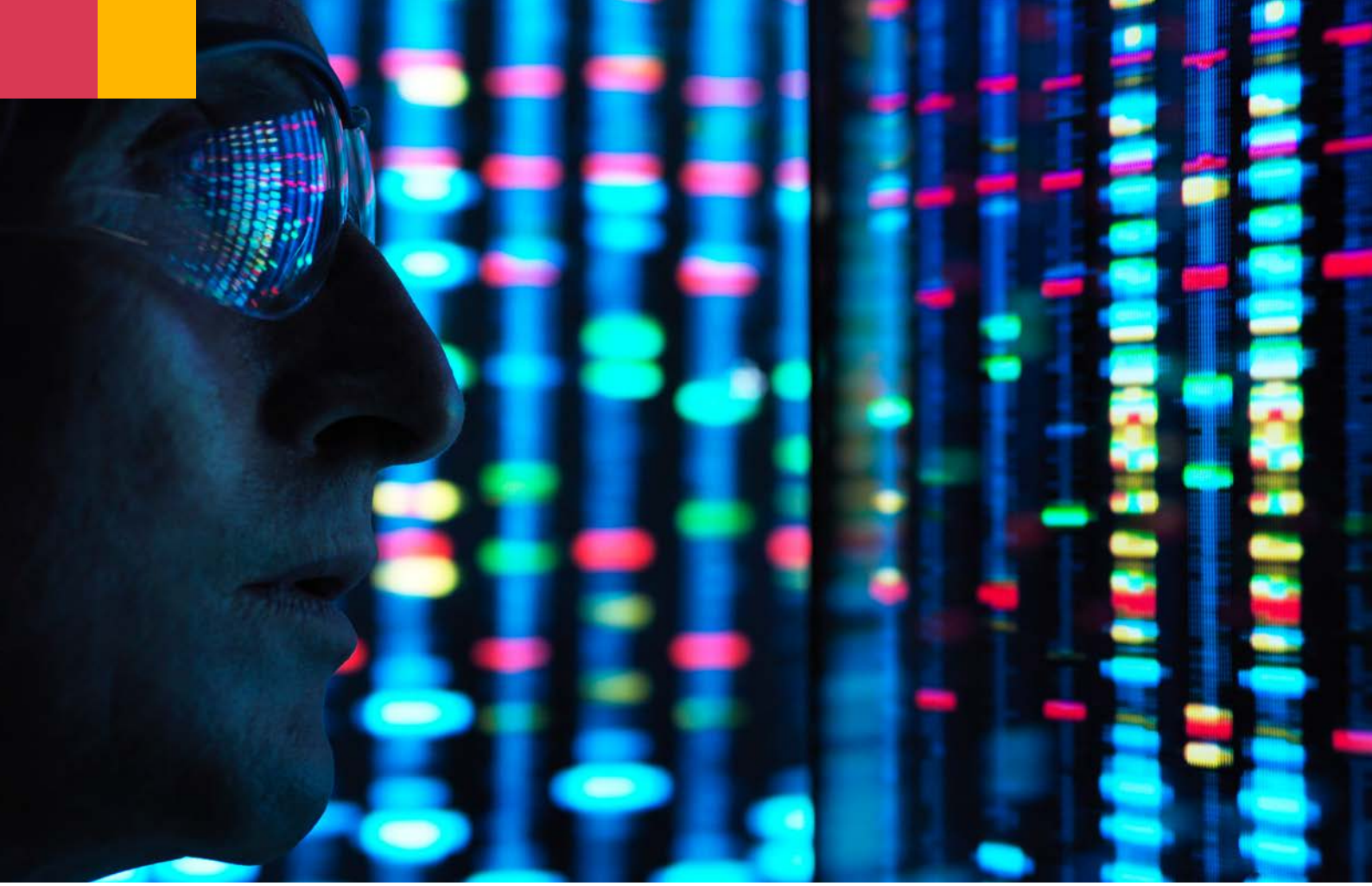




Key context

The UK on the global life sciences stage

The UK is home to one of the world's most vibrant and diverse life sciences sectors, supported by the academic excellence of UK universities, innovative research institutions and exceptional talent. Inspired by the UK's rich history of leading innovation, from antibody engineering to genome sequencing, and more recently, cell and gene therapies (CGT) and machine learning, PwC has prepared a report to shine a spotlight on the transformational science and innovation pioneered by UK life sciences companies.

Our report discusses the strengths and opportunities of the UK life sciences ecosystem, estimates the sector's contribution to the UK economy and outlines prevailing themes in research and innovation based on our stakeholder conversations.

We illustrate the breadth and depth of breakthrough science and innovation coming out of the UK by profiling 50 life sciences companies aiming to solve some of the most important challenges in scientific research and human healthcare.

From within the Future50 sample and beyond, UK life sciences companies are advancing cutting edge technologies, innovating in areas of significant unmet need and finding new ways to transform the latest scientific breakthroughs into tangible patient benefits.

Critical catalysts: powering the UK life sciences engine

Academic excellence

When looking at the key strengths of the UK life sciences sector, world-class science and academic excellence are undoubtedly top of the list, and were themes which echoed throughout our stakeholder interviews. The review of early-stage companies and the interviews we carried out to source and select the Future50 have provided fascinating insights into the strength of the innovation pipeline and the potential breakthroughs ahead.

The launchpad for these companies is an exceptional academic system that includes four of the world's top ten universities for life sciences and medicine (Oxford, Cambridge, Imperial College and University College London)[1].

Together these academic powerhouses have helped to create a life sciences 'Golden Triangle' of new ideas, talent, research capabilities and supporting infrastructure – with 44 out of the Future50 companies based in this area.

Our research suggests that there is significant potential beyond the Golden Triangle as well. Many other UK cities are delivering significant contributions to life sciences innovation and diversifying the UK's life sciences industry beyond the traditional fonts of Oxford, Cambridge and London. Edinburgh (home to Kynos, Macomics and Resolution Therapeutics in the Future50), Glasgow and Manchester (where F2G was spun out from) are in the top 50 life sciences' universities worldwide. Bristol (the academic base for Purespring in the Future50 sample) is not far behind in the global rankings.

1 https://www.topuniversities.com/university-rankings/university-subject-rankings/2023/life-sciences-medicine

Embracing collaboration: a network of leading research institutions

Beyond leading academic institutions, organisations such as the Catapult Network, MedCity, the Crick Institute, the Sanger Institute, Cancer Research UK, Genomics England and the UK Biobank have a significant impact on the UK's life sciences landscape and play crucial roles in driving research and innovation in their respective domains.

Through affiliations with all these institutions and partnerships with NHS trusts, companies in the Future50 sample and beyond are harnessing vast datasets to power research, benefitting from access to patient registries and advocacy groups, or partnering to deliver transformative innovations to patients.

There are some fantastic examples of collaborating with local government, the NHS or leading UK research institutions in the Future50 sample:

CMR Surgical is the industry partner in Wales' National Robotic Assisted Surgery Programme, introduced by the Welsh Government to improve outcomes for cancer patients by increasing the number of patients across Wales who have access to less-invasive, minimal access surgery (MAS). The programme was reported to be the world's first national robotic assisted surgery programme in partnership with industry[2], and in April 2023 it announced the completion of the first 100 robotic operations in Wales[3].

After Brainomix won the NHS's AI in Health and Care Award in 2020, the Oxford Academic Health Science Network supported the spread and adoption of Brainomix's e-Stroke AI-enabled imaging technology in participating Integrated Stroke Delivery Networks[4].

Ieso has been in partnership with the NHS for over a decade and reports having treated over 90,000 NHS patients with its AI-powered, therapist delivered online therapy service[5].

Microbiotica, a company spun out of the Wellcome Sanger Institute in Cambridge, collaborated with Cancer Research UK and Cambridge University Hospitals NHS Foundation Trust to identify and develop microbiome co-therapeutics and biomarkers for cancer patients receiving immune checkpoint inhibitor therapy[6].

Oxford University Hospitals NHS Foundation Trust, in partnership with Perspectum, announced the opening of one of the first community diagnostic centres in Oxford. Community diagnostic centres provide a range of non-emergency diagnostic procedures, such as scans and tests, in the community setting, providing quicker access to tests and greater convenience for patients. Opening such centres was one of the recommendations of an independently commissioned report by NHS England prepared by Professor Sir Mike Richards[7].

Alchemab announced a collaboration with Medicines Discovery Catapult in 2020 with the aim of developing a novel disease-modifying antibody therapy for Huntington's disease, leveraging Medicines Discovery Catapult's experience in the expression of induced pluripotent stem cell (iPSC) derived central nervous system cells (integral for studying brain diseases)[8]. The collaboration was expanded in 2022 to include the functional characterisation of antibodies from resilient patients with Alzheimer's disease and frontotemporal dementia, previously discovered using Alchemab's pioneering platform[9].

2 https://cmrsurgical.com/news/nhs-wales-partners-with-cmr-in-national-robotic-assisted-surgery-programme

3 https://lshubwales.com/news/milestone-100-robotic-operations-reached-wales

4 https://www.brainomix.com/news/oahsn-interim-report/

5 https://www.iesogroup.com/article/in-conversation-clare-hurley-and-rachel-websdale-on-iesos-partnership-with-the-nhs

6 https://microbiotica.com/microbiotica-cancer-research-uk-and-cambridge-university-hospitals-collaborate-in-landmark-cancer-microbiome-study/

7 https://www.perspectum.com/for-patients/research-network-articles/the-oxford-community-diagnostics-centre/

8 https://www.alchemab.com/alchemab-and-medicines-discovery-catapult-to-develop-landmark-novel-antibody-therapy-for-huntingtons-disease/

9 https://www.alchemab.com/alchemab-extends-partnership-with-medicines-discovery-catapult/

The power of UK's regional clusters

As PwC's Good Growth for Cities[10] report highlights, partnership between businesses, local and devolved governments and academia can be as critical as support from central government in helping to develop and maximise the potential of these regional clusters.

This includes investing in the housing, transport and other infrastructure needed to attract talent and support economic growth, while targeting local training initiatives at addressing specific skills gaps identified by local businesses. Examples of partnerships developing hubs, within the Golden Triangle and beyond include:

The Stevenage Bioscience Catalyst (SBC), which is a collaboration between the Department for Business, Energy and Industrial Strategy (BEIS), GSK, Wellcome Trust and Innovate UK, is a cluster for therapeutic research and development that provides support for translation and commercialisation of innovative new medicines. Building on the success of SBC, investors have received approval for a new £900m investment in a new life sciences campus in Stevenage[11], comprising R&D labs and offices, GMP manufacturing facilities and flexible lab buildings, as well as training, innovation and collaboration spaces.

A strategic alliance between Manchester University NHS Foundation Trust (MFT), The University of Manchester (UoM) and QIAGEN, whose Global Centre of Excellence for Precision Medicine is already based in CityLabs 2.0, aims to streamline and accelerate joint projects across areas of diagnostics, cancer biomarkers and infectious disease, to make a difference in the NHS and patients.

The Biosphere in Newcastle Helix, which provides purpose-built laboratory space for the city's life sciences ecosystem.

The Medicines Manufacturing Innovation Centre, in Scotland, a collaboration between the CPI, University of Strathclyde, UK Research & Innovation, Scottish Enterprise, AstraZeneca and GSK, which aims to facilitate knowledge sharing and drives a competitive advantage in advanced therapeutics manufacturing.

The Wales Life Sciences Hub, which connects businesses, research institutions, and healthcare organisations, with the aim to facilitate innovation and the development of life sciences technologies and serve as a catalyst for collaboration and growth within the life sciences sector in Wales.

10 https://www.pwc.co.uk/government-public-sector/g ood-growth/assets/pdf/good-growth-2023.pdf
11 https://www.ubs.com/global/en/assetmanagement/about/news/2023-news-articles/reef-group.html

Pushing the frontiers of innovation

At the onset of the COVID-19 pandemic, the UK life sciences sector was able to deliver for society at astonishing speed. The development, testing and approval of the world's first effective COVID-19 vaccine is a testament to what can be achieved when the immense ingenuity in the sector is met with appropriate funding, mobilisation, and NHS and government support and collaboration.

The industry has shifted from years of lower R&D productivity in the early 2000s to a new era, emboldened by innovation and advances in breakthrough science. The companies in the Future50 sample are pushing the frontiers of innovation, and pioneering breakthroughs in areas of significant unmet need across a broad spectrum of disciplines.

Unlocking intractable drug targets

There continues to be a large number of potential therapeutic targets considered 'intractable', for example membrane-bound proteins, intracellular complexes, proteins with intrinsically disordered regions and proteins in the central nervous system. Within the Future50 sample, companies including Amphista, CHARM, Dunad, Evox, Maxion, NanoSyrinx, Nodthera, NRG, OMass, Peptone and Phoremost are each tackling this problem from a different angle. One approach that has garnered a lot of interest is targeted protein degradation (TPD). Examples in the Future50 include Amphista, Dunad, Mission and Phoremost, which are all developing different strategies to broaden the application of protein degradation to a wider range of targets.

Cell and gene therapy leadership

In the field of CGT, companies in the Future50 are innovating to expand the range of diseases which can be treated by these therapies by direct delivery to the disease relevant organs. Examples include Resolution Therapeutics, which is focusing on diseases affecting the liver; Purespring, which is focusing on diseases affecting the kidneys; and AviadoBio, which is focusing on diseases affecting the brain.

Beyond novel CGT therapies, UK companies are also innovating the supply chain and manufacturing process for CGT, which is traditionally both complex and costly. For example, Touchlight and Ori Biotech, are each focused on driving efficiencies in the CGT manufacturing at scale, through novel manufacturing technologies. This illustrates the UK's leading position in pushing the boundaries of CGT research and commercialisation.

Early diagnosis and personalised medicine

As well as opening up new spheres of treatment, companies in the Future50 sample are looking at improving patient outcomes through early warning, diagnosis and patient stratification. For example, Microbiotica is using advances in the culture of gut bacteria and microbiome bioinformatics to identify how gut bacteria signatures link to patient outcomes in immuno-oncology and autoimmune diseases; Cumulus Neuroscience is using at home patient monitoring to accelerate clinical trials and stratify patients in neurodegenerative diseases; and Nucleome is partnering to use its 3D genome analysis methods to help design biomarker strategy for patient stratification, alongside its discovery platform.

Multidisciplinary collaboration

All of the Future50 companies bring together multidisciplinary teams to tackle complex problems in innovative ways. Our review highlights the increasing trend for a subset of life sciences companies to be co-led by physicists, machine learning experts and data scientists. Examples from the Future50 sample include Peptone and CHARM. While machine learning has advanced scientists' ability to predict the structures of human proteins, the accuracy of these predictions varies across different protein classes. Peptone's approach combines biophysics expertise, machine learning, and wet lab experiments to enhance structure predictions for intrinsically disordered proteins. CHARM's approach leverages expertise in protein/ligand co-folding, machine learning and wet lab experimental validation to discover novel binding sites. These approaches demand a diverse set of skills, including AI expertise, a deep understanding of both biological processes and protein biophysics, and drug discovery. By assembling multidisciplinary teams, Peptone and CHARM are illustrative of UK companies aiming to bridge the gap between theoretical protein structure predictions and practical applications in drug discovery and antibody design.

Supercharging R&D processes

Life sciences R&D is a long, costly and high-risk process. Laboratory protocols are often heavily reliant on manual processes, with experiments involving a mix of techniques, technologies and procedures. Furthermore, certain types of specialised equipment may be outside the reach of a typical small academic or biotech lab.

Many of the companies in the Future50 sample are developing technologies which have the potential to significantly accelerate the pace of research via laboratory automation solutions and collaboration tools or innovating to broaden the accessibility of certain research tools for the scientific community. Examples include:

Synthace, which has developed a cloud-based experiment platform, which allows researchers to design and simulate biological experiments, automate laboratory processes and collect and analyse experimental data all in one place.

LabGenius, which is using a combination of robotic automation, synthetic biology and machine learning to accelerate the discovery and optimisation of novel therapeutic antibodies.

Evonetix, a synthetic biology company which is applying semiconductor technology to gene synthesis, with its desktop platform developed to increase the accuracy, scale and speed of DNA synthesis, aiming to accelerate research in applications across life sciences and other industries.

Refeyn, which has developed instruments measuring the molecular mass of biomolecules using light, with its benchtop instruments designed to broaden accessibility and accelerate scientific discovery.

bit.bio, which is using its precision cell programming technology to advance reprogrammed human cells for use in research, drug discovery and as cell-based therapeutics, which has the potential to accelerate the early stages of drug development.

ONI, which designed a super-resolution microscope, the Nanoimager, which is able to resolve images at the single molecule level, and yet the machine is able to fit on a benchtop without the need for specialist infrastructure.

Revolutionising healthcare delivery

Advances in technology and the power of harnessing data and insights have the ability to transform healthcare delivery to provide meaningful benefits to both patients and healthcare systems globally. Within the Future50 sample, CMR Surgical and Proximie are seeking to improve both patient access to, and patient outcomes from, surgical procedures. CMR does this by enhancing the capabilities of surgeons with the aim of making robotic-assisted surgery more accessible and efficient, via its surgical robotics platform and digital ecosystem providing data and insights to hospitals and surgeons. Proximie focuses on enabling remote surgical collaboration and data-driven insights through its cloud-based software platform which connects multiple video feeds from the operating room and integrates data from medical devices to enhance surgical performance.

Moving up to superpower status

Any country would be proud to have this groundswell of innovation to draw on. The big question is how to make these outstanding early-stage developments go on to deliver the full medical and economic benefits through scale up and ultimate commercialisation.

The Government has set out its ambition for the UK to be a life sciences superpower[12]. While the UK is exceptionally strong in early stage funding, there remains vast untapped potential in converting more of the UK's academic excellence into products which benefit patients. The lack of scale-up capital and capital market experience in life sciences means that many companies have to turn to overseas investors (typically US-based), especially when they move beyond the proof of concept stage or are starting to generate meaningful commercial traction.

Following two record years of global equity investment in life sciences in 2020 and 2021, the global funding environment for life sciences companies has been challenging in 2022. Consistent with the global trend, equity investment in UK life sciences companies fell from £7.2 billion in 2021 to £3.3 billion in 2022 and foreign direct investment dropped from £1.9 billion in 2021 to £1.1 billion in 2022.[13] While the IPO landscape throughout 2022 has been testing for the life sciences sector both in the UK and globally, looking at longer-term historical averages, both equity investment and foreign direct investment in UK life sciences companies in 2022 were broadly in line with historical five-year averages from 2016-2020. The UK ranks consistently in the top five countries for life sciences equity investment globally. Comparing the UK to other countries along the metrics of equity investment and foreign direct investment in life sciences, it appears that the UK may be losing momentum relative to some of its global peers, which have shown higher growth along these metrics over recent years.

While it is clear the UK life sciences sector has both the ambition and potential to become a global superpower, there are hurdles to overcome before the sector can realise its full potential. The UK is exceptionally strong in discovery research and world class science. However, even when allowing for the differential in size of economy and population, comparisons with the US on investment are especially revealing. Compared to the UK, US life sciences companies were 17 times more likely to raise funding rounds of more than £30 million in 2022[14]. Meanwhile, the UK's share of inward foreign direct investment in life sciences is falling[15].

While the UK's re-entry into the European flagship research programme, Horizon, is a welcome relief to many life sciences companies and research teams, there remain underlying challenges to growth, including a lack of scale-up funding, tepid investor appetite, demand for laboratory space and manufacturing infrastructure. There is some concern that development is also being impeded by a decline in the capacity and ability to undertake clinical trials, particularly with the pressure on NHS facilities and resources.

Another challenge is the disparity that exists across the country in terms of life sciences real estate. Within the Golden Triangle it is clear that demand is outstripping supply, with companies waiting to get into their new premises. Given the concentration of lab based business in the region that may not come as a surprise. However, elsewhere around the UK, the rental cost for a high specification laboratory is potentially seen as off-market, which presents a concerning disincentive for investment. As the Future50 sample illustrates it is not just wet lab space that our life sciences companies require. With the proliferation of digital health and broader medical technology companies, the real estate needs differ, and a more flexible space may just be the tonic required.

12 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1013597/life-sciences-vision-2021.pdf

13 https://www.gov.uk/government/publications/life-sciences-sector-data-2023/life-sciences-competitiveness-indicators-2023

14 British Business Bank, Backing Innovation in Life Sciences – Factsheet, May 2023. Available at: https://www.british-business-bank.co.uk/backing-innovation-in-life-sciences-factsheet/

15 https://www.gov.uk/government/publications/life-sciences-sector-data-2023/life-sciences-competitiveness-indicators-2023

So how can UK life sciences become a genuine global superpower? How can it translate the early-stage excellence into the investment, development and commercialisation it needs to flourish? Drawing on the analysis and interviews we've carried out for this report, two priorities stand out; one financial and the other relating to infrastructure and capacity for growth.

Financial: Boosting late-stage funding

The starting point is boosting domestic investment. One important step forward is the Government's agreement with the country's largest defined contribution pension schemes to allocate at least 5% of assets in their default funds to unlisted equities by 2030 (0.5% today)[16]. The increase in allocations to unlisted equity could ultimately generate an incremental £50 billion for investment in UK growth companies, if all defined contribution schemes follow suit[16].

Solving the funding gap requires a multifaceted solution. Overcoming the hurdle to greater life sciences and wider technology capital raising in the UK will require greater risk appetite and experience among UK investors, investment banks and market-makers. Increased analyst research coverage would help to highlight the potential of UK life sciences companies. In turn, greater experience and understanding within the UK capital markets would lead to the virtuous circle of an established track record of returns, leading to more investment, greater appetite and higher valuations. Life science company owners and managers would in turn develop greater experience of running larger companies and engaging with later-stage investors.

Infrastructure: Boosting the capacity for growth

UK life sciences needs more facilities to grow. This includes working with investors and planning authorities to develop the necessary laboratory, clinical trial and manufacturing infrastructure. Again, the US shows what's possible when the right commitments, conditions and collaborations are in place. Boston had around 35 million square feet of occupied lab space in 2022[17] which is over ten times the lab stock of Cambridge, estimated at around 2.5–3.0 million square feet[18,19]. Bidwell's Summer 2023 data for Oxford and Cambridge estimated demand for lab space in Cambridge at 1.24 million square feet, with only 7,200 square feet available[20]. In Oxford, demand was estimated at 551,000 square feet with 48,300 square feet available[21]. Greater collaboration with the NHS could provide an important boost and enabler when seeking to build up capacity. Also a consideration of more flexible infrastructure, that would suit a broader range of the life sciences sub-sectors, could leverage the wider UK capability set outside of the Golden Triangle.

Size of the prize

The potential benefits from boosting late-stage investment and accelerating development and commercialisation could be immense. In a sector that already generates over £90 billion in turnover per year[22] and employs more than half a million people, PwC analysis, performed in collaboration with the ABPI, suggests that increased R&D investment could add a further £68 billion to GDP over 30 years[23]. The same analysis suggests that a step-up in pharmaceutical exports could help to create 85,000 additional jobs. Even more valuable to both people and the economy would be the 40% decrease in the disease burden across the UK from prioritising future healthcare challenges. By seizing the opportunities for increased late-stage investment, the UK not only stands to bolster its economic growth and job market, but could also play a pivotal role in the commercialisation of world-class science, to create a brighter, healthier future for people worldwide.

16 https://www.theglobalcity.uk/resources/mansion-house-compact

17 https://www.us.jll.com/content/dam/jll-com/documents/pdf/research/jll-2023-life-sciences-industry-and-real-estate-perspective.pdf

18 https://pdf.euro.savills.co.uk/uk/office-reports/cambridge-offices-and-laboratories----spotlight---march-2022.pdf

19 https://www.scambs.gov.uk/media/23640/cd833-appellant-proof-of-evidence-need.pdf

20 https://www.bidwells.co.uk/globalassets/databook/office--lab/summer-2023/bidwells-arc-market-databook-offices--labs-cambridge-summer-2023.pdf

21 https://www.bidwells.co.uk/globalassets/databook/office--lab/summer-2023/bidwells-arc-market-databook-oxford-offices--labs-summer-2023.pdf

22 https://www.gov.uk/government/statistics/bioscience-and-health-technology-sector-statistics-2021/bioscience-and-health-technology-sector-statistics-2021

23 https://www.abpi.org.uk/media/0bfpf3wb/revised-pwc-report_ls-superpower_abpi_v4.pdf

Economic contribution

Measuring the economic contribution of the UK life sciences sector

The life sciences ecosystem spans across many sectors in the UK economy, including manufacturing, scientific R&D, administrative and support services and human health services. The interconnections of the ecosystem means life sciences does not fit neatly in the list of sectors defined by the Office for National Statistics (ONS). For this reason and for the purpose of this economic analysis, three core sub-sectors are considered, *aggregated* and referred to as the life sciences sector:

- pharmaceutical development and manufacturing
- medical technology manufacturing
- life sciences research

PwC estimated the economic impact of the life sciences sector by deducing its direct, indirect and induced contribution to the UK economy as summarised below:

The direct contribution is the economic value generated by life sciences entities from their direct business activities.

The indirect contribution is the economic contribution of the life sciences supply chain, as entities purchase goods and services from UK-based suppliers.

The induced contribution is the economic contribution that arises from spending by employees of life sciences entities and employees of their suppliers on goods and services for their own consumption (for example, on groceries, eating out and entertainment).

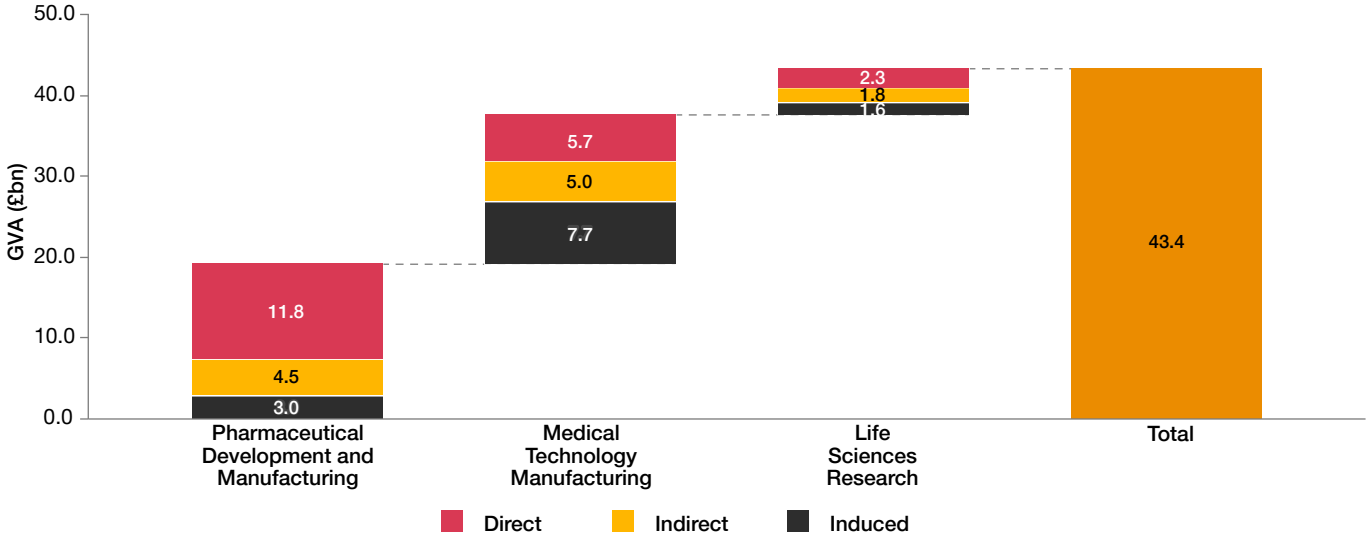
We do this both in terms of gross value added (GVA) and employment across the three sub-sectors defined above as of 2021, an update to previous analysis based on 2019 data[24]. It is noted that the analysis year of 2021 is during the COVID-19 pandemic which may influence the GVA and employment figures of the life sciences sector[25].

A £43.4 billion annual GVA contribution

Our analysis estimates that the life sciences sector contributed a total of £43.4 billion (2021 prices) in GVA to the UK in 2021, as shown in Figure 1. Of this total, £19.9 billion (46 per cent) was directly contributed by life sciences entities themselves, £11.3 billion (26 per cent) was from indirect contributions and £12.2 billion (28 per cent) was from induced contributions.

As Figure 1 shows, in 2021, pharmaceutical development and manufacturing was responsible for the majority of the sector's GVA contribution (£19.2 billion in total), followed by medical technology manufacturing (£18.4 billion). Life sciences research was responsible for £5.7 billion.

Figure 1 Contribution of UK Life Sciences to GVA (2021, £ billion)



24 PwC, ABPI, (2022). Life sciences superpower, 2022. Available at: https://www.abpi.org.uk/publications/abpi-life-sciences-superpower-report/

25 Beyond GVA and jobs, the sector contributes to the UK economy in many other ways, with annual tax revenues, clinical trial revenues, cost savings to the NHS, and increased productivity via the spill-over effects of R&D investment. These effects fall outside of the scope of this section but can be found in our 2022 Life Sciences Superpower report

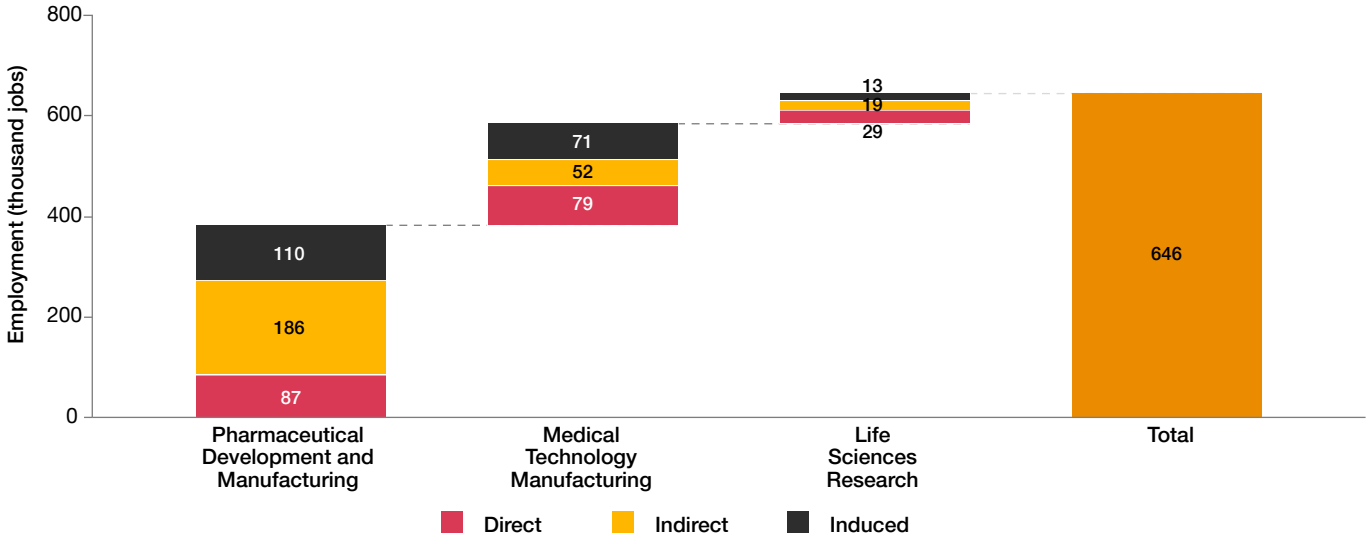
646,000 jobs supported each year

The life sciences sector also plays a significant role supporting employment. Specifically, we estimate that the life sciences sector contributed 646,000 jobs to the UK economy in 2021, as shown in Figure 2. This breaks down as follows:

- 195,000 jobs directly contributed by life sciences companies themselves (at their headquarters, manufacturing plants, research facilities, and so on)
- 257,000 jobs indirectly supported by supply chain spending
- 194,000 jobs supported through induced consumer spending by employees of life sciences companies and employees of their suppliers

As demonstrated by the substantial GVA contribution of £43.4 billion in 2021 and the support for 646,000 jobs, the UK's life sciences sector serves as a powerful engine of economic growth and innovation. It undeniably underscores its pivotal role in shaping the nation's economic landscape and driving progress in healthcare and research. As the sector continues to evolve and adapt, it remains a vital asset for the UK's future prosperity.

Figure 2 Contribution of UK Life Sciences to Employment (2021, thousand jobs)



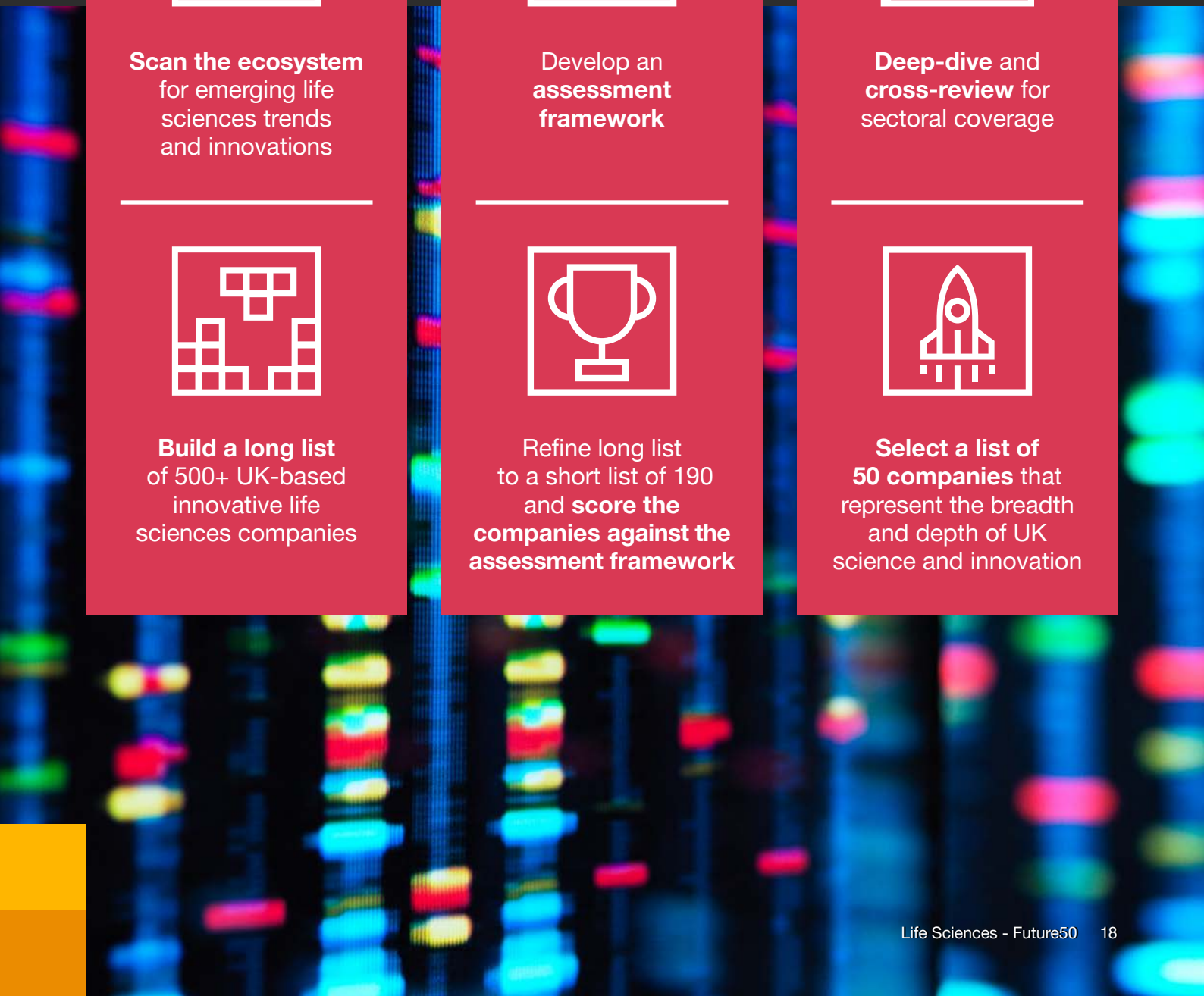
The UK pharmaceutical industry performs the most R&D of any sector – investing £5.0 billion in 2020 (the latest available data).[26]

26 https://www.gov.uk/government/publications/life-sciences-sector-data-2023/life-sciences-competitiveness-indicators-2023

Methodology

Our approach

Figure 3 Methodology



Scan

Scan the ecosystem for emerging life sciences trends and innovations

Build a long list of 500+ UK-based innovative life sciences companies

Score

Develop an **assessment framework**

Refine long list to a short list of 190 and **score the companies against the assessment framework**

Select

Deep-dive and **cross-review** for sectoral coverage

Select a list of 50 companies that represent the breadth and depth of UK science and innovation

1

Scan:

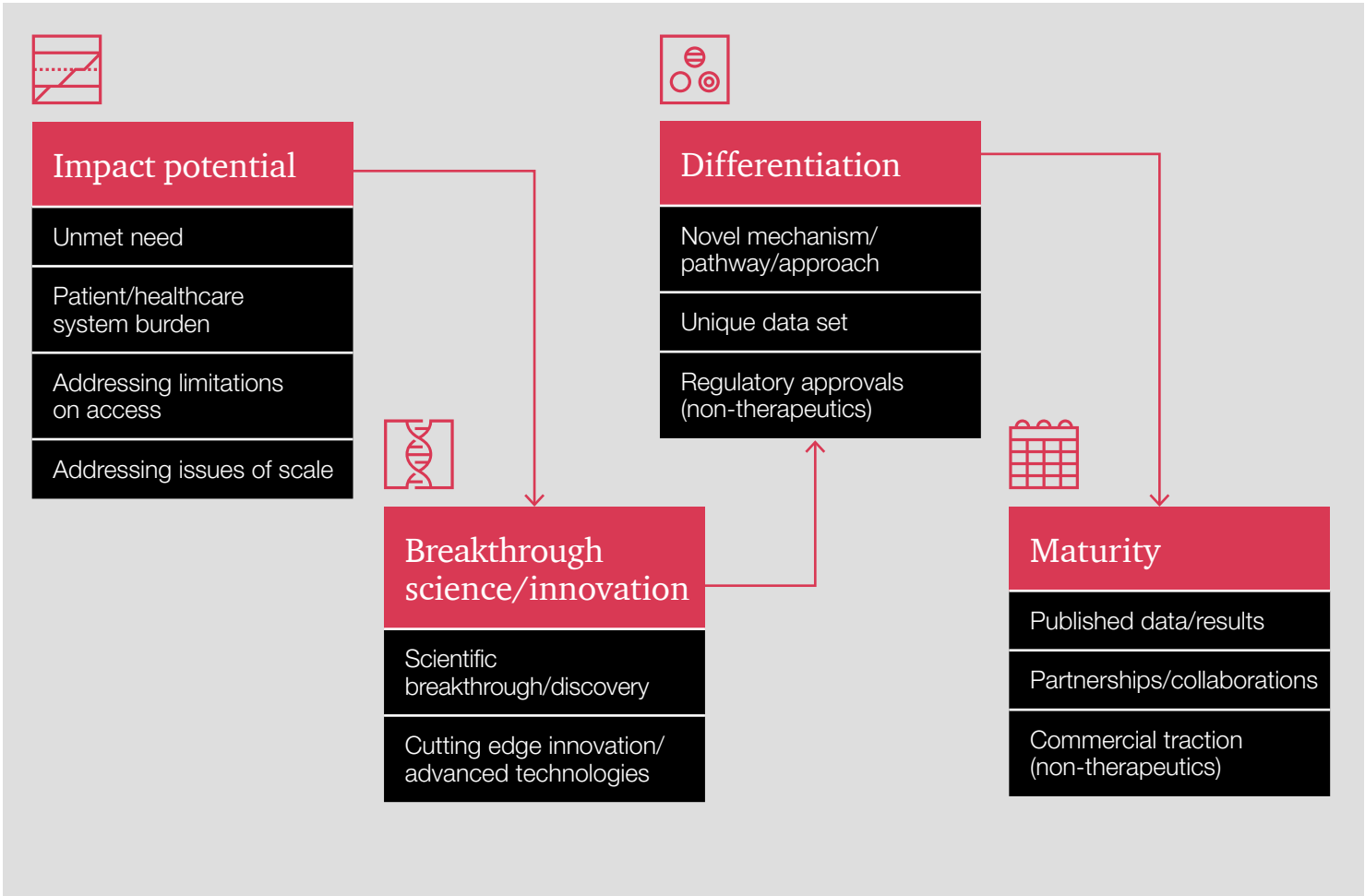
We screened data in the public domain and third-party databases for UK-based businesses across sub-sectors including therapeutics, diagnostics, medical devices, life sciences tools, healthcare technology and digital health, which raised private financing of at least $10 million in aggregate, and had a funding event since 2018. This was complemented by additional resources, including independent research and stakeholder interviews. We identified 500+ UK-based innovative life sciences companies with the potential to deliver breakthrough solutions, from addressing significant unmet needs to improving access to advanced technologies in research, clinical and healthcare settings.

2

Score:

We then built an assessment framework (Figure 4) to evaluate the companies in our sample to include within the UK Life Sciences Future50. We refined the long list of 500+, filtering out companies which had been listed or acquired, and performing an assessment of availability of information in the public domain which would allow for detailed scoring against our assessment criteria. We arrived at a short list of 190, which was scored against the assessment criteria, based on our research of information in the public domain, assessing impact potential (the problem the company is trying to solve), breakthrough science and innovation (what they are doing to solve it), differentiation (how they are doing it) and maturity (where they are on their journey).

Figure 4 Assessment framework



3

Select:

The list of 50 is neither exhaustive nor exclusive but is intended to serve as an illustration of the breadth and depth of cutting edge science and innovation developed by UK companies, with the potential to deliver significant impact to patients, researchers and healthcare systems globally. Hence we selected the final UK Life Sciences Future50 based on the composite scoring along the assessment framework and also undertook a cross-review to ensure representation from multiple sub-sectors and therapeutic areas.

UK 2023 Life Sciences Future50

UK 2023 Life Sciences Future50

Figure 5 shows the split of the Life Sciences Future50 companies across the different sub-sectors.

Figure 5 The list

Number of companies	Sector	Development stage[27]	F50 companies
10	Therapeutics	Discovery	Amphista Therapeutics, Dunad Therapeutics, maxion therapeutics, Mestag Therapeutics, NanoSyrinx, nrg Therapeutics, Nucleome Therapeutics, OMass Therapeutics, Peptone, VaxEquity
9		Pre-clinical	Alchemab Therapeutics, AVIADOBIO, evox, macomics, MyricxBio, PHOREMOST, purespring, sitryx, spybiotech
13		Clinical	artios DNA Damage Response, Crescendo biologics, Epsilogen, F2G, GreyWolf Therapeutics, Kynos Therapeutics, microbiotica, MiNA Therapeutics, mission therapeutics, nodthera, QuellTX, RTx, STORM Therapeutics
1	Medical devices	Commercial	CMR Surgical
5	Life Sciences Tools	Pilot	evonetix
		Commercial	CN-BIO, ONi, RE•FEYN, Synthace
5	TechBio	Discovery	CHARM Therapeutics
		Pilot	Oribiotech
		Commercial	bit.bio, LabGenius, TOUCHLIGHT
3	HealthTech	Commercial	HUMA, ieso, Proximie
4	Diagnostics	Commercial	BRAINOMIX, Cumulus, Perspectum, ULTROMICS

27 Development stage as at 31 July 2023. Companies may have progressed onto a subsequent development stage since this cut-off date.

Future50 snapshot: the data at a glance

Location

Leading academic and research institutions are key to the strength of the UK's life sciences ecosystem, with 31 out of the Future50 companies spun out of, or created, leveraging research from, a UK university or institution.

Figure 6 shows the location in terms of the origin of the science for the 31 companies out of the Future50 sample where links to a specific institution were identified.

In terms of primary location, the Future50 show significant concentration in the Golden Triangle, with 18 based in Cambridge, 15 in London and 11 in Oxford. A recurring theme in our stakeholder conversations was around the UK's strength in leading academic institutions in the Golden Triangle, with equal emphasis on the opportunity to unlock the potential of emerging hubs such as Bristol, Manchester or Edinburgh. Of the Future50, six companies are located outside the Golden Triangle, with three in Edinburgh and one in each of Manchester, Coventry and Belfast.

Figure 7 shows the location by current headquarters for the companies in the Future50 sample.

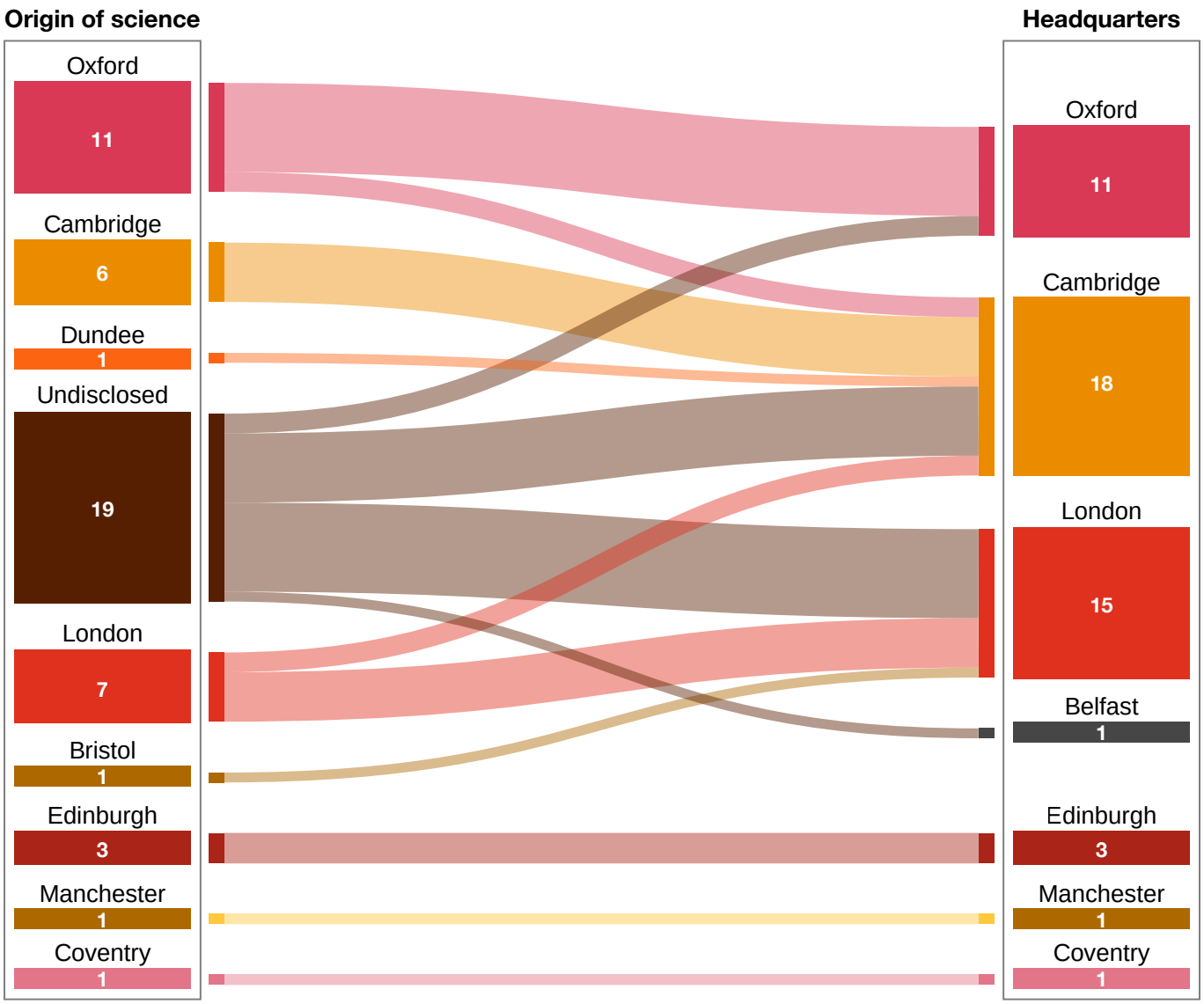
Figure 6 Origin of science

Figure 7 Company headquarters

Looking at the subset of 31 companies where we were able to identify links to a specific UK institution regarding the origin of the science, in terms of their current company headquarters, we observe observe some reshuffling within the Golden Triangle, mainly in the direction of Cambridge.

Of the remaining 19 in the sample, where no specific UK institution was identified, the majority are headquartered in Cambridge and London.

Figure 8 Origin of science and company headquarters



Sector concentration

Figure 9 shows the sector classification of the Future50 along the categories of Therapeutics, Medical Devices, Diagnostics, HealthTech (which represents software-based healthcare solutions), Life Sciences Tools (tools and technologies supporting research and development) and TechBio (companies at the intersection of tech and biotech). The TechBio sub-sector represents an emerging category, the definition for which is evolving.

We recognise that some of the companies could fall into multiple sub-sector categories, with the ultimate classification as shown in Figure 9, based on each company's own view on their positioning.

Over half of the Future50 are within the Therapeutics sub-sector. Of the total 32 drug developers in the list, five are developing cell and gene therapies, 13 are pursuing small molecules and 13 are developing biologics and for one the modality is undisclosed.

Harnessing the power of data and machine learning is a theme in the list which cuts across sub-sectors: most common among the Diagnostics, TechBio and HealthTech categories, but also leveraged by some of the Therapeutics companies in the sample.

Figure 10 shows the sector concentration split further by location in terms of current headquarters.

Figure 9 Sector concentration

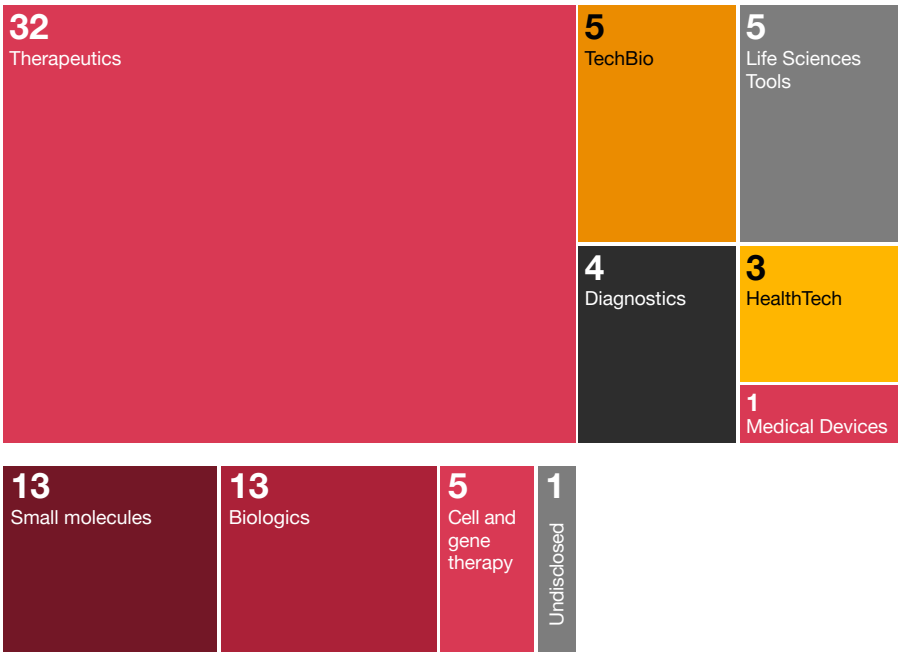
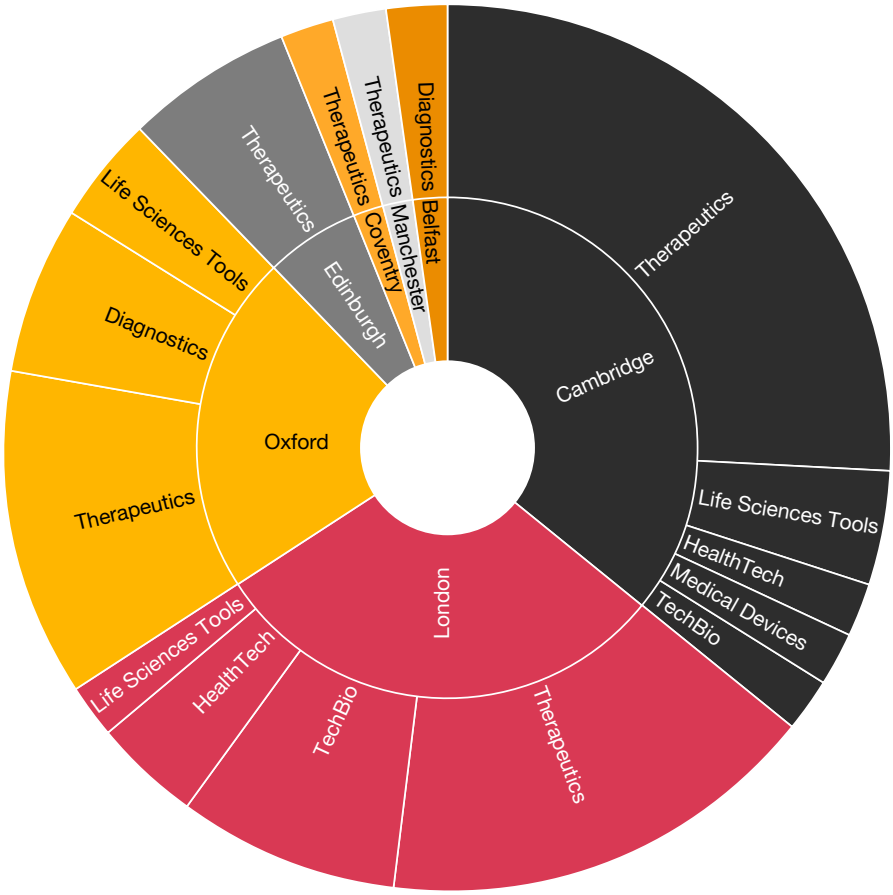


Figure 10 Sector concentration by city (headquarters)



Therapeutic area

While many companies in the list focus on multiple disease areas, the sample split by therapeutic area (illustrated in Figure 11) is broadly consistent with worldwide market forecasts from Evaluate Pharma[28], with Oncology being the largest category, followed by CNS and Inflammation & Immunology.

Development stage

Figure 12 shows the Future50 by development stage[29], split between Therapeutics and non-Therapeutics companies.

Our scoring criteria as part of the Scan, Score, Select methodology for non-Therapeutics companies included commercial traction, hence the majority of non-Therapeutics companies in the Future50 list are in commercial stage.

The Therapeutics companies are split roughly 60% discovery and pre-clinical and 40% clinical businesses, with the majority of clinical-stage companies carrying out Phase 1 trials.

Figure 11 The Future50 sample by therapeutic area

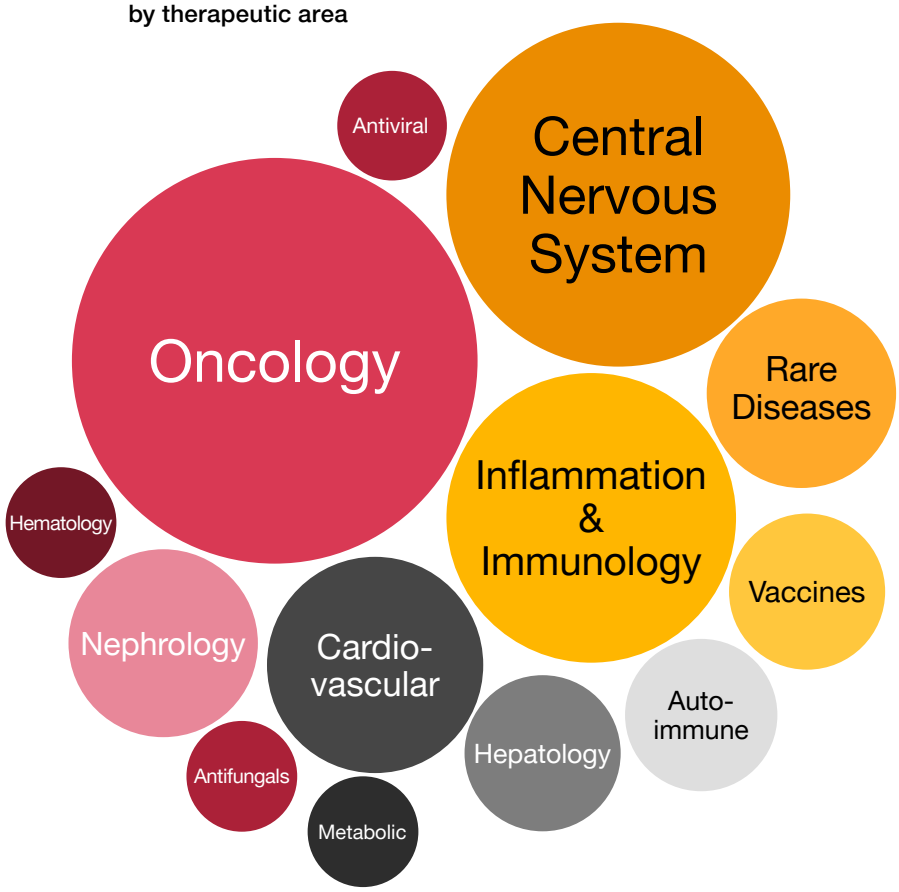
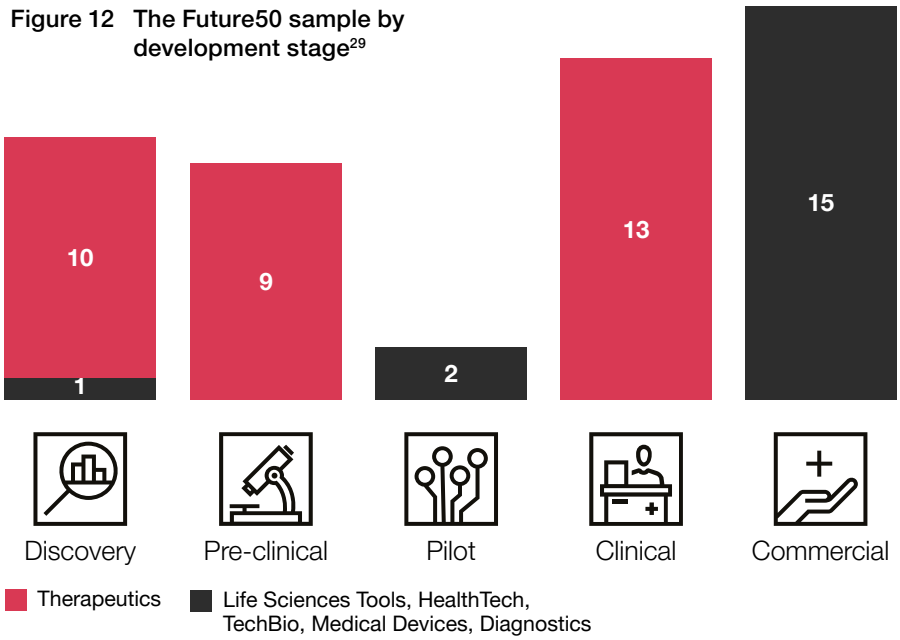


Figure 12 The Future50 sample by development stage[29]



28 https://www.evaluate.com/thought-leadership/pharma/world-preview-2023-pharmas-age-uncertainty

29 Development stage as at 31 July 2023. Companies may have progressed onto a subsequent development stage since this cut-off date.

Company profiles

ALCHEMAB THERAPEUTICS

Summary

Alchemab is pursuing a novel drug discovery approach aiming to harness the power of adaptive immunity. Alchemab's platform has the potential to identify naturally protective antibodies with therapeutic properties, which could be reproduced as treatments for various diseases. The company aims to identify novel targets and antibodies in the areas of neurodegeneration, cancer, and immune related disorders to develop potential first-in-class therapeutics.

Breakthrough science

Alchemab takes a novel approach to drug discovery by focusing on harnessing the power of naturally occurring antibodies found in individuals with exceptional resilience to disease, such as people with slowly progressing neurodegenerative disorders, or long-term survivors of cancer. These individuals, referred to as 'resilient individuals', produce unique antibodies that have potent therapeutic properties. Alchemab identifies and sequences the B cells from these individuals and feeds them into its computational drug discovery engine to develop therapeutic antibodies that replicate the identified protective effect.

Differentiation

Through exploring naturally optimised antibodies, the company's approach 'works backwards' to uncover targets and pathways involved in disease modulation. This approach is powered by the company's machine learning platform and its AntiBERTa model (Antibody-specific Bi-directional Encoder Representation and Transformers), a transformer neural network that reads the components of an antibody amino acid sequence, to form an understanding of the structure and function of antibody sequences.

⟶ Highlights

Alchemab works with academics, biobanks and charities to collaborate on curated patient cohorts and patient samples.

⟶ Partnerships/collaborations

- Illumina
- Nvidia

Stage:
Pre-clinical

#DrugDiscovery
#Antibodies
#DeepLearning

AMPHISTA THERAPEUTICS

Summary

Amphista is a next-generation targeted protein degradation (TPD) company, using its chemistry platform to develop a portfolio of molecules that target and eliminate disease-causing proteins. Amphista's TPD approach harnesses the body's own innate protein degradation mechanisms to degrade the target, removing the disease-causing protein rather than the traditional small molecule approach of inhibiting the target protein function. The company's novel approach enables it to address previously undruggable target proteins and diseases which have been difficult to treat.

Breakthrough science

First-generation TPD approaches leverage a limited range of chemical structures and degrading mechanisms to target proteins of interest. These molecules do not have ideal drug-like properties, meaning that oral bioavailability and CNS penetration can be challenging. Amphista uses a chemistry-based approach to develop bifunctional molecules that make use of different components of the innate protein degradation pathways. Amphista has a portfolio of patent protected small molecules with optimised 'drug-like' properties, that it labels 'warheads'. When combined with a second target-specific small molecule module, the warheads can trigger degradation of a broad range of targets.

Differentiation

Amphista's approach aims to overcome many of the challenges faced by first-generation TPD therapies; achieving increased tissue reach, broader disease applicability (including CNS diseases) and potentially greater clinical efficacy. Improved physicochemical properties, including routine oral bioavailability, are expected to help overcome challenges faced by other TPD approaches and allow for CNS penetration, expanding the range of potential applications for Amphista's therapeutic modality.

⟶ Highlights

The company is founded on the research of Professor Alessio Ciulli at the Dundee University's School of Life Sciences, and is based in Cambridge.

⟶ Partnerships/collaborations

- Bristol Myers Squibb
- Merck KGaA

Stage:
Discovery

#NexGenTPD

#SmallMolecules

#Platform

artios
DNA DAMAGE RESPONSE

Summary

Artios is developing small molecule therapeutics targeting DNA damage response (DDR) pathways to specifically destroy certain difficult-to-treat cancers. Artios has two clinical-stage programmes, an ATR inhibitor (ART0380) and a Polθ inhibitor (ART4215), and a drug discovery platform aiming to exploit the full range of DDR-based therapeutic opportunities.

Breakthrough science

DDR mechanisms are commonly disrupted in cancer, contributing to disease progression and severity. Artios' hypothesis is based on the discovery that certain DDR-defective cancer cells, some of which are resistant to standard of care therapies, are highly dependent on Polθ for survival. Polθ is a DNA repair enzyme that is highly expressed in cancer cells but is virtually absent in most healthy tissues. ART4215 selectively targets tumour cells, whilst sparing normal tissue from toxicity, presenting a safer alternative to radiotherapy or chemotherapy.

Differentiation

Artios believes that what differentiates it from other DDR companies is twofold: its focus on the totality of DDR which goes beyond synthetic lethality, and using its DcoDeR (DNA Damage Response Discovery) platform to explore areas including ALT (Alternative Lengthening of Telomeres) a DDR-mediated telomere maintenance mechanism, DNA damage induced immune stimulation and DNA damage induced replication stress.

⟶ Highlights

Artios was founded by CEO Niall Martin around the idea of targeting the totality of the DDR, following co-invention of blockbuster PARP inhibitor Lynparza with CSO Graeme Smith while at KuDOS.

⟶ Partnerships/collaborations

- Merck KGaA
- Novartis Pharma AG

Stage:
Clinical

#DDR
#DNArepair
#Cancer

AVIADOBIO

Summary

AviadoBio is a gene therapy company targeting neurodegenerative diseases. The company has developed a neuroanatomy-led approach to deliver therapeutics directly to the brain and spinal cord and is developing therapeutics for frontotemporal dementia (FTD) and amyotrophic lateral sclerosis (ALS).

Breakthrough science

AviadoBio is based on the research of neurologist and neuroscientist Professor Christopher E. Shaw at King's College London (KCL) and the UK Dementia Research Institute. Professor Shaw's team has discovered a number of risk genes for ALS and has participated in many clinical trials. AviadoBio's lead developmental candidate, AVB-101, is a novel, investigational, one-time gene therapy for patients with FTD with mutations in the Progranulin (GRN) gene. AVB-101 is administered directly into the brain and is designed to slow or stop disease progression by delivering a working copy of the GRN gene and restoring normal levels of progranulin.

Differentiation

Adeno-associated viral vectors (AAV) are one of the most widely used delivery methods for gene therapy but efficiently delivering them across the blood-brain barrier is a challenge in the field of neurodegeneration. AviadoBio has developed an approach which allows injecting its gene therapy products straight into the thalamus, which has extensive connections to other parts of the brain, including the frontal and temporal lobes, which are affected in FTD. This targeted delivery method aims to overcome the biodistribution and toxicity challenges associated with delivering gene therapies to the central nervous system.

⟶ Highlights

AviadoBio is co-founded by Prof Christopher E. Shaw, Dr Youn Bok Lee and Dr Do Young Lee, building on research from King's College London and the UK Dementia Research Institute.

⟶ Partnerships/collaborations

- King's College London
- Neurgain Technologies

Stage:
Pre-clinical

#GeneTherapy
#FTD
#ALS

bit.bio
THE CELL CODING COMPANY

Summary

bit.bio is developing reprogrammed human cells for use in research, drug discovery and as cell-based therapeutics, using its precision cell programming technology, opti-ox (optimised inducible overexpression), which implements genetic programmes in human induced pluripotent stem cells (iPSCs) at scale.

Breakthrough science

bit.bio specialises in precision reprogramming of human iPSCs into mature human cell types. ioCells are off-the-shelf human cells, including muscle, immune and brain cells and disease model cell types, for research and drug discovery. Traditional methods for creating different cell types from iPSCs rely on a process that mirrors the natural development of the cells, this does not yield consistent results and can take months. Instead, bit.bio reprograms cells by inserting transcription factors (TFs) specific to the desired cell type, resulting in a faster process with more consistent results. bit.bio's opti-ox technology ensures the TFs are delivered to the same genomic location in every cell to maintain cellular integrity and ensure consistent expression of TFs. In addition, bit.bio also applies data analytics and high throughput screening within its discovery platform to discover TF combinations required to expand the cell types it can create.

Differentiation

The company believes the consistency created by opti-ox has the potential to accelerate drug development by enabling research, drug discovery screens and early pre-clinical testing in human cells, which would otherwise be performed in animal derived cell lines or models. bit.bio also expects its technology to support manufacturing cell therapies at scale and at lower cost, improving access to these advanced therapies. bit.bio has cell therapy partnerships and is developing its therapeutic pipeline.

⟶ Highlights

bit.bio was co-founded by Mark Kotter, a stem cell biologist and neurosurgeon at the University of Cambridge.

⟶ Partnerships/collaborations

- BlueRock Therapeutics
- Charles River Laboratories
- Mekonos, Inc
- Automata Technologies

Stage:
Commercial

#CellManufacturing
#CellTherapies
#iPSC

BRAINOMIX™

Summary

Brainomix is developing AI-powered biomarkers to assist clinicians in their diagnosis and treatment decisions in areas of unmet need, having initially focused on stroke, with the aim of improving patient outcomes in all healthcare settings.

Breakthrough science

Stroke is a leading cause of death and disability globally, but patient outcomes can be significantly improved by timely medical intervention. Brainomix co-founder Alastair Buchan established the ASPECTS scoring method to assess the severity of stroke from non-contrast CT scans. The scoring is used to inform treatment and transfer decisions and has been shown to improve outcomes in stroke patients. However, a significant number of stroke patients are initially admitted to local hospital settings that may not have the specialist skills necessary to assess scans. Brainomix developed e-ASPECTS which uses machine learning to automate the ASPECTS scoring, and provides a overlay on the scan to visually assist clinicians to assess the output. The company's Brainomix 360 e-ASPECTS AI imaging tool for stroke received FDA clearance. Brainomix is developing AI-based digital biomarkers for lung disease and cancer.

Differentiation

Brainomix focuses on using machine learning to automate interpretation of simple imaging scans, i.e. non-contrast CT, which is available in most clinical settings, making its products widely accessible and broadening the impact on patient outcomes. The company reports that more than 1.3 million scans have been assessed by e-ASPECTS, and the data from these scans is enabling Brainomix to identify novel biomarkers such as the volume of stroke damage that would only normally be possible to assess in more advanced imaging scans.

⟶ Highlights

Brainomix was co-founded by Alastair Buchan, Professor of Stroke Medicine at the University of Oxford and Dr Michalis Papadakis, previous Scientific Director of the University of Oxford preclinical stroke lab.

⟶ Partnerships/collaborations

- Boehringer Ingelheim
- Stryker
- Blackford

Stage:
Commercial

#DigitalBiomarkers
#e-ASPECTS
#StrokeCare

CHARM THERAPEUTICS

Summary

CHARM Therapeutics is using a deep learning platform combined with laboratory experiments to develop novel medicines for previously hard to drug targets. CHARM is initially focusing on known targets where conventional therapeutics have not been successful.

Breakthrough science

In the past, protein structures were experimentally determined using time-consuming X ray crystallography. Now machine learning models can produce results faster and more efficiently. CHARM Therapeutics was co-founded by David Baker, a 2022 Wiley Prize winner for procedures that predict accurate 3D structures of protein molecules from their amino-acid sequences. CHARM Therapeutics is building on this expertise, and has developed DragonFold technology which provides an algorithm for fast and accurate protein/ligand co-folding. The algorithm uses an iterative process, which takes into account conformational changes resulting from protein/ligand interactions, including identification of cryptic pockets, to find the best fit. CHARM Therapeutics then test the output of DragonFold experimentally. CHARM is applying this approach to develop a pipeline of novel small molecule inhibitors, initially focusing on known cancers targets and other diseases with known targets and unmet medical needs.

Differentiation

CHARM Therapeutics is applying knowledge of the fundamental principles of protein folding gained through David Baker's de novo protein synthesis work to predict protein-ligand co-folding and to design drugs that bind tightly and selectively to proteins implicated in disease.

⟶ Highlights

CHARM Therapeutics was founded in 2021 by David Baker, PhD and Laksh Aithani.

⟶ Partnerships/collaborations

- Bristol Myers Squibb
- Nvidia

Stage:
Discovery

#Co-folding
#DrugDiscovery
#DeepLearning

Summary

CMR Surgical is a surgical robotics company that developed Versius, a small and modular surgical robot to bring more access to minimal access surgery.

Breakthrough science

Minimal access surgery brings many benefits to patients including reductions in complications, surgical site infections, pain and hospital time. Despite these benefits, many procedures which could be performed laparoscopically are still not, which CMR believes it can address with the architecture and functionality of the Versius system. CMR was founded by four individuals with backgrounds in medical technology and robotics together with a laparoscopic surgeon with experience in robotic surgery. CMR believes that its founders' experience led it to design a system which is adaptable to surgeons and the operating theatre environment in which these systems are used, allowing the surgeon to operate laparoscopically in a way which is familiar to them, while also gaining the benefits of robotic-assisted surgery, including reduced stress and fatigue. Versius' design was influenced by feedback from the surgical community, which contributed to features such as an open console. Versius is part of a wider digital ecosystem providing data and insights to hospitals and surgeons to improve surgical care.

Differentiation

CMR designed the surgical arm of Versius to mimic the movement of the human arm during the manual laparoscopic procedure to minimise the changes surgeons would have to make to how they are used to performing manual surgeries. CMR believes its product is also differentiated due to its small and modular design, developed to facilitate adoption. Versius' small-scale design and portability means it can fit into most operating theatres and can be moved between departments easily. The company believes that the portable design improves the cost effectiveness of the tool for hospitals and thus improves access for patients to minimal access surgical care.

→ Partnerships/collaborations

- Johnson & Johnson (Ethicon)
- Institute for Research into Cancer of the Digestive System (IRCAD)
- Teledoc
- VR Fundamental

Stage:
Commercial

#Biomimicry
#RoboticSurgery
#Robotics

CN-BIO

Summary

CN Bio is developing microphysiological 'organ-on-a-chip' systems to generate clinically translatable data in the pre-clinical lab. CN Bio's PhysioMimix solutions recapitulate the structure and function of human tissues and organs with the aim of generating human-relevant data to complement or reduce animal model use in drug discovery and development.

Breakthrough science

Animal models continue to be an integral part of drug development but are limited by a lack of physiological relevance compared to humans, high costs and ethical considerations. The recently enacted FDA Modernisation Act 2.0 removes the requirement for animal testing to form part of the approval of new drugs. CN Bio aims to address the limitations of animal models using its PhysioMimix platform comprising a suite of hardware, software, consumables and assay protocols, to culture microtissues that mimic the structure and function of human tissues and organs. The system incorporates an adjustable flow to mimic blood perfusion to provide nutrients and remove waste products, as well as enabling the addition of immune cells that can recreate important immunological factors. CN Bio has developed single-organ models for liver, gut and lung, as well as disease models, and multi-organ models which mimic the interactions between organs. Its models have applications, including disease modelling, safety toxicology and absorption, distribution, metabolism, and excretion (ADME) testing.

Differentiation

CN Bio has launched PhysioMimix Multi-organ System, plus a higher throughput version of its PhysioMimix Single-organ System, a miniaturised 48-well version of its Liver model. CN Bio anticipates that the lower cost-per-chip and higher throughput will overcome adoption barriers and enable its products to be used across more phases of the drug discovery process. Access to CN Bio's solutions is also available via their portfolio of Contract Research Services.

⟶ Partnerships/collaborations

- Professor Linda Griffiths, MIT
- FDA
- Imperial College London
- Liverpool School Tropical Medicine
- University of Cambridge

Stage:
Commercial

#DrugDiscovery
#OrganOnAChip
#Hepatotoxicity

Crescendo biologics

Summary

Crescendo Biologics is developing targeted T cell enhancing therapies which harness the body's natural immune response to treat cancer. The company expects its therapies to be safer through activation of 'tumour-specific' T cells, in a way that also drives a durable anti-cancer effect ('memory' response).

Breakthrough science

Monoclonal antibody-based therapeutics (mAbs) have transformed the treatment of many diseases. However, traditional mAbs come with certain limitations due in part to the large size of the molecules. Crescendo's Humabody platform generates therapeutic molecules made up of fully human heavy-chain only (V_H) antibody fragments (the smallest part of an antibody capable of specific antigen binding, about a tenth the size of a traditional mAb). These Humabody therapeutics combine the benefits of mAbs in terms of the specificity and strength of target binding, with the benefits of small molecules in terms of biodistribution, allowing for better tumour accumulation and penetration. Crescendo believes the smaller size of Humabody therapeutics will allow for multiple administration routes, enabling a broader range of therapeutic applications (e.g. dermatology). Additionally, Humabody therapeutics can, and are being developed as multi-specific molecules that bind multiple targets at once.

Differentiation

Crescendo believes its differentiation is grounded in the application of fully human antibody fragments in conjunction with its strategy to stimulate the immune response. Crescendo has a pipeline of products that include a CD137 co-stimulatory mechanism within the trispecific constructs. The company expects that this approach will enable tumour selective T cell activation (i.e. tumour killing) and a durable anti-cancer effect, whilst minimising systemic activation (i.e. avoiding an over-active immune response and the related toxicities), a common challenge in immuno-oncology.

⟶ Highlights

Crescendo is a spinout from the Babraham Institute in Cambridge.

⟶ Partnerships/collaborations

- BioNTech
- Takeda
- Zai Lab

Stage:
Clinical

#Immunotherapy

#Cancer

#Bispecifics

Cumulus

Summary

In collaboration with ten large pharmaceutical companies, Cumulus has developed a medical grade, brain health platform that includes 15 assessments of Cognition, Mood, Memory, Language, and Remote electroencephalogram (EEG). Initially developed to improve outcome measurement in dementia clinical trials, today the platform is being used in a range of neurodegenerative and neuropsychiatric clinical studies.

Breakthrough science

The current standard for assessing brain function in CNS clinical studies requires patients to visit a study site and undergo a technician-administered EEG and specifically in dementia studies, to complete clinician-administered paper-based assessments. In many CNS studies, these assessments and EEGs are only captured in the clinic at baseline and end of study, resulting in a lack of objective longitudinal physiological data. Cumulus has developed a platform which incorporates a self-applicable EEG headset and gamified versions of established, validated neurological assessments that patients complete on a tablet at home, which together allow for precisely synchronised brain activity measurement and longitudinal real-world data collection.

Differentiation

Cumulus' platform captures longitudinal data across a range of modalities and five domains of brain function. The data is uploaded in real-time where it is processed using machine-learning analytics that include a real-world database of annotated, longitudinal, matched data to provide new insights. Cumulus expects to evolve the platform to enable the development of digital biomarkers, or fingerprints, of CNS diseases which will enable more accurate patient stratification in clinical studies and precision medicine in the future.

⟶ Partnerships/collaborations

Select members of the Cumulus Pharma Advisory Group:

- Boehringer Ingelheim
- Bristol Myers Squibb
- Janssen
- MSD
- Roche

Stage:
Commercial

#DigitalBiomarkers
#Neurodegenerative
#ClinicalTrials

DUNAD therapeutics

Summary

Dunad Therapeutics (Dunad) is developing targeted protein degradation (TPD) therapies, focusing on targets where degradation of the protein is expected to have greater impact than inhibition.

Breakthrough science

The first generation of TPD therapies were based on a bifunctional approach which comprised two active domains connected by a link; one which binds to the target protein, and the other which binds to components of the proteasome. This approach has challenges because the molecules are large and therefore do not have ideal drug-like properties. Through research into small molecule scaffolds for the manipulation of protein-protein interactions, Dunad's co-founders claim to have developed a novel, monovalent warhead that can covalently bind to the target protein causing it to be recognised by the cellular degradation machinery. Dunad believes that its chemistry is able to target a broad range of amino acids, and is tunable to specific targets making it applicable to a wide range of targets including those previously thought to be undruggable. Despite the approval of a number of covalent inhibitors, including some blockbuster drugs, there has been a reluctance to develop new covalent drugs because of concerns around potential side-effects. Dunad expects that its platform will allow it to overcome these challenges.

Differentiation

Dunad's technology is based on monovalent small molecules, meaning its degrader molecules are designed to have the characteristics of traditional small molecule drugs, which it hopes will allow it to unlock previously inaccessible degradation targets, including the development of orally bioavailable and CNS-accessible degrader therapeutics. In addition, Dunad's mechanism of action does not rely on creating physical proximity of the target and a specific element of the proteasome, and Dunad expects its molecules to act in an E3-ligase agnostic mechanism, which would overcome challenges with first generation TPD approaches, that can be limited by the levels of the targeted proteasome components.

⟶ Partnerships/collaborations

- Novartis

Stage:
Discovery

#NextGenTPD

#CovalentTPD

#SmallMoleculePlatform

Epsilogen

Summary

Epsilogen is developing immunoglobulin (IgE) antibody based therapeutics for treatment of cancer. IgE antibodies have features including increased tumour access, potency, and a longer tissue half-life, that make them well-suited for treatment of solid tumours in particular.

Breakthrough science

The first generation of antibody-based cancer therapeutics have been almost exclusively based on IgG antibodies, however this is just one of five human antibody classes. IgE antibodies have evolved to provide immunity against tissue-dwelling parasites by stimulating the allergic immune response. Such responses are powerful and Epsilogen's strategy is to harness this potency and redirect it against tumour cells. IgE is capable of binding to immune effector cells including macrophages, monocytes, basophils and eosinophils, with high affinity, and can remain on the surface of the effector cells without the presence of an antigen. This facilitates immuno-surveillance, a process wherein immune effector cells seek and destroy cancer cells throughout the body. Epsilogen has also developed a novel class which combines features of IgE and IgG into a single antibody molecule, the IgEG. Such molecules can activate a broader range of immune effector cells including those of myeloid lineage but also Natural Killer cells.

Differentiation

Leveraging its expertise in the discovery and development of IgE antibody drugs and derivatives, Epsilogen believes it is differentiated by its in-house capabilities to discover, evaluate and develop novel IgE antibodies to a given target antigen, key aspects of which are covered by patent filings.

⟶ Highlights

Epsilogen's lead antibody drug candidate, MOv18 IgE, targets the tumour antigen folate receptor alpha. MOv18 IgE is the first therapeutic IgE antibody to enter the clinic and has successfully completed a Phase 1 trial in ovarian cancer. MOv18 IgE was found to be safe and well tolerated with early signs of clinical activity seen. Epsilogen was spun out of King's College London.

⟶ Partnerships/collaborations

- Cancer Research UK
- King's College London

Stage:
Clinical

#IgE
#Immunotherapy
#Oncology

evonetix

Summary

Evonetix is developing a platform that uses semiconductor technology to synthesise gene-length DNA sequences on a benchtop device, with the objective of accelerating research and development activities across a range of bioengineering applications.

Breakthrough science

Synthesis of gene-length DNA can be a limiting factor in scientific research. Many existing techniques are limited by the length of DNA they can synthesise, with error incorporation increasing exponentially with sequence length. Longer sequences can be obtained by assembling fragments, but this is a time-consuming process. Evonetix uses thermally controlled phosphoramidite chemistry combined with the ability to precisely control temperature on thousands of individual sites on a semiconductor chip. Controlled microfluidics move DNA fragments across the chip to enable assembly of DNA into long sequences. The precise temperature control of each site allows for in-built error checking that uses known melting points to remove mis-assembled oligonucleotides.

Differentiation

Evonetix is developing a benchtop device, with 'plug-and-play' cartridges containing the synthesis and assembly chip plus all the reagents required for a single synthesis run which is controlled by a downloaded pre-specified run file. This approach brings long DNA production into individual research facilities, instead of reliance on outsourcing to a small number of external service providers.

⟶ Highlights

Evonetix has recently delivered DNA synthesised using its technology to the Engineering Biology Interdisciplinary Research Centre at the University of Cambridge under its early-access programme.

⟶ Partnerships/collaborations

- Analog Devices
- LioniX International
- imec

Stage:
Pilot

#DNASynthesis
#SyntheticBiology
#Nanotechnology

Summary

Evox Therapeutics is building a pipeline-driven genetic medicines company using engineered exosomes as a novel modality for the treatment of serious diseases. Evox is harnessing the natural delivery mechanism of exosomes to solve the development and delivery challenges of genetic medicines.

Breakthrough science

Exosome-mediated delivery of genetic medicines has the potential to improve the transport of drugs across key cellular barriers and potentially across broader anatomical barriers, including the blood-brain barrier. In 2011, co-founder Professor Matthew Wood published research showing delivery of small interfering RNA (siRNA) to the brain by systemic injection of targeted exosomes, demonstrating the potential for exosomes to address key delivery challenges associated with genetic medicines. Evox's DeliverEX platform builds on this research and the associated intellectual property estate. Evox has developed capabilities and technologies enabling the advancement of exosome therapeutics as a novel genetic medicine modality.

Differentiation

A major challenge for many genetic medicines is the fact that viral vector delivery is needed, resulting in immune-mediated safety and tolerability concerns. Evox believes it is taking a differentiated approach to solving this challenge by advancing an internal pipeline of engineered exosomes which carry and shield gene therapy vectors or genome editors from the immune system by hiding these advanced modalities inside exosomes. Evox expects that exosome-mediated cloaking of genetic medicines will not only shield the drug payloads from the human immune system, to allow for repeat dosing in e.g. paediatric settings, but will also enhance intracellular delivery of the payloads in question, allowing for lower doses, safer and more effective medicines.

⟶ Highlights

Evox was founded by Professor Samir El Andaloussi, Dr Per Lundin, and Professor Matthew Wood and leverages foundational research and intellectual property stemming from the University of Oxford and the Karolinska Institute.

⟶ Partnerships/collaborations

- Eli Lilly

Stage:
Pre-clinical

#Exosomes
#GeneEditing
#GeneTherapies

F2G
The Rare Fungal Disease Company

Summary

F2G aims to discover and develop therapeutics to treat life-threatening invasive fungal infections in immunocompromised patients. The company is focused on developing a new class of antifungal agents called orotomides, that treat rare and resistant fungal infections.

Breakthrough science

F2G was founded to develop new treatments of systemic mould infections which have a high mortality and unmet medical need. F2G has since discovered and developed the orotomides, agents that utilise a novel mechanism of action which selectively targets fungal dihydroorotate dehydrogenase (DHODH), a key enzyme in the pyrimidine synthesis pathway. This pathway plays a critical role in the survival and proliferation of fungal pathogens and the inhibition of this pathway can be an effective strategy for developing antifungal drugs. By targeting specific enzymes involved in pyrimidine synthesis, F2G expects to ultimately impair the fungal cells' ability to replicate and survive. DHODH is a therapeutic target which was identified and developed by F2G. F2G developed Olorofim, as the first-in-class orotomide antifungal. Olorofim is in clinical development for the treatment of invasive fungal infections, including those which are resistant to other antifungals.

Differentiation

There has been no new class of agents in the past 15 years despite rising cases of antifungal resistance. Olorofim is one of the new class of antifungals that F2G has developed (orotomides). F2G believes that orotomides will be able to counter the resistance pressures which have developed for antifungal drug classes such as azoles based on their novel mechanism of action which has no cross-resistance, and the drugs' application in a rare disease setting. F2G claims that Olorofim is active against some moulds for which there are no current active treatment options.

⟶ Highlights

F2G was spun out from the University of Manchester.

⟶ Partnerships/collaborations

- Shionogi

Stage:
Clinical

#InfectiousDiseases
#Antifungal
#RareDiseases

Grey Wolf THERAPEUTICS

Summary

Grey Wolf is developing novel small molecule inhibitors for immuno-oncology. The company's lead programmes target specific enzymes, endoplasmic reticulum aminopeptidase 1 and 2 (ERAP1 and ERAP2). By inhibiting these enzymes, Grey Wolf is aiming to increase the tumour visibility to the immune system, to promote the attack and destruction of cancers (either on its own, or in combination with other therapeutics).

Breakthrough science

Recent breakthroughs in immuno-oncology checkpoint inhibitors have transformed the treatment options for certain types of cancer. Many tumours however are not recognised by the immune system and as such do not respond to this new form of treatment. This is the challenge that Grey Wolf is aiming to address with its pipeline of therapeutics. ERAP1 is an enzyme in the antigen presentation pathway that trims peptides. It plays a crucial role in shaping the repertoire of peptides presented on the cell surface. Academic research has shown that modulating ERAP1 can result in the tumour expressing an array of novel tumour-specific cell surface markers for the immune system to recognise and attack. The structure of ERAP1's active site however (i.e. the part a molecule would bind to) has made it particularly challenging to develop ERAP1 inhibitors. Grey Wolf believes it has worked around this challenge and identified a potent and selective inhibitor of ERAP1 which is currently in clinical development.

Differentiation

A key challenge in immuno-oncology is that cancers evade detection by the immune system. Much of immuno-oncology research focuses on targeting new immune checkpoints or finding new ways to activate the immune system to enhance its response to tumours. Grey Wolf's approach is differentiated by its strategy of aiming to modify the tumours themselves to make them easier to spot by the immune system, by modulating the mechanism which marks the tumour as 'non-self' for greater immune recognition and destruction.

→ Partnerships/collaborations

- University of Oxford
- University of Southampton

Stage:
Clinical

#Immunotherapy

#Neoantigens

#ERAP

HUMA

Summary

Huma takes a digital-first approach to healthcare and research, and leverages patients' mobile phones to connect and interact with centralised clinician-monitored dashboards. The company has developed digital platforms across patient communication and engagement in primary care, remote patient monitoring, companion apps to support patients through treatment, and in research for decentralised clinical trials (DCT). Using these platforms, patients are evaluated, monitored and treated in near real-time and in a real-world setting.

Breakthrough science

Huma believes that AI-supported clinical decision-making has the potential to reduce the burden on health infrastructure and staffing by ensuring that only the sickest patients go into the clinic, thus improving patient outcomes. Huma's regulated Software as a Medical Device (SaMD) holds EU MDR Class IIb, US FDA (510-k) Class II clearance and Class IIb registration with the UK MHRA. This level of regulation permits the platform to host AI algorithms that use automated data analytics to support patient screening, diagnosis, medication dosing recommendations, clinical decision-making and prognostication. Huma believes its DCT technology can improve the efficiency of clinical trials, by broadening the reach of trials (since patients can be monitored in their own home and have to make fewer site visits), increase recruitment to trials and drive patient engagement during trials. Huma says that the ability to continuously monitor patients provides more data points which allows better prediction of downturns in a patient's condition and more proactive patient care by clinicians.

Differentiation

Huma's technology platform is device agnostic and disease agnostic. Having regulatory status in the US and EU allows it to not only collect and visualise data from patients, but also drive clinical decision-making through algorithms embedded in the technology that can provide clinical advice to patients.

⟶ Partnerships/collaborations

- NHS
- Bayer
- AstraZeneca
- UCB
- Smith+Nephew

Stage:
Commercial

#AIinHealthcare
#DigitalHealth
#SaMD

ieso

Summary

ieso is a digital healthcare company aiming to develop new digital therapy products that provide clinical-grade care at scale.

Breakthrough science

Access to traditional psychotherapy is constrained by the number of trained therapists, and for those able to access care it is reported that success rates have stagnated at around 50%. As early as 2009, clinical studies showed that text-based online Cognitive Behavioural Therapy (CBT) is at least as effective as face-to-face CBT, and early intervention has also been shown to improve outcomes.

For over a decade, ieso has provided text-based therapy to treat a range of mental health conditions. The text transcript and the entire interaction between the patient and the therapist is stored (with permission) and analysed using AI-driven tools to categorise the topics discussed and identify the therapeutic techniques used in the sessions. This allows ieso therapists to closely track their patients' recovery progress against predictive models.

Differentiation

The data collected from over 600,000 hours of text-based therapy, combined with the progress measures and therapy outcomes, gives ieso a unique dataset, which allows it to tailor the treatment a patient receives. ieso is now using the real-world data it has obtained about 'what works in therapy' to create digital therapy tools, which augment the reach and impact of each therapist.

⟶ Highlights

ieso works with half of the Integrated Care Systems in England and has a national agreement with Scotland.

⟶ Partnerships/collaborations

- Roche Diabetes Care Limited
- King's College London
- University of Sheffield
- Dorset HealthCare University NHS Trust

Stage:
Commercial

#ToHelpMyAnxiety
#DigitalHealth
#MentalHealth

Kynos Therapeutics

Summary

Kynos is developing small molecule therapeutics inhibiting the kynurenine 3-monooxygenase (KMO) enzyme, which is important in inflammation, immunity and metabolism.
The company is developing first-in-class KMO inhibitors for acute and chronic inflammatory conditions, with its lead asset in Phase 1 clinical development.

Breakthrough science

Kynos was founded based on Professor Damian Mole's discovery of KMO inhibition as a new drug discovery target relevant for inflammation and his research on KMO biology. KMO inhibitors are expected to have therapeutic potential due to their ability to target 3-hydroxykynurenine (3HK) which in turn plays a role in both mediating tissue injury and suppressing T-cell function. KMO inhibition may be relevant in conditions where tissue injury plays a dominant role, such as acute pancreatitis. By blocking KMO and reducing the production of 3HK, KMO inhibitors may be able to protect pancreatic tissue from damage and mitigate the severity of acute pancreatitis. During cardiac surgeries, the kidneys can experience ischemic stress, leading to tissue injury and subsequent kidney dysfunction. KMO inhibition may be able to attenuate tissue injury in the kidneys and potentially reduce the incidence and severity of cardiac surgery-associated acute kidney injury (CSA-AKI). Kynos expects its pipeline therapeutics to also be relevant in conditions driven by inflammation (such as endometriosis) as well as in certain cancers and post-viral immune suppression.

Differentiation

Kynos is pursuing the development of a pipeline of potent and selective first-in-class KMO inhibitors. Kynos believes its lead asset, KNS366 is the first KMO inhibitor in clinical development.

⟶ Highlights

Kynos was founded by Professors Damian Mole and Scott Webster at the University of Edinburgh. Kynos' programmes are based on academic work of Professor Mole on the KMO target and build on a prior collaboration between the University and GSK, led at the University by Kynos' founders, which identified and optimised small molecule inhibitors of KMO now being developed by Kynos.

Stage:
Clinical

#Inflammation
#KMO
#Metabolism

LabGenius

Summary

LabGenius is a machine learning-driven protein engineering company focusing on antibody discovery. The company's smart robotic platform (EVA) combines robotic automation, synthetic biology, and machine learning and runs a full design-build-test-learn cycle to discover and optimise novel therapeutic antibodies.

Breakthrough science

Antibody-based therapeutics have transformed the treatment of many diseases over the last decades. Designing safe and effective multispecific antibodies is challenging however, as researchers need to simultaneously optimise for properties like efficacy, potency, selectivity and manufacturability which can sometimes be offsetting (i.e. improving on one property may inadvertently worsen another). This multiparametric optimisation problem lends itself well to machine learning-based solutions, which is what LabGenius is pursuing. The company is leveraging its machine-learning lead optimisation platform to model design-fitness relationships across multiple molecular properties and has designed an integrated Bayesian Optimisation loop combining experimental and computational steps to navigate high dimensional design spaces. Based on the EVA platform's design-build-test-learn cycle, LabGenius is aiming to increase the likelihood of discovering uniquely powerful antibodies at speed.

Differentiation

LabGenius believes its approach is differentiated by its focus on multiple disease-relevant molecular parameters (as opposed to just binding) and the data set its algorithms are trained on. The company has its own 'wet lab' in London where the team generates data in-house, using a bottom-up approach to collect the required datasets. The company uses disease-relevant cell-based assays, to help with modelling an environment similar to the human body.

⟶ Highlights

LabGenius is developing an internal pipeline of immuno-therapeutics by leveraging its immune-cell engager lead optimisation platform.

⟶ Partnerships/collaborations

- Sanofi

Stage:
Commercial

#DrugDiscovery
#MachineLearning
#Antibodies

macomics

Summary

Macomics is leveraging its understanding of macrophage biology to develop treatments for cancer based on modulation of tumour-associated macrophages (TAM).

Breakthrough science

TAM can contribute up to half of tumour mass and contribute to the suppression of the immune system in the tumour microenvironment. High numbers of TAM are associated with poor prognosis in cancer patients and reprogramming of TAM into their pro-inflammatory state may be an attractive mechanism for cancer treatment. The study of macrophages and drug discovery efforts have been limited by challenges culturing macrophages that faithfully represent human macrophages. Furthermore, manipulation of gene expression in human macrophages is challenging, due to poor transfection rates, cell viability and maintenance of gene expression changes in different cell states. Building on decades of study of macrophage biology by its founders, Macomics has developed a platform (ENIGMAC) that combines the use of human induced Pluripotent Stem Cells (iPSC) to produce large numbers of macrophages that are phenotypically and functionally similar to human monocyte-derived macrophages, gene editing methods, and clinical bioinformatics data-sets. The platform is applied to new target identification and drug discovery against targets which were previously not possible to study in vitro. Macomics has identified multiple targets that it expects will modulate TAM biology directly or the activity of the broader immune system and is developing a portfolio of antibody-based therapeutics.

Differentiation

Macomics reports that its ENIGMAC platform uses human iPSC derived macrophages to overcome drug discovery challenges specific to macrophages, allowing the company to perform gene-to-function studies by integrating cell models, genome editing and high-throughput screening, to discover novel targets and study disease specific target biology.

⟶ Highlights

Macomics was founded based on the research of Dr Luca Cassetta and the late Professor Jeffrey Pollard whilst at the University of Edinburgh.

⟶ Partnerships/collaborations

- Ono Pharmaceutical

Stage:
Pre-clinical

#Macrophages
#DrugDiscovery
#Oncology

maxion therapeutics

Summary

Maxion is developing protein therapeutics targeted to ion channels and G-coupled protein receptors (GPCRs), opening up the possibility of providing treatments to currently untreatable or poorly treated ion channel driven diseases, such as multiple sclerosis, diabetes, dementia, epilepsy and cancer.

Breakthrough science

Ion channel and GPCR dysfunction are implicated in a wide range of debilitating diseases. Current treatments based on small molecule drugs suffer from poor efficacy and side effects due to these molecules' low selectivity. Monoclonal antibodies (mAbs) offer many advantages over small molecules (including better selectivity) but developing mAbs that target ion channels is challenging and Maxion's KnotBody technology aims to help overcome this problem. KnotBodies are a novel bispecific format fusing antibodies with small naturally occurring peptides with ion channel-blocking activity ('knottins'). Knottins are not ideal therapeutic proteins on their own having short half-lives and low specificity. Fusing knottins to mAbs overcomes these limitations and combines the functional ability of knottins in targeting ion channels, leveraging the drug properties of antibodies (potency, selectivity, half-life) to hit previously intractable targets.

Differentiation

There have been numerous approaches to develop mAbs to target ion channels and GPCRs but this has come with challenges. Ion channels and GPCRs have complex structures and limited exposure on the cell surface making them inaccessible for binding by mAbs. Maxion believes that its approach is differentiated by its strategy of using knottins to target ion channels and GPCRs, circumventing such developmental challenges. In this way, Maxion aims to learn from nature and improve upon it.

⟶ Highlights

Maxion founder John McCafferty was a co-founder of Cambridge Antibody Technology (acquired by AstraZeneca). He is also the co-inventor of antibody phage display, the subject of the 2018 Nobel Prize in Chemistry awarded to his co-inventor Greg Winter. He and Maxion's co-founder Aneesh Karatt-Vellatt also co-founded IONTAS (acquired in 2020 by Fairjourney Ltd).

Stage:
Discovery

#KnotBodies
#GPCR
#IonChannels

MESTAG THERAPEUTICS

Summary

Mestag Therapeutics harnesses new insights into fibroblast-immune cell interactions to develop therapies for cancer and inflammatory diseases. Using its understanding of fibroblast biology, Mestag is developing a novel pipeline of pre-clinical antibody programmes and collaborating with partners to discover novel fibroblast targets.

Breakthrough science

Recently, increasing interest in cells known as fibroblasts has shown them to play an active role in cancer and inflammatory disease in influencing the immune system's response to diseases. Using single-cell sequencing and other high resolution technologies, the founders of Mestag identified previously unknown activated fibroblast populations in cancer and chronic inflammatory diseases. These populations share features of immune cells and actively influence immune effector cells in disease. The company is using these findings to develop antibody-based therapies which modulate fibroblast biology to reshape the tumour micro-environment and enable the body's immune system to attack and destroy tumours; or to promote and suppress immune activity in inflammatory diseases.

Differentiation

Mestag leverages an understanding of fibroblast biology and antibody engineering, combined with single cell data analytics to develop new drugs in cancer and inflammatory disease.

⟶ Highlights

Mestag builds on the work of founders including Chris Buckley and Mark Coles at the University of Oxford, as well as scientists from Brigham and Women's Hospital (Boston), Harvard Medical School (Boston) and Cold Spring Harbor Laboratory (NY).

⟶ Partnerships/collaborations

- Janssen Biotech, Inc.
- Vlaams Instituut voor Biotechnologie (VIB)

Stage:
Discovery

#Fibroblasts
#Immunotherapy
#DrugDiscovery

Summary

Microbiotica is a therapeutics and biomarkers development company, with a focus on the microbiome. It has developed a discovery platform that seeks to identify how gut bacteria links to patient diagnoses and drug response, which can be used to identify biomarkers and develop live bacterial therapeutics. These bacterial signatures can also be used to stratify patients for precision treatments. Microbiotica is currently focusing on immuno-oncology and autoimmune diseases.

Breakthrough science

A key challenge facing any microbiome program is selecting the correct bacteria. In 2016 the co-founder of Microbiotica published research on 'culturing the unculturable,' demonstrating that a substantial proportion of intestinal bacteria are culturable using a targeted phenotypic culturing approach. Using this approach, Microbiotica has developed a large clinical microbiome database that reveals full-sequence data, to overcome the limitations of lower quality reference genomes in the public domain.

Differentiation

Microbiotica developed a platform which uses genomic, machine-learning and bioinformatic technology to identify bacterial signatures linked to specific patient phenotypes. In 2021, Microbiotica presented data demonstrating that the company was able to identify a gut bacterial signature predictive with 91% accuracy of cancer immunotherapy response in melanoma.

⟶ Highlights

Microbiotica's CEO, Tim Sharpington, led the development of two early-stage assets: one was out-licensed to Novartis and one was granted accelerated approval for ovarian cancer. The company was spun out of the Sanger Institute in Cambridge and its academic founder, Dr Trevor Lawley, remains the CSO.

⟶ Partnerships/collaborations

- Genentech
- MSD
- Cancer Research UK
- Cambridge University Hospitals NHS Trust

Stage:
Clinical

#Microbiome
#PersonalisedMedicine
#Biomarkers

MiNA Therapeutics

Summary

MiNA Therapeutics is developing a clinical-stage therapeutics platform based on gene activation, using small activating RNA (RNAa) to enhance gene expression and restore normal function to cells.

Breakthrough science

Recent years have seen the approval of the first small interfering RNA-based therapeutic and the first messenger RNA-based vaccine. RNAa-based therapies have the potential to be a new class of RNA-based medicines. siRNA and RNAa are structurally and chemically indistinguishable, and both function through the Argonaut family of proteins. However, where siRNA bind to complementary RNA sequences to silence gene expression, RNAa bind to complementary DNA sequences to increase gene expression. MiNA developed a bioinformatics platform that predicted potential activation sites across the genome and has published data demonstrating the therapeutic potential of RNAa in Phase 1b clinical trials. MiNA is advancing an internal pipeline of genetic medicines, where there is evidence that restoring or increasing expression of a single gene can restore function. For example, in sickle cell disease, MiNA expects that increasing levels of foetal haemoglobin in vivo through RNAa may provide a functional cure, and an alternative to bone marrow transplantation.

MiNA is also exploring the potential of RNAa in additional disease areas with its industry collaborators.

Differentiation

MiNA believes that it has demonstrated leadership in the field of RNAa by being the first to advance into clinical development and establishing the breadth of application through peer-reviewed pre-clinical reports on multiple targets and multi-target discovery collaborations with blue chip biopharma partners.

⟶ Highlights

MiNA was co-founded by Nagy Habib, Professor of Surgery at Imperial College London, alongside co-founders from the City of Hope's Beckman Research Institute and NTNU Trondheim.

⟶ Partnerships/collaborations

- Eli Lilly
- BioMarin

Stage:
Clinical

#GeneActivation

#BioinformaticsPlatform

#RNAa

Summary

Mission Therapeutics focuses on developing first-in-class therapeutics targeting mitophagy – a ubiquitin-mediated mechanism which selectively removes dysfunctional mitochondria to preserve cellular health and function. Dysfunctional mitochondria are significant pathophysiological drivers of multiple diseases including acute kidney injury and Parkinson's Disease. Mission's lead assets inhibit USP30, a mitochondrial deubiquitylating (DUB) enzyme, and could potentially treat diseases driven by mitochondrial dysfunction.

Breakthrough science

Mission Therapeutics was founded based on the research of Professor Stephen Jackson and his team in Cambridge and their work on synthetic lethality and understanding the role of the ubiquitin proteasome system in controlling DNA damage response (DDR) processes.

DUBs are a group of ~100 human proteins that have a critical role in regulating a number of important cellular processes and have been linked to many disease pathways and pathologies in autoimmune disorders, chronic inflammation, oncology and neurodegeneration. Professor Jackson and his team's research demonstrated the role of certain DUBs in DDR processes, suggesting that DUBs can promote cell death through the inability to repair damaged DNA.

Differentiation

DUBs essentially inhibit protein degradation, hence DUB inhibitors promote protein degradation by 'inhibiting the inhibitor'. This approach differentiates Mission from other companies pursuing targeted protein degradation via E3 ligase activators and PROTACs which 'activate the activator'.

⟶ Highlights

Mission was spun out of Professor Stephen Jackson's lab at the Gurdon Institute in Cambridge and Cancer Research Technology (Cancer Research UK's commercial arm). Professor Stephen Jackson was also the founder of KuDOS, where the first-in-class PARP inhibitor olaparib (Lynparza) was discovered.

⟶ Partnerships/collaborations

- Pfizer
- AbbVie

Stage:
Clinical

#ProteinDegradation

#DUBinhibitors

#Platform

MyricxBio

Summary

Myricx Bio (Myricx) is developing an N-myristoyltransferase (NMT) inhibition based platform, which exploits the specific sensitivity of certain cancer cells to NMT inhibition. Myricx' lead candidate is an antibody-drug conjugate with a novel NMT inhibitor payload.

Breakthrough science

NMT catalyses a lipid modification (myristoylation) of proteins, which is involved in signal transduction, protein stability, and the localization of certain proteins to membranes. Myristoylation has also been shown to be essential for some viruses, fungi and parasites and had previously been explored as an anti-infective. Professor Ed Tate, in collaboration with the Sanger Institute found that a subset of cancers are sensitive to NMT inhibition. Using a novel fragment reconstruction approach, which started from high-throughput screening of small molecule inhibitors that they had previously developed against NMT enzymes from pathogenic fungi and parasites, Myricx developed a new series of human NMT inhibitors optimised to be potent human NMT inhibitors. Myricx reported initial data indicating that sensitivity to NMT inhibition is linked to the unfolded protein response stress pathway and NMT inhibition results in reprogramming tumour-associated macrophages into a pro-inflammatory, anti-cancer state.

Differentiation

Myricx reports that it has identified a molecular signature that is predictive of sensitivity to NMT inhibition, and is using this to develop ADCs for hard-to-treat solid cancers that express both the NMT sensitivity signature and ADC-compatible antigens.

⟶ Highlights

Co-founders Professor Ed Tate and Dr Roberto Solari have roles at Imperial College London and the Francis Crick Institute.

⟶ Partnerships/collaborations

- Sanger Institute
- Institute of Cancer Research, London
- Peter MacCallum Cancer Centre, Melbourne

Stage:
Pre-clinical

#NovelPayLoadMoA
#AntibodyDrugConjugates
#NMTi

NanoSyrinx

Summary

NanoSyrinx is a synthetic biology company developing a platform for the targeted intracellular delivery of protein payloads. The company's system is based on naturally occurring nanosyringes which are genetically modified to deliver therapeutic proteins or peptides directly to the cytosol of targeted cells. The company believes its approach will unlock a broad array of intracellular therapeutic targets which are currently considered 'undruggable'.

Breakthrough science

Biological therapeutics have revolutionised medicine, but delivering biological molecules to targets inside the cell remains an unsolved challenge, leaving many therapeutic targets inaccessible. NanoSyrinx' delivery platform aims to address this hurdle, and as a result, unlock an entirely new array of targets for drug development.

The company is built on Joe Healey's research at the Waterfield Lab of Warwick Medical School. The company's approach was inspired by a solution created by evolution: naturally occurring nanosyringes used by bacteria to deliver toxins into cells. The company's solution entails engineering nanosyringes to deliver a range of protein and peptide payloads to a specific target. The nanosyringes deliver the drug to the specific target by binding to the cell surface, puncturing the membrane, and injecting the payload directly into the cell cytosol. The main variation between nanosyringes is the protein responsible for binding the vehicle to the cell surface, allowing the nanosyringes to target a wide range of cells.

Differentiation

Relative to other solutions for intracellular delivery, NanoSyrinx believes its technology is differentiated due to the combination of a set of features including an inherently targeted approach, modifiable cargo, the stability of the construct, the simplicity of manufacturing process and the approach being fully genetically controllable.

⟶ Highlights

NanoSyrinx is a spin-out from the Waterfield Lab at Warwick Medical School, based on the PhD research of co-founder Dr. Joe Healey.

Stage:
Discovery

#SyntheticBiology
#Nanosyringes
#IntracellularDelivery

nodthera

Summary

NodThera focuses on chronic inflammatory and neuro-inflammatory diseases and is developing inhibitors of the NLRP3 inflammasome, a key innate immune sensor that when aberrantly activated leads to the release of pro-inflammatory cytokines, and is implicated in diseases such as Alzheimer's disease, Parkinson's disease and cardiometabolic disease. NodThera aims to provide more effective treatments than current medicines by targeting the underlying mechanism driving these chronic diseases.

Breakthrough science

Chronic diseases often involve release of certain cytokines such as IL-1ß that promote inflammation. Current therapies aimed at lowering IL-1ß are large antibody molecules that require regular injection and can be expensive. These treatments also have limitations, such as limited access to specific organs (including the brain) and pose an infection risk due to non-specific IL-1ß blockade. By targeting NLRP3, NodThera believes its therapies will have the potential to regulate the inflammation caused not only by IL-1ß but also by IL-18 and other inflammatory molecules, to provide improved anti-inflammatory benefits. NLRP3 can be inhibited using small molecules, allowing for the benefits of oral administration. By specifically targeting the inhibition of NLRP3, the reduction in IL-1ß can be enough to reduce the inflammatory processes without compromising the body's ability to fight infections.

Differentiation

NodThera has built a pipeline of small molecule therapeutics which are able to cross cell membranes, distribute to target tissues and penetrate the blood brain barrier for the treatment of chronic peripheral and CNS diseases. NodThera believes its novel brain penetrant chemistry platform sets it apart from other NLRP3-targeting approaches, with its lead clinical asset, NT-0796 being differentiated due to its design to deliver an intracellular payload directly to the specific immune cell types that drive inflammatory diseases, with potential applications in both peripheral and neuroinflammatory diseases.

⟶ Highlights

NodThera has announced results for its lead molecule NT-0796 showing reductions in inflammatory and neuroinflammatory biomarkers in humans.

Stage:
Clinical

#Inflammasome
#ImmuneModulation
#NLRP3

Summary

NRG Therapeutics is developing disease-modifying small molecule therapeutics to slow or halt the progression of neurodegenerative disorders such as Parkinson's and motor neurone disease (Amyotrophic Lateral Sclerosis or ALS) by rectifying mitochondrial dysfunction.

Breakthrough science

The mitochondrial permeability transition pore (mPTP) has been identified as central to the disease pathology of neurodegenerative disorders; in Parkinson's and in ALS. Whilst the mechanism through which mPTP is involved in cell death may differ between Parkinson's and ALS, mPTP inhibition has emerged as a promising strategy for the treatment of neurodegenerative diseases. In Parkinson's and ALS, mPTP inhibition is thought to protect neurons from the pathological effects of toxic proteins (α-synuclein and TDP-43, respectively), reducing neuroinflammation and cell death, which in turn may slow disease progression.

While there are certain known molecules which inhibit mPTP opening, these cannot cross the blood-brain-barrier which limits their potential as effective drugs for neurodegenerative diseases. NRG has identified multiple series of novel, drug-like mPTP inhibitors, which are orally available and brain penetrant.

Differentiation

NRG has reported that its drug-like, brain penetrant small molecule mPTP inhibitors act through targeting of a previously unidentified component or modulator of the mPTP. NRG believes its discovery of the function of this protein will help improve understanding of how the mPTP is formed and regulated, and its role in disease pathophysiology.

⟶ Highlights

NRG is located at the Stevenage Bioscience Campus. The company has a partnership with the Michael J Fox Foundation.

⟶ Partnerships/collaborations

- Walter and Eliza Hall Institute of Medical Research
- The Michael J Fox Foundation

Stage:
Discovery

#NeurologicalDisorders
#Mitochondria
#DrugDiscovery

Nucleome Therapeutics

Summary

Nucleome Therapeutics is developing a platform using precise 3D genetic mapping, decoding the disease-linked genetics located in the dark matter of the human genome with the aim to deliver first-in-class precision medicine.

Breakthrough science

Only 2% of the human genome encodes proteins, and only 10% of known disease associated genetic variations fall within these regions, with 90% falling in non-coding regions. This presents a significant opportunity for discovery of genetically-validated drug targets, however the functions of non-coding regions are largely unknown, and a variant may be involved in the regulation of genes far away on the genome. There is therefore a compelling need to understand the functional impact of genetic variations in non-coding regions.

Nucleome is developing a genomics platform to identify de-risked genetic targets with corresponding biomarkers for patient stratification; and believes it also has the ability to validate high value existing targets. The platform is based on decades of research from the University of Oxford and built around the founders' expertise in mapping 3D genome interactions and other genetic analysis.

Differentiation

Nucleome's founders have recently published a method that they believe reliably maps interacting DNA sequences in the 3D space of the cell, with great precision, down to the single base-pair level. Nucleome combines this with machine learning algorithms that predict causal disease-linked variants and disease relevant cell types and a method that performs large scale functional validation, to confirm causality, in cell culture and understand the variants' role in health and disease. The company's technology is disease-agnostic, and it is seeking to leverage its platform to identify genetically-validated targets and discover new drugs and associated biomarkers across therapeutic areas and cell types, with an initial focus on lymphocytes and associated autoimmune diseases.

⟶ Highlights

Nucleome is based on the research of its co-founders Dr. Danuta Jeziorska, Prof. Jim Hughes and Dr. James Davies at the University of Oxford.

Stage:
Discovery

#PrecisionMedicine
#TargetDiscovery
#Genomics

OMass THERAPEUTICS

Summary

OMass leverages novel biochemistry techniques, native mass spectrometry and custom chemistry to develop small molecule therapeutics against well-validated but intractable or inadequately drugged targets, focusing on immunological and rare diseases.

Breakthrough science

Small molecule drug discovery has traditionally focused on targeting proteins, such as enzymes, which operate in relative isolation. Many potential drug targets however operate in more complex environments such as a cell membrane or a particular node in a biological signaling pathway. These pathways are highly complex, involving multiple protein-protein interactions and changes to protein localisation and structure. Traditional drug discovery tools offer limited insight into how a hit compound interacts with the target of interest inside the cell on a molecular level and how the local cellular context may affect binding. OMass' founder, Professor Dame Carol Robinson, pioneered breakthroughs in native mass spectrometry (nMS), a technique which can be used to study the structure, dynamics, and interactions of large molecules, such as proteins and protein complexes, in their undenatured, natural state.

Differentiation

OMass combines native mass spectrometry with biochemistry techniques to extract the target ecosystem with fidelity. The company's technology isolates the protein of interest together with key interaction partners from its ecosystem which are preserved intact for compound screening. The OMass drug discovery platform incorporates nMS to interrogate and observe the relationship between compound and target proteins within the broad cellular ecosystem, allowing it to develop therapeutics against undruggable and intractable targets like membrane proteins or intracellular complexes. The company has a pipeline of pre-clinical assets discovered using its platform.

⟶ Highlights

OMass was founded based on Professor Dame Carol Robinson's research at the University of Oxford. She was the first female professor of Chemistry at both the University of Cambridge and the University of Oxford and currently the Chair of Scientific Advisory Board at OMass.

Stage:
Discovery

#ProteinBiochemistry
#StructuralBiology
#MassSpec

ONi

Summary

ONI is developing solutions for super-resolution microscopy, with the aim of unlocking a new generation of diagnostics and treatments. The company's first product, the Nanoimager, is a desktop-sized, single-molecule microscopy platform that can visualise, track and image individual molecules in cells or tissues for biomedical research and development.

Breakthrough science

Conventional light microscopes rely on light waves emitting off a surface, which means that if the studied object is smaller than the wavelength of light, the object cannot be resolved clearly. Super-resolution microscopes overcome these limitations and allow viewing biological processes at the individual molecule level. The Nanoimager combines fluorescence imaging modalities to allow single molecules in living or fixed specimens to be observed and tracked down to a 20 nm resolution. This means that important molecules and biological structures, such as extracellular vesicles, can now be studied with greater detail to understand their surface profile and internal cargo, to help unlock new opportunities for developing therapeutics and diagnostics.

Differentiation

While the idea of super-resolution has been around for years, many instruments require large-scale specialist infrastructure which meant that the technology is not widely accessible to researchers. ONI designed the Nanoimager to fit on the benchtop, without requiring any specialist infrastructure (such as an optical table or a dark room). The data generated by the Nanoimager requires a lot of computing power to analyse. ONI's solution relies on its cloud-based Collaborative Discovery (CODI) platform which allows Nanoimager users to store, share and analyze microscopy data in one place using advanced analysis tools and workflows.

⟶ Highlights

ONI spun-out from the University of Oxford in 2016. It has offices in San Diego and Oxford, with over 120 employees and is expanding its product portfolio.

⟶ Partnerships/collaborations

- University of Pennsylvania
- University of Leeds

Stage:
Commercial

#SuperResolution
#Microscopy
#Nanoimager

Oribiotech

Summary

Ori Biotech is developing a flexible manufacturing technology platform that allows for a fully automated and standardised cell and gene therapy (CGT) manufacturing to produce personalised CGT products at scale. The company expects its technology will increase throughput, improve quality and decrease costs, to enable more widespread patient access to these therapies.

Breakthrough science

Manufacturing CGT therapies typically requires modulating the individual patient's own cells, which means that currently, scaling production of CGTs is expensive and time-consuming, in turn limiting patient access to these treatments. Ori aims to address these challenges with its manufacturing technology platform which works to automate processes, increase throughput and reproducibility and reduce the costs of CGT manufacturing for both centralised and decentralised facilities.

Differentiation

Many critical processes in CGT manufacturing are performed manually, resulting in high variability and costs. By introducing automation and robotics, Ori aims to enhance throughput, improve product quality, and reduce the costs of manufacturing at scale. Ori's technology leverages its cloud-native data platform to gain insights into the internal workings of cells and the health of cell cultures, allowing teams to understand how cells grow and metabolise ex vivo. This data platform enables the capture, organisation, and analysis of data, to generate information and insights to optimise the manufacturing process and facilitate faster technology transfer, potentially shortening technology transfer timelines.

⟶ Highlights

Ori was founded by Dr. Farlan Veraitch and Professor Chris Mason of UCL and has advisors with CGT expertise including Prof. Bruce Levine of University of Pennsylvania, Bob Preti Co-founder of Minaris Regenerative Medicine, Jason Bock, CEO at CMTC, Diana Petersen, Chief Business Officer with Avrobio and Jian Irish, President/COO at Metagenomi.

⟶ Partnerships/collaborations

- CMTC (JV of National Resilience and MD Anderson)
- InceptorBio
- Achilles Therapeutics
- Cell and Gene Therapy Catapult

Stage:
Pilot

#CGT
#Manufacturing
#Automation

Peptone

Summary

Peptone has developed a platform to characterise proteins with regions that lack a rigid 3D structure, known as intrinsically disordered regions (IDRs). Peptone aims to develop therapeutics for proteins with IDRs.

Breakthrough science

Recently, machine learning has been applied to protein folding on a large scale, and predicted structures of all human proteins is now available. However, there are certain classes of proteins where the predicted structure are less reliable, including proteins containing IDRs, which play important roles in certain biological processes, rendering them interesting therapeutic targets. Experimental approaches to identifying IDR structure are also limited in isolation. Peptone is applying a translational biophysics approach, which combines experimental data on the physical properties of IDRs from nuclear magnetic resonance (NMR) spectroscopy and hydrogen-exchange mass spectrometry (HDX-MS) experiments. These experiments are performed in Peptone's wet lab facilities, with a machine learning algorithm specifically trained to predict the structure of IDR containing proteins, and identify potential binding sites. Peptone is applying this to the development of new therapeutics, using an iterative process of AI-driven candidate generation and biophysical screening.

Differentiation

Due to the lack of understanding of their structure, IDRs were previously considered 'undruggable'. By incorporating its experimental data on the target into its folding algorithm, Peptone aims to identify binding sites that would not otherwise have been known. Around 50% of all known proteins are thought to have IDRs, including proteins whose dysregulation is implicated in disease (e.g. alpha-synuclein in Parkinson's disease). Peptone is exploring a list of proteins with IDRs as identified as disease-relevant. Beyond the discovery platform, Peptone is also using its understanding of protein structures to explore biological pathways and disease pathways, to engineer protein therapeutics with IDRs to improve their properties.

⟶ Partnerships/collaborations

- Nvidia
- Verne Global

Stage:
Discovery

#ProteinModelling
#Biophysics
#IDR

Perspectum

Summary

Perspectum develops digital diagnostic solutions for patients with liver disease and has four key diagnostic products: MRCP+, LiverMultiScan, CoverScan and Hepatica. LiverMultiScan is a non-invasive alternative to liver biopsies, which can be invasive, painful, and limited by the locations which can be sampled.

Breakthrough science

Perspectum is based on research by Dr Rajarshi Banerjee, which demonstrated the potential of an MRI scanning approach for assessing patients with liver disease. This approach faced significant challenges, due to the impact of iron deposition and its interference with signals. Dr Banerjee and his team developed an algorithm that sought to correct for the variable effect of iron, which is now a crucial component of Perspectum's LiverMultiScan. Using this approach, Perspectum identified an MRI biomarker, namely cT1, that could be used to inform clinical decision making, and monitor liver health, presenting an alternative to liver biopsies, the current standard of care. More recently, Perspectum has developed CoverScan a non-invasive imaging tool that aims to assess the health of six organs using a single scan.

Differentiation

Perspectum's cloud-service model uses big data and AI-driven software to work to identify liver tissue from MRI scans, allowing quantification of liver fat, correlates of iron, fibrosis and inflammation. The company's software then produces reports and quantitative metrics, with the aim of assessing the current state of liver disease. Perspectum is now expanding its focus to other tissues and organs. The company is currently involved in clinical trials across a broad range of liver diseases, breast cancer, diabetes, endometriosis and other cancers.

⟶ Highlights

Perspectum is a spin-out from the University of Oxford, based on research by Dr Rajarshi Banerjee. Perspectum's technology was used in multiple epidemiology studies and clinical trials.

⟶ Partnerships/collaborations

- University College London (UCL)
- Nuance Healthcare
- UK Biobank
- The Dallas Hearts and Minds Study
- Datavant

Stage:
Commercial

#LiverDisease
#MedicalImaging
#AIHealthcare

PHOREMOST

Summary

PhoreMost is using functional proteomics for target and drug discovery in the 'undruggable' space. The company developed its SITESEEKER screening platform and PROTEINi technology to identify new drug targets and find new ways of drugging them. Using these tools, Phoremost is advancing a pipeline of programmes in oncology and targeted protein degradation.

Breakthrough science

Disease biology is deeply complex; understanding and identifying the right biological target to tackle is crucial to developing successful new medicines. There is need for new technologies that can discover novel targets across disease areas, and help to understand how to design therapeutics to protein targets thought to be undruggable. Phoremost has developed a high-throughput screening platform, SITESEEKER, that combines the company's human cellular assays that model disease biology and its diverse, computationally optimised library of genetically-encoded micro-proteins (PROTEINi). Using phenotypic screening Phoremost identifies interactions between the micro-protein fragments and proteins of interest, to enable the discovery of novel targets or 'cryptic' pockets on known targets. Phoremost is applying computational and deep-learning approaches, using information about the micro-protein binding site to inform the design of novel small molecule therapeutics.

Differentiation

PhoreMost believes its unbiased, systematic and physiologically-coupled technique screening platform will allow it to identify novel targets and find druggable/cryptic sites on already-known targets previously thought to be undruggable.

⟶ Highlights

PhoreMost was spun out from the University of Cambridge's MRC Cancer Unit, and was co-founded by Dr Chris Torrance, and academic co-founder Professor Ashok Venkitaraman.

⟶ Partnerships/collaborations

- Boehringer Ingelheim
- Roche
- Otsuka
- Sentinel Oncology
- Oxford Biomedica

Stage:
Pre-clinical

#DrugDiscovery
#ProteinDegradation
#DruggingtheUndruggable

Proximie

Summary

Proximie has developed a cloud-based software platform with the aim of driving efficiency and effectiveness for healthcare systems. By combining telepresence, content management and data insights, Proximie allows experts to 'scrub in' to an operating room remotely, record, share and archive procedures in a secure library, and gain insights into performance and productivity.

Breakthrough science

Global access to safe surgery remains a significant challenge which is what Proximie is aiming to address via its software solution connecting up to four video feeds from the operating room, cath lab and (robotic) surgical devices for clinicians to 'scrub in virtually' via a livestream, using a phone, tablet or computer. Users can control the cameras to zoom in or out on areas of interest and can collaborate, share expertise, provide guidance or a second opinion in real time. The platform includes an overlay to draw instructions on a shared screen. Data from the procedures can be recorded in an online library where surgeons can edit or tag the footage to use later in training or debriefing. Proximie's data insights platform can integrate video from the operating room with data from medical devices used in the procedure, together with metadata and patient health data to generate insights for trend analysis and performance measurement, to drive better patient outcomes.

Differentiation

Proximie believes its solution is differentiated by its software first approach, security standards, and by its ability to cover the entirety of the operating room, combining telepresence, content management, and data insights in one, integrated system.

⟶ Highlights

Proximie was founded by Dr. Nadine Hachach-Haram, consultant Plastic Surgeon and Director of Clinical Innovation and Strategic Partnerships at Guy's and St Thomas' NHS FT. Proximie is being taught in a course at Harvard Business School and in UCL's Global Health MBA.

⟶ Partnerships/collaborations

- Vodafone Centre for Health
- Amazon Web Services
- UN Health Innovation Exchange
- HiveMQ
- Loughborough University

Stage:
Commercial

#PatientSafety
#Collaboration
#DataInsights

purespring

Summary

Purespring develops gene therapies to treat kidney disease by specifically targeting podocytes, a cell type implicated in chronic kidney diseases. Purespring's approach utilises a platform which combines a modular kidney-specific adeno-associated viral vector (AAV) and a delivery system for local administration for all its pipeline products. Purespring has three programmes under development, for both rare monogenic forms of kidney disease and common kidney diseases with multi-gene causes.

Breakthrough science

In 2019, Professor Moin Saleem, Purespring's scientific founder, presented research showing improvement in disease markers and survival in mouse models of monogenic kidney disease by delivery of a functional copy of the disease causing gene via an AAV with a kidney specific promoter. He also showed successful transduction of an engineered AAV into a human podocyte in vitro model of monogenic kidney disease resulting in functional rescue.
The current standard of care for most kidney disease is dialysis to manage symptoms until a transplant can be found, contributing to a high disease and economic burden of chronic kidney disease. Purespring hopes that by delivering a disease modifying gene to the podocytes, which are terminally differentiated non-dividing cells, the impact on the disease will also be durable.

Differentiation

Purespring is differentiated by its approach of directly targeting the podocyte. Furthermore, Purespring expects that its local delivery approach will enable it to avoid risks associated with systemic delivery, as well as reducing vector dose requirements. This enables the company to supply the gene therapy product on a scale that would be needed to treat common forms of chronic kidney disease, and to reduce manufacturing costs. Purespring believes that its platform, which uses a common capsid and promoter across all of its programmes will create efficiencies in the manufacturing and regulatory processes, including shorter development timelines, lower risk and lower costs across development and commercialisation.

⟶ Highlights

Purespring is based on research from the scientific founder, Moin Saleem, Professor of Paediatric Renal Medicine at the University of Bristol. The company's mission is to transform the treatment of chronic kidney diseases and improve the lives of patients affected.

Stage:
Pre-clinical

#KidneyDiseases
#Genetherapy
#Podocyte

Summary

Quell Therapeutics is developing engineered T-regulatory cell (Treg) based therapeutics to prevent organ transplant rejection and treat immune-driven diseases. Tregs are typically responsible for preventing over-stimulation of the immune system. Quell aims to use engineered Tregs to selectively suppress immune response through antigen targeting.

Breakthrough science

CAR-T therapies in oncology have shown that effector T-cells can be engineered to target specific cell types or tissues to kill tumour cells in an antigen-specific manner. Quell is aiming to use the suppressive capacity of Tregs to selectively suppress the immune response in medical conditions with immune dysfunction.
The company's lead programme (QEL-001) is under development to improve outcomes following liver transplantation, and reduce the need for current medications used to prevent organ rejection that cause significant comorbidities as well as leaving transplant patients open to infections. A key challenge in the use of Treg-based therapies, is that Treg cells are plastic and can convert to other T-cell types, which could mount an immune response against the tissues they were intended to protect. To counter this, Quell developed a Phenotype Lock technology, which uses FOXP3 expression to maintain the Treg transcriptional programme and to ensure the cells maintain their suppressive state through the manufacturing process and after infusion in patients.

Differentiation

Quell has developed a multi-modular approach to Treg engineering, which includes the Phenotype Lock core module, antigen-mediated tissue-specific targeting and modules that modulate Treg behaviour. The company hopes this approach will allow it to tailor therapies to a range of immune-driven conditions like Type 1 Diabetes, Inflammatory Bowel Disease and neuroinflammatory conditions.

⟶ Highlights

Quell was founded in 2019 in partnership between King's College London and University College London with academics from King's, UCL, and Hannover Medical School.

⟶ Partnerships/collaborations

- AstraZeneca
- Cellistic

Stage:
Clinical

#Immunology
#CellTherapy
#Tregs

REFEYN

Summary

Refeyn develops, manufactures and distributes analytical instruments that measure molecular mass of biomolecules using light. Refeyn's instruments have a broad range of applications in scientific research and drug development, including sample characterisation, biomolecular interactions, protein oligomerisation, adeno-associated viruses (AAV) sample analytics and more.

Breakthrough science

Refeyn was founded on the idea that it might be possible to 'see' individual biological molecules with light. This was first demonstrated using a simple light microscope, and Refeyn developed more powerful instruments that were sensitive enough to determine the mass of molecules. This technology was named mass photometry. Mass photometry relies on measurement of light scattering of individual molecules. The interference of light scattered by molecules and light reflected by the measurement surface is proportional to the mass of the biomolecules being measured. Refeyn initially applied mass photometry to proteins but the correlation of scattering and mass also applies to glycoproteins, nucleic acids, and lipids and Refeyn continues to expand the applications. The company now has four instruments, TwoMP/TwoMP Auto that can be used for biomolecules including proteins, RNA and DNA and SamuxMP/SamuxMP Auto, which is specifically designed for characterisation of AAV samples. Refeyn designs its instruments to be bench-top for use in academic and biopharma labs, to broaden the accessibility and accelerate the R&D of new therapeutics. The company also has a line of consumables for mass photometry.

Differentiation

Unlike traditional techniques, Refeyn's technology seeks to measure mass of molecules directly in solution, without labelling, quickly and with low sample consumption, looking at the behaviour of molecules in their native state.

⟶ Highlights

Refeyn was founded in 2018, based on the research of Daniel Cole, Gavin Young, Justin Benesch and Philipp Kukura from the University of Oxford.

Since 2018, instruments developed by Refeyn have been used in over 200 publications on mass photometry.

Stage:
Commercial

#MassPhotometry
#Biomolecules
#Bioanalytics

Resolution Therapeutics

Summary

Resolution Therapeutics is developing treatments for inflammatory organ disease by harnessing the regenerative properties of macrophages, with an initial focus on chronic liver disease. Currently, patients with end-stage liver disease typically undergo a liver transplant, which can be complicated and costly. The company aims to treat these patients at risk of liver deterioration, to help patients avoid the need for a liver transplant. The treatment involves the use of macrophage cell therapy for regeneration and organ repair.

Breakthrough science

Resolution is developing a process to use the regenerative potential of macrophages to promote tissue repair for organs with prolonged damage. Macrophages form part of the immune system, and have a prominent role in organ repair. These cells have pro-restorative functions, including wound sterilisation and phagocytosis to clear necrotic tissue and excess debris. However, when it comes to diseases of long-term chronic injury like liver fibrosis, resident macrophages in the liver stop performing their wound healing role. The company is seeking to develop a cell therapy using pro-restorative macrophages to promote organ repair.

Differentiation

Targeting hepatic macrophages for liver disease is a widely pursued area of research, with many approaches focusing on modulating macrophage activity in the liver (e.g. prohibit recruitment or inhibit activation). Resolution's approach is different in that it seeks to genetically engineer patients' own macrophages to enhance their natural ability of organ repair. The company is developing a macrophage cell therapy manufacturing process, which allows monocytes to be extracted from the patient to be converted into pro-restorative macrophages. These enhanced macrophages can then be reinfused to the patient to support liver repair. Resolution is optimising its manufacturing process to make enough macrophages so that it can administer to patients without having to repeat the initial monocyte extraction.

⟶ Highlights

The company was founded based on the research of Professor Stuart Forbes and his group at the University of Edinburgh, in partnership with Professor John Campbell at the Scottish National Blood Transfusion Service.

Stage:
Clinical

#CellTherapy
#RegenerativeMedicine
#Macrophages

sitryx

Summary

Sitryx is focused on regulating cell metabolism to develop disease-modifying therapeutics in immuno-inflammation. Metabolic changes within cells of the immune system can drive the pathology of a disease. By intervening in cell metabolism, it is thought that inflammation and tissue damage can be reversed and resolved, leading to better patient outcomes.

Breakthrough science

Current biological agents for the treatment of autoimmune diseases such as rheumatoid arthritis (RA), are reported to achieve remission in 30-60% of patients, and require chronic use. It has long been known that changes to metabolic pathways are linked to inflammation and tissue damage, with pro-inflammatory and resting immune cells having distinct metabolic signatures. Like cancer cells, activated immune cells have a high metabolic requirement, and there has been increasing interest in whether this could be exploited to develop therapies selective for activated immune cells. Sitryx is building on the work of its scientific founders from the UK, Ireland and the US, who focus on immunometabolism, immunology and immunoregulation, with specialisms covering key immune cell types, B-cells, T-cells, regulatory T-cells, stromal cells and macrophages. Sitryx has identified several enzymes involved in metabolic control of different cell-fate decisions, and is developing orally-available small molecule drugs to target these enzymes. The company's goal is to develop therapeutics across a range of diseases including; atopic dermatitis, idiopathic pulmonary fibrosis, inflammatory bowel disease, RA, multiple sclerosis, asthma, systemic lupus erythematosus and psoriasis. The company hopes that shifting cells to a non-inflammatory, pro-resolution state will reverse inflammation and tissue damage and achieve disease remission in more patients than current treatments.

Differentiation

The ability to study the relevant cell types, in different cell states that recapitulate the nutrient conditions of diseased states is core to the discovery of modulators of immunometabolism. Sitryx expects that its expertise in immunometabolism will enable it to accelerate progress of its discovery engine and five current programmes towards the clinic.

→ Partnerships/collaborations

- Eli Lilly

Stage:
Pre-clinical

#DrugDevelopment
#Immunometabolism
#CellMetabolism

spybiotech

Summary

SpyBiotech is developing vaccines using its molecular superglue technology SpyTag/SpyCatcher, which enables attachment of pathogen antigens to virus-like particles (VLPs). The company's lead programme is a VLP vaccine for human cytomegalovirus (HCMV), a common virus that has severe and life-threatening complications including birth defects and organ failure in at risk populations.

Breakthrough science

There is increasing evidence that VLPs are safe and can induce a strong and durable immune response, making them suitable for protection against infectious diseases, as well as treatment of chronic diseases and cancer. However, there are challenges with current methods of attaching the antigen of interest to the VLP. Direct attachment can result in changes to antigen and/or VLP conformation. Chemical attachment can be complex and does not allow for control of the number or distribution of antigens on the VLP. SpyBiotech's SpyTag/SpyCatcher protein superglue circumvents these issues by creating a modular system where the antigen is attached to the SpyTag and the SpyCatcher is attached to the VLP. The SpyTag/SpyCatcher modules are a protein from the common bacterium, Streptococcus pyogenes, split into two parts. The two pieces of the SpyTag/SpyCatcher protein then bind back together, forming a stable covalent bond. This allows for control of the number of antigens attached to the VLP to optimise the immune response. The company is also focusing on applying its approach to a recombinant adenovirus platform, SpyVector, which it hopes will allow for treatment where a stronger T-cell mediated immune response is required.

Differentiation

SpyBiotech hopes that the ability to load high number of antigens and organise these optimally on the VLP surface, will produce a strong and durable immune response. The company expects that its modular approach will allow for more rapid development of vaccines against novel pathogens.

⟶ Highlights

SpyBiotech was spun-out of the University of Oxford in 2017 by Prof. Sumi Biswas (currently the President and CSO of the company) along with Professors Mark Howarth, Simon Draper and others.

Stage:
Pre-clinical

#VaccineDevelopment

#Vaccines

#Adenovirus

Summary

Storm Therapeutics aims to harness the potential of RNA modifying enzymes (RME) as therapeutic targets. By developing small molecule drugs that can modulate the activity of these enzymes, the company aims to develop new therapies with an initial focus on oncology and antivirals.

Breakthrough science

RNA epigenetics is an emerging area of research that explores the chemical modifications of RNA molecules and their impact on RNA function and protein expression. RNA modifying enzymes are involved in adding, removing, or modifying various chemical groups on RNA molecules, thereby influencing their stability, structure, and interactions with other molecules. The dysregulation of specific RNA modifications has been linked to various diseases, including cancer, neurological disorders, metabolic disorders, and cardiovascular diseases. There are more than 170 RNA modifications that regulate many types of RNA offering a wide range of potential therapeutic opportunities. In cancer for example, inhibiting an RNA modifying enzyme may increase the levels of beneficial RNAs that help fight cancer or decrease the levels of harmful RNAs that promote tumor growth, potentially slowing down or even killing cancer cells.

Differentiation

Storm's drug discovery and RNA analytics platform led to the development of a pipeline of novel projects including what Storm believes is the first RME inhibitor to enter human clinical trials. The company's lead programme is targeting the enzyme METTL3 to reduce the m6A RNA modification and potentially influencing protein expression and activation of immune responses in a way that can be therapeutically beneficial for cancer treatment.

⟶ Highlights

Storm is a spin out of the University of Cambridge, based on the research of Professor Tony Kouzarides, Professor in Cancer Biology, and Professor Eric Miska, Professor in Molecular Genetics. The company believes it has the first METTL3 inhibitor in the clinic which could become a novel first-in-class cancer therapy.

⟶ Partnerships/collaborations

- Exelixis Inc.

Stage:
Clinical

#RNA
#RNAModifyingEnzymes
#SmallMolecules

Synthace

Summary

Synthace has developed a cloud-based no code digital experiment platform which allows researchers to design and simulate biological experiments, automate laboratory processes, and collect and analyse experimental data in one place.

Breakthrough science

Synthace developed its experiment platform to address common challenges faced by scientists when running experiments. These include time-consuming manual processes, difficulties ensuring consistent understanding of the intent and context behind protocols across wider teams, getting lost in the relationship between different steps and protocols, and aligning data from various assays related to the same samples. Synthace's platform aims to address these challenges by allowing for easier automated pipetting, simulating the outcome of protocol changes before entering the lab, improved capture of experimental context and rationale and the visualisation of workflows, simulations, executions, and associated data outputs.

Differentiation

Synthace believes its digital experiment platform is differentiated by combining elements related to designing, running and analysing experiments all in one place. The company's platform is device agnostic: it can run the same experiment on different makes and models of equipment.

⟶ Highlights

Synthace integrated OpenAI's ChatGPT with its platform, enabling scientists to use a natural language interface to describe their intent then work with the AI to define the details and specifications of their experiment.

⟶ Partnerships/collaborations

- AstraZeneca
- UCL
- Syngenta
- Oxford Biomedica
- Wheeler Bio
- uncommon
- Virica
- Ipsen

Stage:
Commercial

#DigitalExperiments
#ExperimentDesign
#LabAutomation

TOUCHLIGHT

Summary

Touchlight is a contract development and manufacturing organisation producing synthetic DNA as a critical starting material and active pharmaceutical ingredient for use in advanced therapies, such as DNA and mRNA vaccines and cell and gene therapies.

Breakthrough science

The manufacturing of advanced therapies, such as mRNA, cell and gene therapies all rely on DNA in some way in their production process, making it increasingly important to find ways to manufacture DNA affordably and at scale. Touchlight's technology was developed to address this challenge based on its novel, synthetic DNA vector, known as doggybone DNA (dbDNA) and its enzymatic manufacturing process. dbDNA is a linear, double-stranded, covalently closed DNA vector. Traditionally, DNA is manufactured using E.coli fermentation, a process which can be limited in terms of speed, scalability and cost. Touchlight is using an enzymatic and cell-free approach, which allows it to manufacture DNA rapidly, at scale and with existing equipment.

Differentiation

Touchlight believes dbDNA is different because it is a 'clean', small piece of DNA containing only the gene of interest (without containing other pieces of DNA such as antibiotic resistance genes). Touchlight's technology doesn't rely on a complex biological system but uses a simpler enzymatic approach, which allows for faster and scalable DNA production.

⟶ Highlights

The company's manufacturing facility is located in a restored and repurposed Victorian waterworks in Hampton and has 15 GMP production suites with up to 1kg/month capacity.

⟶ Partnerships/collaborations

- Pfizer
- Lonza
- Bill and Melinda Gates Foundation
- Defense Advanced Research Projects Agency
- Cancer Research Malaysia
- Janssen
- Multiple academic institutions

Stage:
Commercial

#DNAManufacturing
#CGT
#GeneticMedicine

ULTROMICS™

Summary

Ultromics is developing an AI-based platform for echocardiography for the prediction and detection of heart failure and its phenotypes, with a focus on heart failure with preserved ejection fraction (HFpEF).

Breakthrough science

Diagnostic imaging and ultrasound play a crucial part in the detection and management of heart disease. Traditional forms of diagnosis rely on clinicians assessing echocardiogram images along multiple parameters, a process which is manual, time-consuming and prone to human error and operator variability. Ultromics is seeking to address these limitations with its products. Ultrasound images of the heart contain huge amounts of information which can be explored via machine learning to improve diagnostic accuracy. Ultromics has worked with the heart imaging database of the University of Oxford to identify patterns unique to different heart diseases. The company is developing its products to automate the interpretation of echocardiograms to detect disease and re-stratify patients.

Differentiation

Ultromics built its AI stack with the aim of being predictive and correlative with patient outcomes, with its algorithms developed on over 10 years of patient outcome data. The company has published results demonstrating that based on a single apical four-chamber ultrasound view, its AI-enabled platform could identify HFpEF and produce fewer indeterminate classifications of HFpEF relative to conventional scoring methods.

⟶ Highlights

Ultromics is a spin-out from the University of Oxford, built in partnership with the NHS. The company's co-founders, Prof. Paul Leeson and Dr. Ross Upton are both NHS clinicians.

⟶ Partnerships/collaborations

- NHS
- Janssen (J&J)
- Mayo Clinic
- Microsoft
- Northwestern University

Stage:
Commercial

#Echocardiography
#DigitalHealth
#EchoGo

VaxEquity

Summary

VaxEquity is developing self-amplifying RNA (saRNA) vaccines and therapeutics based on a modified form of saRNA which it expects will be able to regulate the natural immune response of the body in order to prevent the breakdown of RNA therapeutics to enhance their effectiveness.

Breakthrough science

During the COVID-19 pandemic, Professor Robin Shattock and his team at Imperial College London developed a COVID-19 vaccine candidate based on saRNA technology which demonstrated encouraging data in healthy volunteers. This led to the founding of VaxEquity, to pursue the development of saRNA technology. SaRNA is a type of synthetic RNA molecule that is designed to generate large amounts of a specific protein within a cell. It is called 'self-amplifying' because once it enters a cell, it can replicate itself, leading to the production of multiple copies of the desired protein. This amplification process can result in a higher yield of the desired protein compared to traditional RNA-based approaches, which the company expects may bring benefits in terms of manufacturing time, cost, dosing and side-effect profile.

Differentiation

saRNA-based vaccines or therapeutics have the potential to induce a stronger innate immune response, which presents certain challenges. VaxEquity's technology applies specific modifications to saRNA, by including elements called Innate Inhibitory Proteins (IIPs) to fine-tune the innate immune response, aiming to prevent the innate immune response from suppressing RNA replication. By fine-tuning the innate immune response through the inclusion of IIPs, VaxEquity aims to improve the tolerability and optimise the effectiveness of the saRNA-based products by promoting robust protein expression, to potentially improve seroconversion rates and overall efficacy.

⟶ Highlights

Vaxequity was founded based on the research of Professor Robin Shattock at Imperial College London.

⟶ Partnerships/collaborations

- AstraZeneca

Stage:
Discovery

#RNA
#Vaccines
#Platform

Appendices

Appendix 1 – Methology (economic contribution)

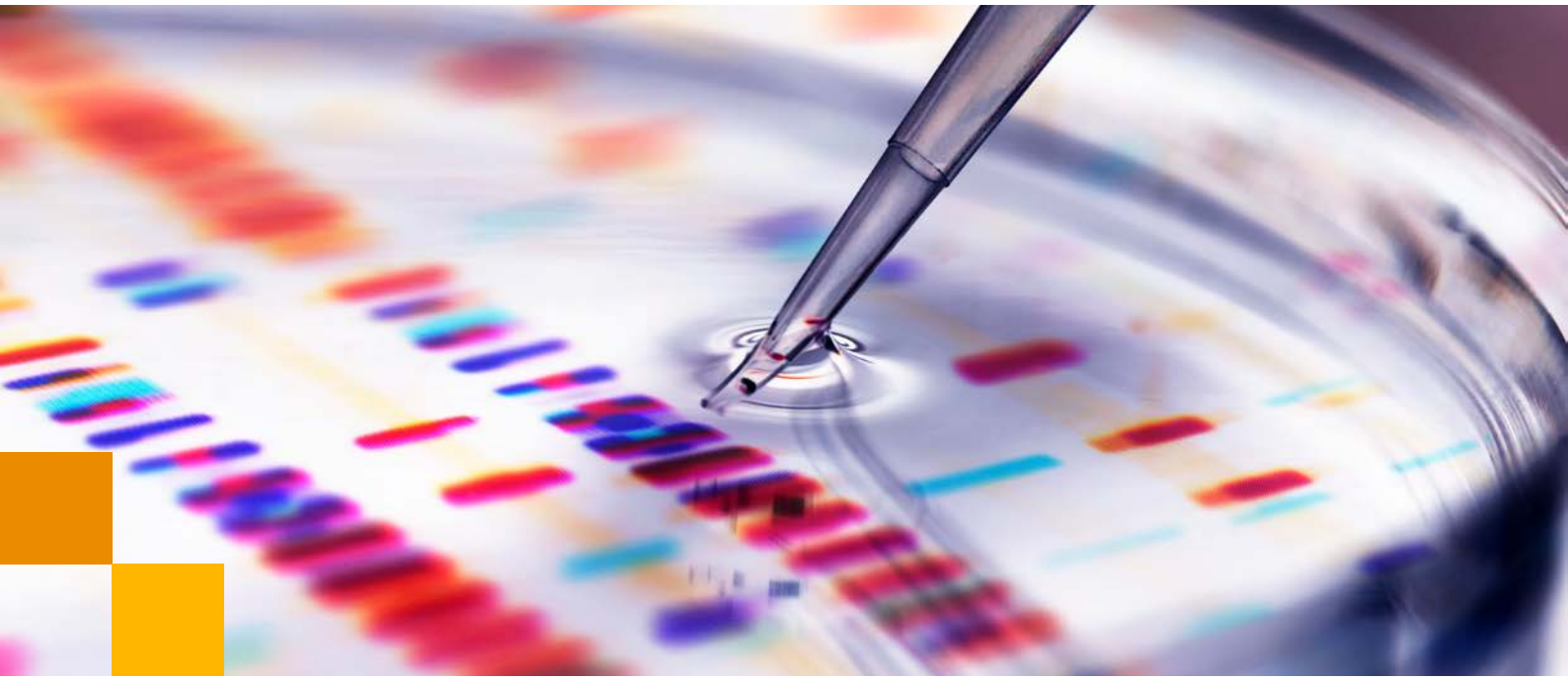
The results of this analysis are based on data inputs from 2021. This is an update to previous analysis conducted by PwC using 2019 data.

To estimate the direct GVA of the sector, we consider the increase in the overall turnover of the Life Sciences sector in the UK between 2019 and 2021 and applied its growth rate to the direct GVA of the sector in 2019. Similarly, we calculated the direct employment figures for 2021 by applying the growth rate of the total employment in the Life Sciences sector between 2019 and 2021 to the 2019 direct employment results. The turnover and employment data of the total Life Sciences sector is from the Office of Life Sciences in their Bioscience and Health Technology Sector Statistics Reports.[30,31]

To calculate the indirect and induced contributions, we multiply the direct impacts by the economic multipliers set out in Figure 13. These multipliers are derived from a bespoke input-output modelling exercise of the UK life sciences sector conducted by PwC (2017)[32]. We take confidence in using these multipliers for this analysis as sector multipliers are unlikely to change significantly from year to year.

Figure 13 PwC multipliers for the UK life sciences sector

Industrial classification group	Type I GVA (supply chain effect)	Type II GVA (employee spending effect)	Type I Employment (supply chain effect)	Type II Employment (employee spending effect)
Pharmaceutical development and manufacturing	1.38	1.63	3.14	4.40
Medical technology manufacturing	1.88	3.22	1.65	2.55
Life Sciences research	1.77	2.44	1.68	2.12



30 Office of Life Sciences (2019). 'Bioscience and Health Technology Sector Statistics', August 2020.
31 Office of Life Sciences (2021). 'Bioscience and Health Technology Sector Statistics', June 2023.
32 PwC (2017). 'The economic contribution of the UK life sciences industry', March 2017.

Appendix 2 – 2019, 2021 comparison

The two figures below compare the GVA and employment contributions of the UK Life Sciences sector to the UK economy in 2019 and 2021. The figures reported in 2019 are based on the analysis conducted in the Life Sciences Superpower report (published June 2022).

Figure 14 Contribution of UK Life Sciences to GVA (2019, 2021 comparison)

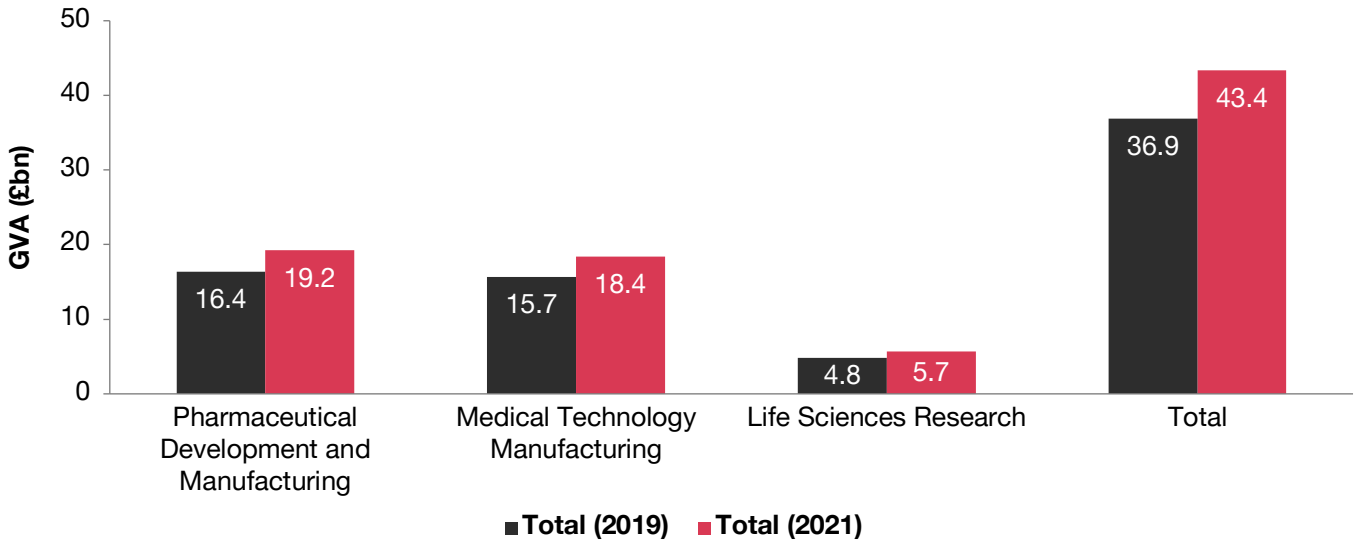
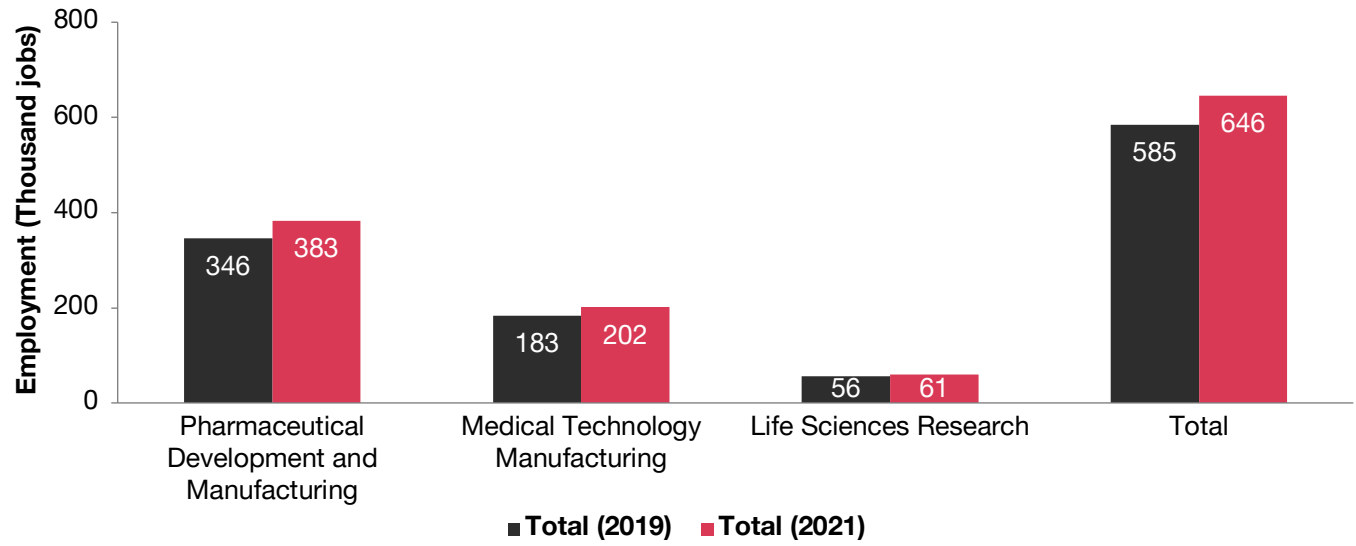


Figure 15 Contribution of UK Life Sciences to Employment (2019, 2021 comparison)



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