

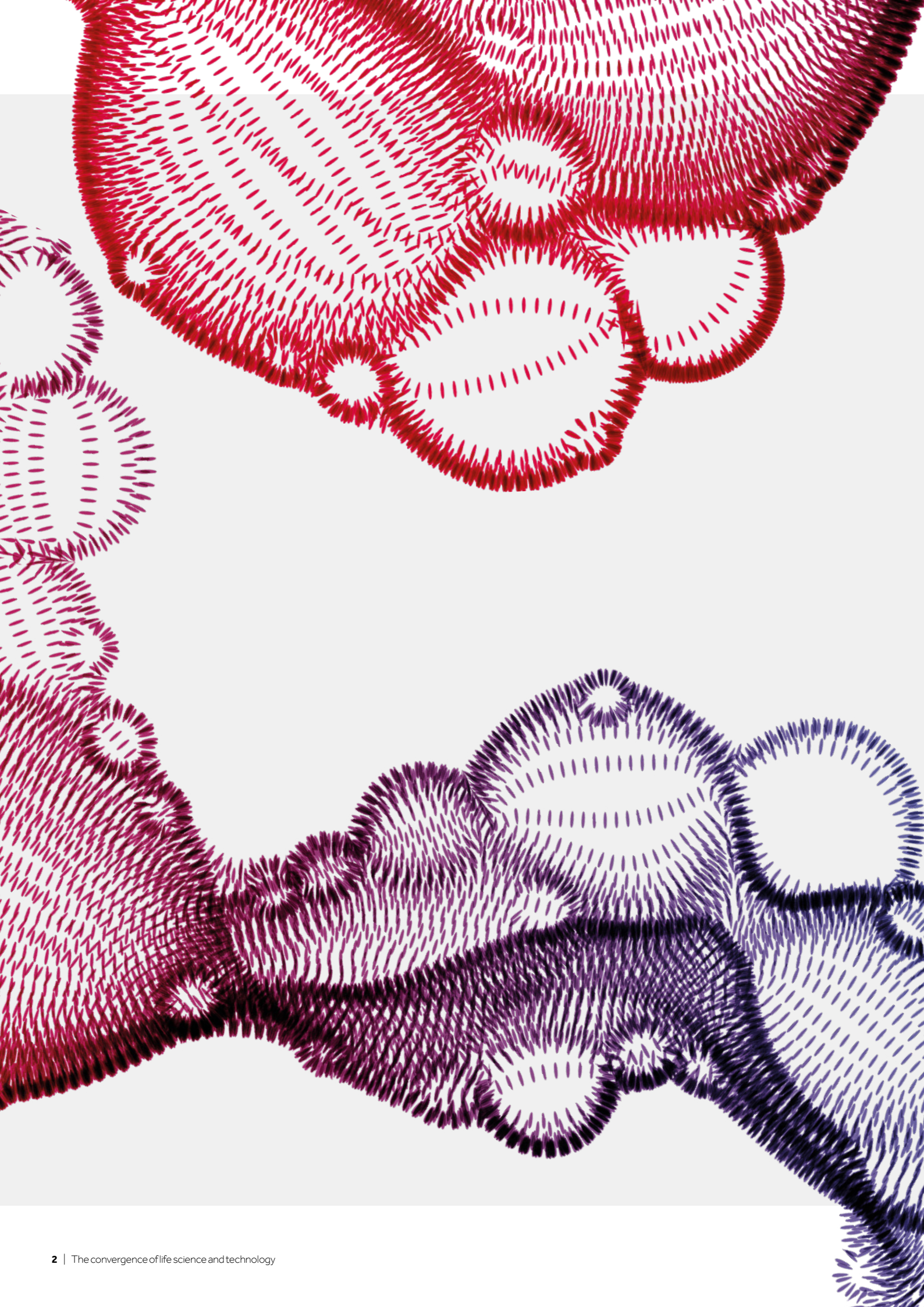
# The convergence of life science and technology

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LIFE SCIENCES 2030







# Introduction

**In the last two years, we have seen social media giant, Meta, use artificial intelligence (AI) to predict the structures of some 600 million proteins, NVIDIA, a gaming chip company launch Clara Discovery for drug discovery and Alphabet raise \$1bn of investment into Verily, its life science offshoot.**

This big tech movement into life sciences is the tip of the iceberg with a depth of specialist companies across the technology sectors raising finance and making real differences in potential health outcomes globally, not in some distant future, but in many cases over the next couple of years.

Working with YouGov, we have tracked this growing relationship between science and technology and seen the momentum of their convergence. In our latest piece of work, we asked R&D managers at many of the UK's leading life sciences research businesses what the future holds in order to understand the implications for location and property specific demand.

The pace of advances and business activity is extraordinary. US biotech companies Verge Genomics and Recursion Pharmaceuticals, as well as Oxford based Exscientia have all announced drugs discovered or developed using AI and machine learning tools that have progressed to clinical trials.

Inceptive, a biotech start-up, has raised \$100m to fund a generative AI platform to develop new types of vaccines and drugs. The company is designing "biological software" using the latest AI technology that was pioneered by the founder Jakob Uszkoreit, a former Google artificial intelligence expert who co-authored a paper that propelled generative AI advances such as ChatGPT.

It is estimated that AI has the potential to save two to four years in pre-clinical discovery depending on the novelty and complexity of the target. At present it has little direct impact on the clinical

development timelines, but the enhanced probability of drug success due to better chemistry and target choice, reduces the time and cost of drug development. These were the key concerns of R&D leads in the companies we surveyed previously with YouGov in 2021.

As yet, no drugs developed using AI technology have been approved, but this milestone is not far off. Insilico, a biotech company backed by Chinese conglomerate Fosun Group and private equity giant Warburg Pincus commenced one of the first mid-stage human trials of a drug discovered and designed by AI. The company also used AI to recruit patients who are more likely to respond to the therapies the company has created.

The advances continue. University of Exeter spinout, Attomarker, uses big data in a new testing device which will diagnose a range of conditions ranging from long Covid to female fertility, food allergies, diabetes and Alzheimer's. At present, the technology is a benchtop laboratory instrument, but Attomarker expect to launch a handheld device which connects to a mobile phone in 2024. This underlines the importance of the hardware innovation that is occurring in parallel, with advances in robotics and automation accelerating to keep pace with application potential.

While the funding environment has been more challenging over the last year, the appeal of tech driven life sciences prevails. The annual Barnes Thornburg investment survey found that while investment in life sciences has cooled slightly, more than half of respondents identified the areas of gene therapy, precision medicine, AI/machine learning, and cell therapy as key opportunities.

There are signs of a return in venture capital funding in the UK, according to the UK BioIndustry Association. While the public markets remain challenging, the UK biotech sector showed greater momentum in the attraction of capital in Q2 2023. Measures to drive greater funding through the City of London will be positive for future homegrown growth.

This will be crucial. The convergence of life science and technology will open up opportunities across the globe, all the while US big tech companies are positioned to capitalise on the data hungry advances ahead. The competitiveness of the UK's life science position will increasingly be determined by its tech capabilities.

# The drivers of convergence

**While the application of advancing technology was widely adopted in other sectors, the spur to accelerate the process within the life sciences sector was the global covid-19 pandemic.**

The convergence story remains at an early stage, but three interrelated factors are expected to drive an evolution in operations and ownerships over the next couple of years.

- 1** The traditional approaches to drug discovery are associated with long lead times and high failure rates. The decade running up to the pandemic saw rising costs impact on profitability. This was noted as a key challenge for businesses in our R&D survey undertaken with YouGov in 2018 and 2021. This financial dynamic has spurred life science companies to collaborate with technology companies to enhance drug discovery efficiency.
- 2** Availability of patient data has expanded at an enormous pace, with CB Insights estimating a 500% increase in the quantity of patient data held in clinical systems between 2016 and 2020. This data facilitates the application of technology, both at the drug discovery stage and advancements in the potential for the personalisation of patient treatment.
- 3** Technical advances in the areas of AI and big data have supported the leveraging of this data in tech driven drug discovery, clinical trials and patient management. The rapid pace of learning in these areas is building specialist knowledge in life science applications of technology, both in large companies but particularly through the creation of start ups and spin-outs with unique areas of concentration.





# The purpose of the research

**Advances in technology, the availability of data and the financial pressure on drug discovery in particular, as highlighted in our previous R&D research with YouGov, have coalesced to propel convergence in the scientific arena and therefore in the commercial sector.**

In order to provide a more informed understanding of the dynamics underway, we once again worked with YouGov to undertake a survey of both life science companies and tech businesses working in the life science arena to better understand the trends in motion and the likely implications for location and business space. The details of the survey are detailed in the box below.

## The survey

YouGov conducted an interview survey of 34 life science companies across the country, providing a statistically significant view of the sector as a whole. The businesses that kindly gave up their time to contribute to the study worked in areas including drug discovery, biotech, advanced therapeutics, medical devices and diagnostics.

In addition to the survey of life science companies, YouGov undertook an online survey of tech companies that are working in the life science arena or expect to do so. Again, the sample was statistically significant at a national level. The results of this survey will be reported in future papers in this series.



# The technology currently adopted by life science companies

**We focused our questions around four key areas of emerging technology in the life sciences sector: Robotics and Automation; Artificial intelligence and Machine Learning; Software Development; and Quantum Computing.**

As anticipated, no companies in our survey are currently using quantum computing in their activities, but there are expectations that it will be under investigation over the coming years, particularly by larger companies. The box to the side provides a brief summary of technology and early signals to its application.

Most businesses we surveyed are already making use of one form of new technology in their R&D, across the business size spectrum. As might be expected, larger companies are greater users and are at a more advanced stage in its integration in their R&D activities. Looking ahead, adoption across the technology types will accelerate, again with larger companies leading the way.



## Quantum Computing

This nascent technology could transform life science R&D over the next decade through improved machine learning algorithms and faster computing speeds, which solve complex problems in hours rather than years with classical computing capability.

As we expected, no companies are currently using quantum at present, although 12% expect to be doing so within the next five years. However, this will remain at an early stage – half will be using to a limited extent – very much early adopters, with the rest at an experimental stage looking at the application within the business.

The expectation of use is not limited to large companies but are perhaps spread across the size spectrum, although larger companies perhaps a little further ahead in terms of moving beyond the experimental stage. This is to be expected as it is still not clear whether practical computers will be available within this time frame.

Companies that anticipate some form of use or exploration within the business, state that they want providers within the UK, which is likely a practical factor relating to the technology.

At present, companies and organisations like the tech giants Google, IBM, and Microsoft are leading the development of quantum computing. Google is one of the world's largest technology companies and has been actively developing quantum computers for several years. IBM has been developing quantum computers since the early 2000s and has made significant contributions to the field. They

currently offer cloud-based access to several small-scale quantum computers. In 2019, Google claimed to have achieved "quantum supremacy" with a quantum computer that performed a calculation that would have taken a classical computer thousands of years to complete.

Microsoft has been investing in quantum computing research for several years and is developing a programming language and software tools for quantum computing. They currently offer the Microsoft Azure Quantum service – the 'world's first full-stack, open cloud quantum computing ecosystem' for researchers, businesses and developers. Meanwhile, the multinational technology company Honeywell has been developing quantum computers since 2018. In 2020, they announced a quantum computer with 10 qubits, which is one of the most powerful quantum computers currently available.

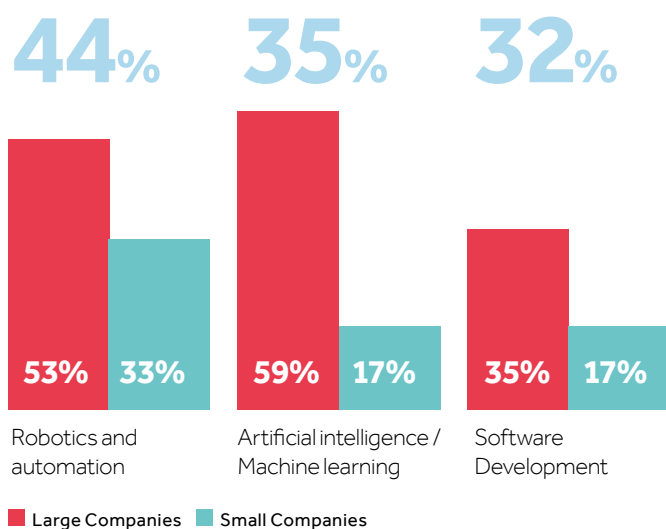
However, there are emerging smaller scale options. Rigetti Computing, a start-up that specializes in developing quantum computers and software tools for quantum computing, currently offers cloud-based access to several small-scale quantum computers.

# 12%

of companies surveyed expect to be using Quantum computing within the next 5 years



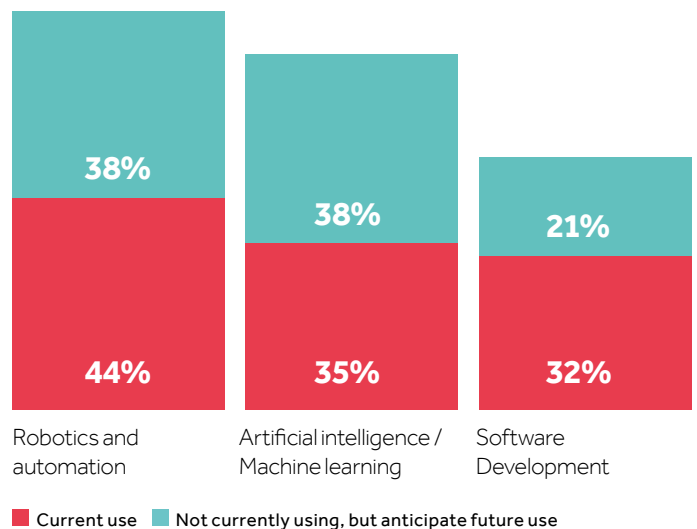
## Technology use across the life science sector



Source: Bidwells, YouGov, 2023

Note: Total proportion of respondent companies stating they currently use the technology and the breakdown by size.

## Future technology use across the life science sector



Source: Bidwells, YouGov, 2023

Note: Respondent companies stating they currently use the technology and those who are not applying it presently but anticipate doing so in the future.



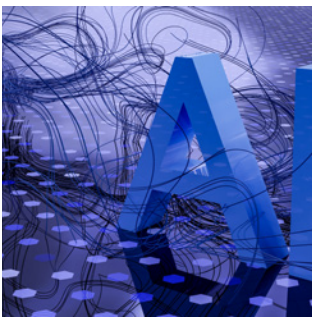
## Robotics and automation

Our survey finds robotics and automation is widely employed in the life sciences sector. 44% of the companies surveyed currently utilise the technology, with a quarter of this group considering it integral to their R&D processes. The application of the technology shows very little difference across the company size spectrum, or region of the country.

Companies expect a strong pace of growth in the application of the technology in the

future. Over two thirds of companies not currently using robotics expect to use it in the next five years.

While robotics and automation technology is currently delivered predominately through a combination of in-house teams and external partners, there is an expectation that the next five years will see a greater level of outsourcing. Companies anticipate working with partners either wholly or partly, reflecting growing specialisation in this area.



## AI and Machine Learning

Our research finds the use of AI, and the precursor to this machine learning, is slightly less established, with just over a third of respondents reporting its use in their operations. This is more pronounced amongst smaller life science companies. However, three quarters of companies expect to be employing the technology over the next five years, again with larger companies taking the lead in its application, a number anticipating it will be integral to their work in the future.

As with the case with robotics and automations, AI and machine learning is currently provided predominately by a mix of in-house and external providers although sole in-house operations are in the minority. This is perhaps to be expected given the specialist nature of the technology. Looking ahead, companies anticipate greater levels of collaborative outsourcing. A minority of companies expect the technology to be provided solely either in-house or by external parties.



## Software applications

The application of software encompasses a wide range of activities, although our respondents reported these tools to be less established in their R&D processes. Expectations of growth were also lower than the other areas.

Nearly 40% of software applications are currently provided in-house. This is

particularly the case amongst SMEs, while larger companies are again more likely to partner with providers. Looking ahead a far greater level of collaboration is expected. This is likely to relate to the expectation of the growing application of cloud technologies in the life sciences sector, with companies effectively purchasing software service rather than building in-house operations.





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# Growth in collaborative relationships

## The finding of the research underlines the importance of technology companies in the new life science ecosystem.

Certainly, the last couple of years have seen a range of established and new technology based companies entering the life science space. This diverse landscape is reflected in the results of our survey.

**Robotics and automation** Big tech businesses are currently major collaborators, although a third of technology solutions are provided by small specialist providers. This duality of provision is expected to continue, but small specialist providers, often coming out of university R&D, will be a growing target for large technology companies.

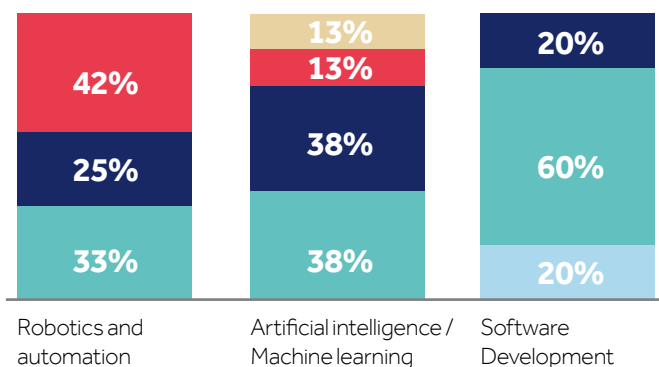
**AI and Machine Learning** As reflected in the emergence of companies operating in this space, this technology is currently provided by a mix of companies, with academic R&D playing a crucial role. Respondents reported the role of big tech was relatively limited, but the potential for capturing value from the drug discovery process is likely to see these companies grow their influence.

**Software** Smaller specialist companies were reported as key providers in this space with only little input from big tech. Advances in the delivery of software as a service through cloud technologies and the possibilities presented by the linkages with patient data is likely to change this balance. Partnerships between life science and big tech are expected to accelerate.

Given the emerging role of large technology companies in the life science industry, internationalisation of relationships is inevitable. The respondents to our survey reported that the majority (63%) of their technology collaborators, even at this relatively early stage in the convergence story, are located outside the UK. These global links were particularly noted in those areas which are currently most likely to outsource robotics and automation and AI and machine learning. However, software technology providers are also expected to follow suit.

### Who provides this technology?

- Universities / Research Institutions
- 'Big tech' businesses
- Other corporates
- Small specialist businesses
- Other



Source: Bidwells, YouGov, 2023







# Convergence will be disruptive

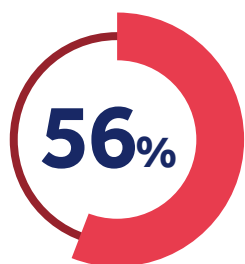
It is evident from our survey results that technology companies will be taking a significant and evolving role in the life science sector. Perhaps the most striking finding from our research is the expectation that, on balance, life science companies believe it will be the tech companies taking the lead rather than the science.

Our analysis of Beauhurst data shows an accelerating pace of tech company acquisition of life science companies prior to the recent economic slowdown. While the financing environment is tighter at present, the potential opportunity presented by the life science value chain will sustain the sector's appeal in terms of the creation of long term profits in the tech sector.

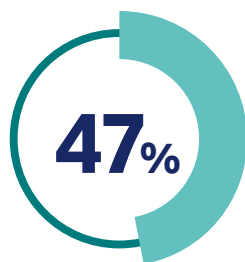
Clearly, this has major implications for how the market will evolve. The dominance of US technology companies in particular is likely to shift the centre of gravity for the UK life science sector.

However, centres of excellence in Germany, France and Switzerland are also reflected in the survey, with life science companies seeking collaborations with the best in class in specific fields. Crucially these fields are becoming increasingly specialised.

## The intersection between tech and life sciences will be increasingly blurred



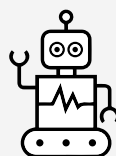
of respondents agreed with the statement "tech companies will acquire life science companies"



of respondents agreed with the statement "life science companies will acquire tech companies"

Source: Bidwells, YouGov, 2023

## Proportion of companies stating their current technology providers are located outside the UK



67%

Robotics and automation



63%

Artificial intelligence / Machine learning



40%

Software Development



67%

Would ideally like their technology providers to be UK based

Source: Bidwells, YouGov, 2023



For sure, there is greater complexity ahead. However, our survey suggests this evolution in how life science companies and technology providers collaborate in the future is likely to be more sophisticated than these headline figures suggest. Three factors will position the UK for the future:

### 1. A preference for UK tech partners

Two thirds of the life science companies surveyed stated they would prefer their technology partners to be located in the UK. This is because they are collaborators rather than simply providers. The models described in the survey underline the relationship between tech companies and in-house teams in life science businesses with regular face-to-face meetings between the two. The survey found 40% of life science businesses meet with tech providers at least once every 3 months.

### 2. Strength of UK university R&D

The respondents underlined the importance of university R&D to deliver future advances. Proximity to the leading researchers and institutes in the respective fields is a primary location driver, reported in our previous research with YouGov. University spin-outs will therefore continue to take an important role as specialist collaborators, albeit will be increasingly vulnerable to overseas purchase further down the line.

This is not an area for complacency, however. UK institutions need to continue to compete for top scientists and funding, particularly given emerging centres of research excellence globally, including elsewhere in Europe. The announcement of the UK joining the EU Horizon research programme as an Associate member is clearly positive in this respect.

### 3. NHS data

The possibilities presented by the depth of longitudinal data held by the NHS offers a unique opportunity for tech driven life sciences. With consistent and long-term data comes the possibility of greater analysis and assessment of treatments and patient outcomes, allowing life sciences companies to optimise the performance of their drugs and procedures.

The NHS is continuing to invest in its data. For example, their 100,000 Genomes Project will provide a database that can help more quickly identify diseases and provide opportunities for the development of more personalised care solutions.

The combined appeal of these factors has driven a number of global technology companies to build a R&D presence alongside UK academic institutions. In Cambridge, this includes Microsoft who have been working with Addenbrookes Hospital on the implementation of a new AI system, OSAIRIS as part of Project InnerEye, that will cut patient wait times for radiotherapy treatment.

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**56% of respondents expect university spinouts will be the main source of technology solutions for life science applications**

### Project InnerEye

The technology helps with the segmentation part of the treatment planning process, identifying areas of healthy tissue in order to avoid damaging it with radiation. The technology system was developed with the use of Microsoft's Project InnerEye technology, which aims to open up AI usage for medical imaging. Thus far the system has been used for prostate, head and neck cancers, cutting radiotherapy preparation times by up to 90%. The potential for the use of this technology for other cancers and the development of other AI systems to be used within the NHS will be supported by a new £21 million fund set up by the NHS specifically for AI.



# A nationwide opportunity

**Critically, the opportunity presented by the convergence of science and tech is a nationwide prospect. Life science companies are more flexible in where their tech collaborators might be located.**

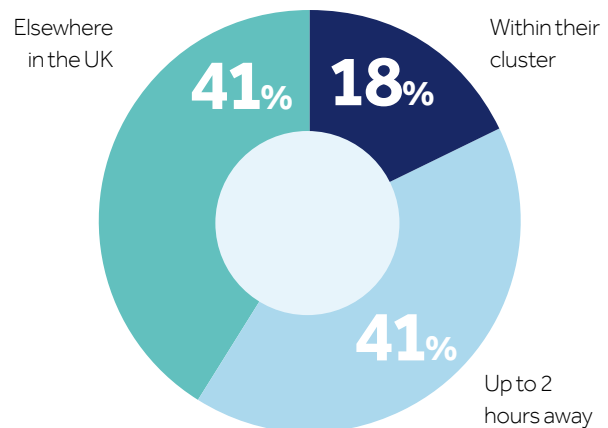
While a fifth of respondents to our survey would prefer to see the tech companies with whom they are partnering to be located within the same cluster, nearly 60% of companies considered a distance of two hours to be satisfactory.

The potential for the Oxford – Cambridge Arc to be a science and tech superpower is evident, particularly when combined with the additional tech and life science strengths of London.

However, the opportunities are not solely focused on this region. The greater flexibility of geography enables life science and technology companies across the UK to capitalise on the opportunities presented by convergence.

Nonetheless, the UK's relatively weaker position in tech – particularly Big Tech – has the potential to undermine this opportunity. The national vision for life sciences must go hand in hand with an ambition for technological strength, encompassing everything from education, attracting and retaining globally leading talent, to nurturing and funding great ideas into home grown unicorns of the future.

**Where there is a preference for a UK based tech provider, where would they ideally be located?**

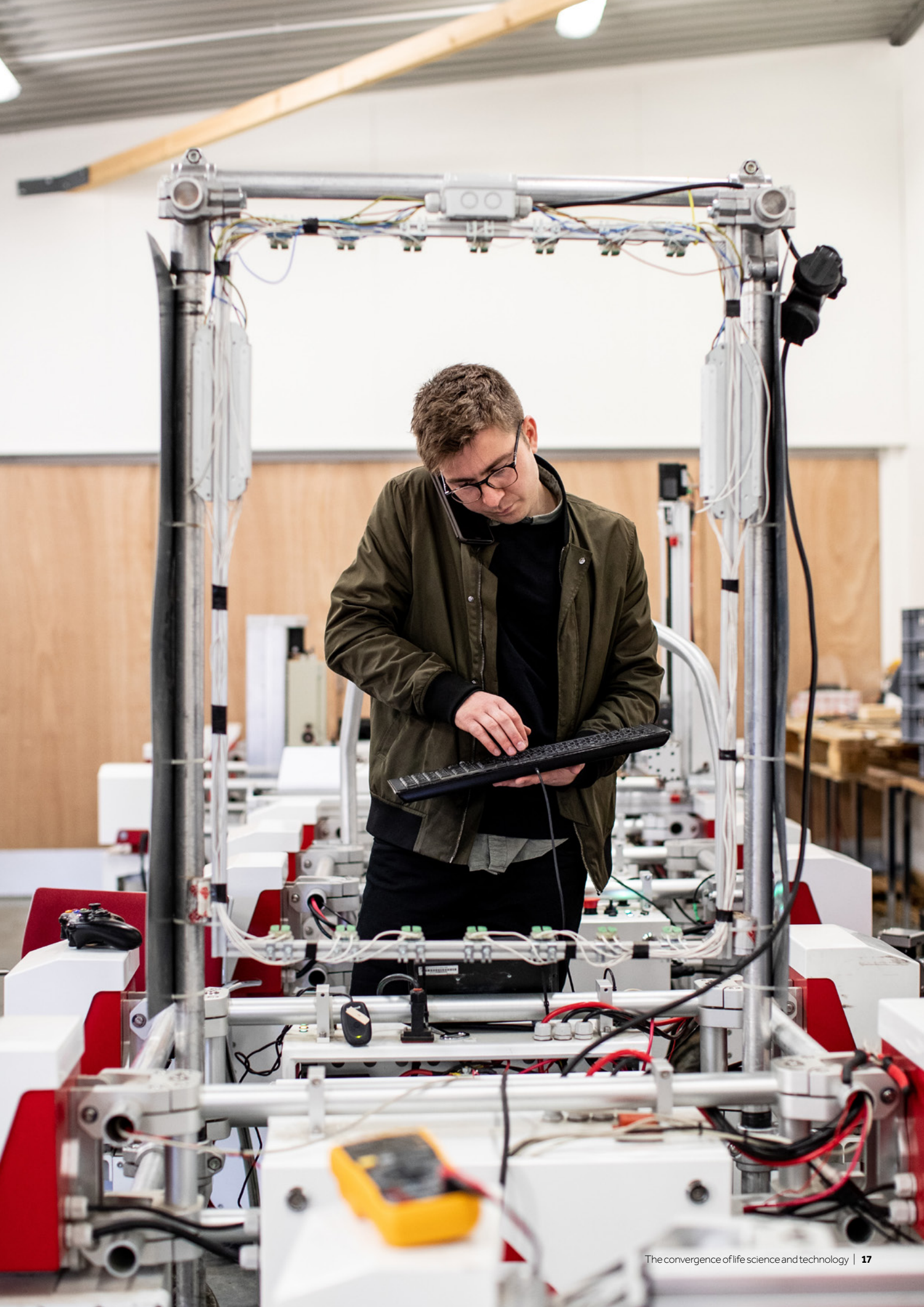


Source: Bidwells, YouGov, 2023

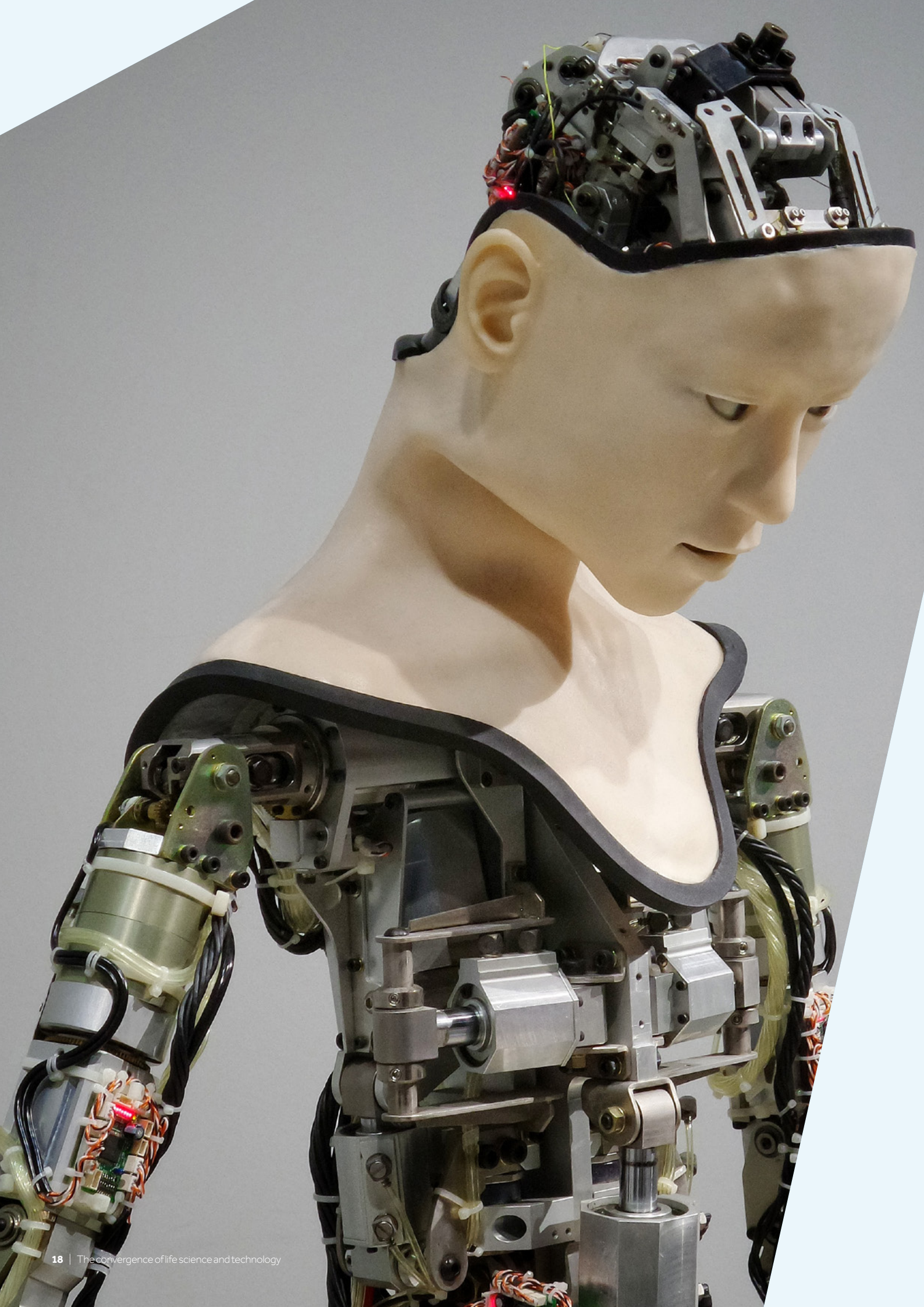
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**Life science companies would prefer collaborators within a couple of hours of their location, providing opportunities across the UK in the areas of AI, software and robotics.**











## With thanks

We would like to thank the team at YouGov for their ongoing work with Bidwells in this area of research. We would also like to thank Sarah Haywood at Advanced Oxford for advising on this project.

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