HOUSE OF LORDS

Science and Technology Committee

Corrected oral evidence: Engineering biology

Tuesday 23 April 2024

11.30 am

Watch the meeting

Members present: Baroness Brown of Cambridge (The Chair); Lord Berkeley; Lord Borwick; Lord Drayson; Lord Lucas; Baroness Neville-Jones; Baroness Northover; Lord Rees of Ludlow; Viscount Stansgate; Lord Strasburger; Lord Wei; Baroness Willis of Summertown.

Evidence Session No. 4 Heard in Public Questions 34 – 40

Witnesses

I: Mark Bustard, Chief Executive Officer, Industrial Biotechnology Innovation Centre; Dr Martin Turner, Associate Director of Policy, Public Affairs and Investor Relations, BioIndustry Association.

USE OF THE TRANSCRIPT

1. This is a corrected transcript of evidence taken in public and webcast on www.parliamentlive.tv.

Examination of witnesses

Mark Bustard and Dr Martin Turner.

The Chair: I would like to welcome our two witnesses to this fourth session of our inquiry into engineering biology. The session is being broadcast on parliamentlive.tv, a full transcript is being taken, and you will receive copies of it shortly after this session. We would be grateful if you would make any minor corrections that you think are needed.

In addition, if you think of something that you did not get a chance to say to us, or if you have any further data or information that you think would be useful to our inquiry, we would be very pleased to receive it as formal evidence.

I should have done this first—sorry about that—but let me welcome Mark Bustard, the chief executive officer of the Industrial Biotechnology Innovation Centre, who is joining us virtually today, and Dr Martin Turner, the associate director of policy, public affairs and investor relations at the BioIndustry Association. Thank you very much for coming; you are both very welcome. I turn to Baroness Neville-Jones to ask the first question.

Q34 **Baroness Neville-Jones:** Good morning. It would be very helpful if you could characterise the landscape for engineering biology and industrial biology technology in the UK to start us off, and how things have developed and changed over the last 10 years. Martin, can I start with you?

Dr Martin Turner: Good morning, and thank you for having me. The engineering and biology sector in the UK is vibrant, exciting and entrepreneurial, and we are in a fundamentally better place than we were 10 years ago. We have seen really exciting growth of the sector and significant innovation. There are 600 or more BIA members, about two-thirds of which are SMEs, and they are developing new medicines and other healthcare technologies using engineering biology, developing new materials and chemical manufacturing processes, producing biofuels and bioremediation technologies to improve the environment, and improving agriculture and food production.

We have seen growth in this area over the past 10 years and have now coined the term deep biotech to describe the application of biotechnology outside the health space, because we see this as a significant growth area for the UK economy. The Government estimate that there are 1,100 or so engineering biology companies in the UK, of which about half are in the health space, so we are excited to see the other half of those growing. It is important to

understand that it is SMEs—small companies—that are really driving the innovation in this area, and the UK is leading the world.

There is a conference in two weeks in California, SynBioBeta, which is the biggest conference in the world on synthetic biology, otherwise known as engineering biology. The UK is the biggest overseas delegation going to America to attend that conference, which gives you a sense of the vibrancy.

Over the past 10 years, we have been supported by having an Engineering Biology Leadership Council led by Lionel Clarke, which was set up in 2012 by the then Science Minister, Lord David Willetts. That leadership has been valuable and has seen us grow as a sector. Extra private investment and great innovation based on the UK's excellence in academic life sciences research have come with that. Fundamentally, we are in a much better and more exciting place than we were 10 years ago.

Baroness Neville-Jones: You are painting a bright picture, I must say. Mr Bustard?

Mark Bustard: Thank you. I was frozen and unable to unmute, so hopefully you can hear me. It is a pleasure to sit before you today, virtually. I am sorry I cannot be there in person.

I will talk a little about where we operate. We support industrial biotechnology in its broadest sense. We tend to operate in spaces across wider sectors, from first generation—biofuels production, bioethanol, biosolvents and so on—all the way through to emerging opportunities for the application of biotechnology—textiles, food and feed, energy, marine and so on—so we work very broadly.

We have 220 member organisations that work with IBioIC. You might not be aware that innovation centres—as we operate—are unique within Scotland, so we are funded to drive the translation of assets out of universities in a business-led way. We are not catapults; we do not do our own research, and we do not support market failure in that way. We are there to foster collaboration. To date we have supported over 260 companies, of which 90% are start-ups and SMEs; the others are multinationals interested in horizon scanning.

We see engineering biology as a tool in the toolbox of wider industrial biotechnology. The advancements that we have seen across the UK and the growth in critical mass in particular clusters are hung around academia, and the companies are accessing that expertise. I would like to see us move into more of a translational phase, away from the fundamental research and development

phase. My interest is driving fantastic science into great manufacturing. There are ways we can do that, and I am sure we will probably talk a little about it.

It is a vibrant and fast-moving multidisciplinary space, and that comes with its own challenges, but equally fantastic opportunities that see the UK teeing itself up to be a world leader in that space. We are continuing to support a wide range of activities in a business-led fashion. I echo what my colleague from the BIA said. We are partnering with the BIA to go out to the US to showcase a lot of the activity, and it is the largest delegation the UK has ever sent.

Baroness Neville-Jones: The mention of translational research leads me to my next question. You said the industry is dominated by SMEs. Are bigger companies interested in this industry? Are they taking up what the SMEs are doing? Are they helping? How is the scale-up going?

Dr Martin Turner: In healthcare, it is certainly a well-trodden path for SMEs to interact with large pharmaceutical companies. At the moment we see it less in other industries, and I am sure it will be different between agriculture and chemical manufacturing, for instance, but I do not think there is a significant pull from the large companies. This is quite possibly largely because they are the incumbents in the space and are perhaps quite comfortable with their manufacturing processes or whatever they have invested a lot of money into. It is the smaller companies that are likely to disrupt that in the years to come with more sustainable solutions. We need to see greater interaction and openness to innovation with the larger companies.

Baroness Neville-Jones: That seems like a very significant statement.

Mark Bustard: Some larger companies that we work with—multinationals such as Unilever, Procter & Gamble and Diageo—are very keen to show their sustainability credentials and develop green supply chains.

The most prominent one was Unilever, which said that by 2030 it would not be reliant on fossil-based carbon for the largest part of its business, which is its cleaning, detergents and enzymes business. That has proven challenging, and it is in the public domain trying to find global green supply chains that can service its needs. A lot of the work we are doing is with companies across the supply chain, all the way from feedstock and natural capital, through technology providers and engineering biology solutions, to

converting natural products into usable carbon that is not petrochemically derived. The market must pull: it must be market-driven, and therefore the products must stack up against the current petrochemically derived products. We see that with examples in AstraZeneca, which is doing a lot of work in sourcing biosolvents rather than petrochemically derived solvents. The pharmaceutical industry is a huge user of solvents, as I am sure you are aware.

The market will drive this. We need to support the innovation that allows us to grow robust, sustainable supply chains, because they are not there yet. At the moment, when I look locally here in Scotland, a lot of the conversation about sustainability is around energy generation. We perhaps fail to consider that we have a strategy for generating the energy, but we do not have an all-encompassing strategy to enable us to derive the carbon we need to make all our materials and products from sources other than petrochemicals. The UK needs to grasp that it is a huge task in terms of transitioning.

Baroness Neville-Jones: I am not quite clear whether it is the absence of the pull factor that is delaying the growth of the supply chain and an industry that is moving green at all stages, or the absence of feedstocks—or that there is not enough of a bio-base yet. Or is it all of the above?

Mark Bustard: It is a number of those elements. It is trying to get critical mass and bring on next-generation technology such as engineering biology, which can provide quite significant solutions to these challenges. Some companies that will ultimately be the end users are aware that the robust supply chain is not there yet. Our focus is growing the supply chain opportunity, and the market will pull that. A lot of the large companies are very keen to show their sustainability credentials and not be seen to greenwash. Many are legitimate in what they are trying to achieve, but they are not quite there yet, and we can help with those solutions in the UK.

Dr Martin Turner: I agree with that. The desire is probably there, but we do not see enough of a real willingness to invest in building those capabilities and supporting small companies to bring those products to market at the moment. There is perhaps not enough incentive for companies to pursue more sustainable technologies at this time, although there is significant public pressure to do it. Economics often still win out and, unfortunately, it can be cheaper to have the more environmentally unfriendly, less sustainable processes in place.

The vision talks about government playing a role in bringing together big and small companies, and we definitely support that. In some areas, government can also be a first customer of some of these innovations.

Q35 **Baroness Northover:** This follows on from our earlier session. In your introductory remarks you came at this from slightly different positions in terms of Dr Turner's optimism as to where we are. Across the world, this area should presumably be bigger than 10 years ago and we are looking at where the UK is placed within that.

How easy is it for companies in the engineering biology sector in the United Kingdom to obtain investment? You have been referring to that. Where does this investment typically come from? Dr Turner mentioned that there are a number of SMEs. How does the UK sector compare with international competitors such as the US and Germany?

We heard that the UK was at the forefront of developments 10 years ago—you mentioned David Willetts—but that it has fallen behind when you look across the board now. Would you agree with that—looking not at the advance from then until now but at the comparative picture across the world?

Dr Martin Turner: As you have heard from previous witnesses, there are different business models across the applications of engineering biology. Fundamentally, either you have companies that are going to be pre-revenue for a very long time and will have to rely on venture capital and other private investment, or you have business models where you can start generating income revenue sooner and you will be able to start financing your activities through revenues from customers, although you will need some kick-start funding.

The majority of engineering biology innovation is probably funded by venture capital. The environment for UK venture capital has got a lot better, but we still lag behind America in particular. We do not lag behind our European counterparts and in fact, in biotech, we are very strong, making about 40% of all venture capital investment across Europe. The Government estimate that UK engineering biology firms raised £5.2 billion between 2017 and 2022—third in the world after the US and China—which is very reassuring.

As you have heard before, the challenge is in scale-up. By scale-up funding, I mean £20 million or so, although it differs between sectors. In health it is definitely £20 million, or even £100 million or £200 million. There are not very many investors in the UK with

those deep pockets. American, European or other investors have to be attracted.

In other applications of engineering biology, some sectors are less developed, and therefore the venture capital investment is less developed. Seed and series A early-stage venture capital funding is still a challenge in those sectors. That private investment is greatly aided by grants from government, particularly Innovate UK but also other UKRI funders.

R&D tax credits are also hugely important for supporting these companies. These are R&D-intensive companies that are developing new innovations, so R&D tax credits provide a valuable source of capital and, much more importantly, encourage the venture capitalists to put their money into these companies in the first place and to encourage these companies to start and grow in the UK.

Baroness Northover: Can I probe you on one or two of those things? What you are saying does not quite square with what our previous panel said is happening in practice. When you say the United Kingdom is third behind the US and China, what is the level of investment in the US and China over that period?

Dr Martin Turner: I do not have that data with me; those are government statistics in the engineering biology vision.

Baroness Northover: Could you send it to us, please?

Dr Martin Turner: Yes.

Baroness Northover: What did you think of the point about Innovate UK not being willing to support loss-making companies, given that they may very well be in that situation?

Dr Martin Turner: It is very concerning to hear that. I do not know the specifics of those companies, but Innovate UK's grants used to be governed by an EU rule called undertakings in difficulty, which made it very difficult for loss-making companies to access that funding because it incorrectly labelled those companies as undertakings in difficulty—that is, about to go insolvent—and said that state aid could therefore not be given to those companies. That was a very poorly designed rule, and luckily Innovate UK has been able to largely eradicate its application in its grant funding programmes, I believe. Whenever government is looking at subsidy rules, they are always designed for non-innovative, more traditional industries, which can be really problematic for R&D-intensive, venture capital-backed, innovative industries.

Baroness Northover: From your answers, it sounds as though you do not think there is much we can learn from other countries.

Dr Martin Turner: No, certainly not. DARPA—the programme in America that gives funding to companies to develop innovations and is an end user and customer of those innovations—was mentioned in the previous session. Equally, we can learn a lot from other countries such as Singapore and their approach to regulation, but also how they attract and support companies interested in establishing facilities in their countries. Other Governments provide a lot of account management; the UK Government could do the same.

Baroness Northover: Mr Bustard, could you address these issues as well?

Mark Bustard: In the wider bioeconomy space, we see healthy environments for initial rounds of funding, angel investors, particularly strong initial seed rounds and so on. The UK has not been so successful in securing major capital investment and investors who are willing to put steel in the ground and support the construction of facilities to enable the company itself to manufacture a product.

Having spoken to US investors, I know they are not concerned about putting $100 million into a company to build a biorefinery because they know they will get a return on it, but we do not seem to do very well in securing relationships with those types of investors in our space. Like Singapore and Ireland in the past, the UK needs to do more to make itself more attractive to bring in those major investors that will help build the infrastructure. We are not asking the UK Government to invest themselves but for more public/private and de-risking activity.

I could not reinforce enough that Innovate UK funding is exceptionally good for companies in growth. Some initiatives and flexibility that have been built in more recently are hugely valuable and have enabled those early-stage companies to secure much more private investment. Some companies in our portfolio are able to secure capital at probably between £20 million and £60 million. There is nothing beyond that, so they tend to go overseas then, which is a story you will hear in many manufacturing sectors. We need to be careful that does not happen with the bio-based manufacturing industry.

I am speaking predominantly in the non-health area. There are different models for how healthcare products, biopharmaceuticals and advanced therapies are outsourced and made around the

world. Many countries—particularly in Europe and the US—are hugely supportive as a community and as a culture for having a bio-based activity alongside their traditional petrochemical. We have done quite a bit of work looking at best practice in some of those clusters.

Taking the Netherlands as an example, the petrochemical industry—working in partnership with the Government—put quite a lot of investment into building green supply chains in the Netherlands, and that continues to this day, in the realisation that transition will come eventually and that the downturn in petrochemical must happen.

In terms of investment, we predominantly deal with high-growth and early-stage companies. We see the wave starting to hit now; some of our companies are at the stage where they are looking to secure their own manufacturing assets, which is a challenging environment in the UK.

Q36 **Lord Wei:** I want to focus a bit more on the scale-up challenge. We have already had a lot of conversations about some of the challenges, but what are the major barriers? What has worked? Are there particular areas within engineering biology where we are seeing some success? We spoke about DARPA and the relationship between the major pre-existing industries, such as chemical fuel, and as you spoke about in the Dutch example, where we are seeing some of that.

What can the Government do? Are we just doomed to have a small market and that is a physical limit, or do you think we can perhaps do more with the pensions industry or others to supercharge this?

Mark Bustard: Scale-up is still a major issue, particularly at mid-scale. When we were formed, we did a lot of innovation support, business to academia, partnerships and projects, and so on, and then on skills and the workforce, which is the challenge. If you are going to build major manufacturing and scale-up, you need the workforce to be able to handle and deliver it for you.

We invested in scale-up facilities within IBioIC. We have a facility in expansion, and it will take companies through to 300 litres. It has just been supported by Scottish Enterprise in terms of the business plan to scale to that. We were there because there was a very clear market failure in companies accessing equipment and the bioprocess knowledge in non-healthcare spaces to enable them to run their very first process. This is really proof of process. It then gives them robust data to go to their boards with, say, "This is what our process looks like", and ask for more investment. It is also robust in that investors see IBioIC as non-academic. The data

is produced by a stand-alone team that we operate and that stands up. There is sometimes a concern about using academic facilities and things like that with investors.

We have delivered over 130 projects for companies in doing initial runs of their scale-up—everything from taking shellfish waste and turning it into biopolymers and wrapping for food. We have done all sorts of things, even cultured meat. The flexibility is important because the breadth of what is happening in the bioeconomy is important.

Unfortunately, when they go beyond our scale, they tend to go to European facilities in the first instance. BBE and others across the Netherlands and Belgium support our companies to go into larger scale-up. When we go to a demonstrator scale, we lose them and they tend not to come back for manufacturing. We need the infrastructure in place at the correct scale so that we can support them here in the UK and nucleate that cluster. Alongside that must be the parallel development of the skills and expertise; it is absolutely critical.

Lord Wei: If they are going to Europe, is it because they can physically access more markets there, or because there are literally more facilities and people go where they are—or both?

Mark Bustard: Before Brexit, they were going there because they could tap into Horizon funding and de-risk some scale-up work rooted into bids. Then Brexit arrived, it all stopped and there were no significant facilities in the UK where companies could go, apart from CPI.

We also heard that companies that went overseas into eastern Europe, the US and India a number of years ago were able to access that nearly immediately, with one month to three months' lead time. Because so many companies are building bio-based processes, those facilities are now demonstrating longer wait times and higher costs, so again there is a prohibitive element for companies to get out to scale up.

We have not really addressed that in the UK. The academic base in engineering biology is fantastic and moving at pace, but where does it go after that? There are a few organisations like us and some pilot facilities, but our ambition is to do more and to supercharge it, as you say—to get them up to that next level where they can go out for major investment and hopefully place their manufacturing assets in the UK if we build the right infrastructure.

Dr Martin Turner: I completely echo everything that Mark says. Capital is the fundamental barrier: it takes an incredible amount of money to develop these technologies and bring them to market and, as I said in my earlier answer, we just do not have the number of investors in the UK or the deep enough pockets. There are some significant European venture capital firms and some very large American ones that are very keen on engineering biology.

We need to encourage more venture capital firms to start and grow in the UK, and the Chancellor's Mansion House reforms are critical. You mentioned pensions in your question; the UK pension industry has changed significantly over the past two decades. It has divested from equities in general, very significantly, but with the growth of defined contribution pension schemes—the new workplace pension schemes we have in the UK now—these are starting to reach a scale where they will be big enough to start specialising in investing into equities, private venture capital and innovative sectors of the economy.

The Mansion House reforms, led by the Chancellor and the previous Lord Mayor of London, were really welcome; that is a door that needs to continue to be pushed on. There are some innovative, forward-thinking pension providers and there are some that are yet to take the leap. Whoever the next Government are, I hope they continue on that agenda.

British Patient Capital, the equity investment arm of the British Business Bank, is really valuable; it has worked well in life sciences. It could—and I am sure it is—look at engineering biology applied outside healthcare. Currently, it has a life sciences investment team and a tech investment team, and a lot of these industries fall between the two. I would like to see British Patient Capital and the Government focus some efforts there, because that type of government-supported equity investment can really leverage in much greater amounts of private capital, which will be key in unlocking the pension funds.

Lord Wei: Is there not a need for some kind of buyer—maybe the Government—to give that certainty of a sufficiently large demand and market for bioengineering products so that we can have these larger facilities? It seems like a chicken and egg situation between needing a big factory that can be used for a number of purposes but needing enough customers who want to use the capacity of the factory to be able to pay up front to create it. Otherwise, you do not have an economic case; the VCs or investors will not fund things where there is no market. How do you overcome that barrier? It is a very high upfront cost compared with software or

other industries.

Mark Bustard: I was just thinking through some conversations we have had. I met with the US Department of Agriculture, which has something called the BioPreferred scheme, a procurement scheme that the US Government run for products that are predominantly bio-based; they preferentially procure. As you have just described, Lord Wei, it gives companies an opportunity to invest in the production at scale because there is a better chance that it will be procured, and they will sell their goods.

Italy changed its policy around waste sorting and waste utilisation to generate other products. Legally, citizens needed to fulfil their obligations to sort waste and so on, which created an enormous opportunity for those companies making biodegradable biopolymers. We all have our little compostable bags for various items, and Italy grew a whole industry on the back of that and had a policy shift to enforce it as the way forward. Other countries in Europe have similar positions, such as Switzerland, where the citizens have to adhere to policy set down by the Government.

The exciting thing about the US scheme is that it has grown the opportunity for business, and it sits on the back of President Biden's biomanufacturing initiative, which has promised to pump multiple billions of dollars into supporting bio-based manufacturing in the US. I am not saying the UK has the ability to give £40 billion for bio-based manufacturing, but it shows an ambition of a country and the Government to drive the change. It is not being passive; it is driving change.

Baroness Willis of Summertown: We have had lots of examples of other countries, but is there anywhere in the UK where you feel the ecosystem for scaling up actually works, or are there good examples that we could look at to build on good?

Dr Martin Turner: You need a critical mass in these types of things. Oxford, Cambridge and London have clearly worked very well for life sciences where you have the critical mass of companies, academia and investors. When looking at developing other engineering biology-driven industries, you should be looking at where there is heritage in those areas—aquaculture in Scotland, for instance—and leveraging off that the academic excellence and the location of these companies that are starting to cluster around those areas.

Baroness Willis of Summertown: Mark, do you have any views as to what good looks like in the UK?

Mark Bustard: The focus on clusters is important; the golden triangle has certain elements. Thinking about scaling up and production manufacturing, the north-west and north-east of England and Scotland are critical to the growth of the cluster and have powerhouse universities and workforce coming out of those universities, which is critical for that cluster. That is important.

When we started out, we were working with 42 companies that said they used or were interested in industrial biotechnology. There was not even a mention of engineering biology in those days, but we have now existed for 10 years and are working with over 220 companies that we support. The emergence of engineering biology as a critical tool to enable production, scale-up, environmental impact and so on is hugely important.

Do not feel that we need to do new things all the time, but back initiatives and investments that have started to show traction or have exhibited acceleration; do not think about starting something just because it is new. We need to consider the timelines.

Initiatives such as the Fraunhofer in Germany run in 10-year cycles—10, 20 or 30 years—not three-year cycles. I am pleased UKRI has changed its horizon on how long it supports innovation, but, as a Government, appreciate the fact that it takes time to get that traction and acceleration phase. At the moment, our cluster in Scotland is in that acceleration phase, and that is the case for others in the UK as well.

Q37 **Baroness Neville-Jones:** Some of the ground has already been covered, but could I pursue the issue of when the drift away from the UK occurs? One of the things Mr Bustard said was that companies go abroad because they cannot get the facilities here to do the development and testing, and then tend not to come back for manufacturing. That seems to be a point at which we then begin to lose momentum and the possibility of exploitation at scale of what is being created. It seems the private sector owes it to itself to invest in its future, but government needs to know how else it can help and facilitate a richer environment for development.

What do you think the Government can usefully invest in by way of facilities? Dr Turner, you mentioned things such as investment by pensions. There are certainly policy measures that government can take, and you may have more to offer. I would like to hear what you both think in terms of the concrete facilities, buildings, and other environmental ways of developing, and also how the Government should use their economic levers to facilitate and to close some of these gaps.

Mark Bustard: The culture is changing in things such as pension schemes, where there is certainly an appetite to demonstrate a green portfolio of investments, and that is often improving. Anything the Government can do to enhance that is incredibly important.

From where I am at, in the coalface, it is correct to say that the private sector should step in to sort out this market failure. I do not think it will just yet, but the Government will need to de-risk that and start the infrastructure building; the private sector will then come in on the back of it.

Baroness Neville-Jones: When you say structure building, what sort of structures do you mean?

Mark Bustard: There is still an issue in incubation, research hotels, scale-ups—physical assets at a sensible price—which is a challenge we have found. We have ended up incubating some of our member organisations as start-ups because they were struggling to find space in the central belt of Scotland, for example. We have had conversations with property investors about trying to do more to support that, so that is an issue. It may not be the same issue in the London, Oxford and Cambridge region; I suspect it probably is, but we see it amplified quite significantly in Scotland.

Baroness Neville-Jones: Is training an issue?

Mark Bustard: Training and skills are issues; we work with many universities and colleges on skills programmes across the piece. At the end of the last session, I heard a comment about apprenticeships and the fact that not everybody—

The Chair: We have a specific question on skills coming up shortly. If you do not mind, perhaps you could save your comments for that.

Dr Martin Turner: In terms of what the Government can do to stop companies going overseas, there are two clear policy levers. The first comes back to the pension funds and increasing investment; although we are very welcoming of overseas investors, if you have more UK-based investors to balance them out on the board, the control of that company has more of a centre of gravity on the UK, and there will be less of a pull or push from investors to set up operations overseas. So it will help if we can get more of those UK pension funds investing into innovative sectors of the economy.

The other is what we call sticky investments: getting those companies to make investments into the UK that are quite difficult

to move, and that is generally infrastructure, particularly manufacturing infrastructure. Unfortunately, there is very little incentive within the Government's fiscal policy for companies to make manufacturing investments. R&D tax reliefs do not encourage capital investment; outside of medicines manufacturing, very few capital grants are available to companies to invest in this kit. These things are very expensive to set up and run, but the Government are not currently providing as much support as they could to encourage these companies to make sticky investments.

As a result, they need to access other facilities, which was a large part of your question. We need different types of facilities for different applications of biotechnology; the needs vary. They need to be cost-accessible and not too expensive to access, so they need some form of subsidy. They also need to be able to be accessed when the companies need them. These companies are in an international race to develop their products, and they might lose ground to others if they cannot start their manufacturing scale-up programme for another six months. Those types of activities are very internationally mobile as a result of that need to get ahead of the game.

Baroness Neville-Jones: In the past, Governments have put out allowances for research and development by companies, and these allowances have not been used; in the end, the Government scrapped them. I do not entirely understand. Is it a question of the stage the industry has reached? There does not seem to have been adequate take-up of allowances the Government have made in the past.

Dr Martin Turner: I am not sure which allowances you are referring to, but currently we have R&D allowances and capital expenditure allowances. They all reduce a company's tax burden, but none provides cash relief for loss-making companies; you need to be making a profit and paying tax to benefit from them. So none will be taken up by loss-making companies, which most of these companies are.

The Chair: I am afraid we are going to need to speed up a little, so it would be very helpful if we could keep answers short.

Q38 **Lord Borwick:** Which are the main regulators in this industry, and do those regulators have the knowledge and the nous to regulate properly? Are they obstructing the companies you have been talking about? It must be very difficult for a regulator to regulate a completely new industry and to learn from behind what is going on and what could go wrong. What are your thoughts on the regulating industry?

Dr Martin Turner: I completely agree that it must be very difficult. The Government set up an engineering biology regulatory network, which is really welcome and has between 10 and 14 regulators on it. We do not know which regulators they are, but the initiative is welcome; we just need a bit more information and transparency about it.

There are different regulators for different applications of engineering biology: the MHRA for health; the Animal and Plant Health Agency for veterinary and plants; the Civil Aviation Authority; the Environment Agency; the Food Standards Agency for food; it goes on and on. It is really welcome that this network has been set up and that the Government in general have a pro-innovation regulatory agenda, but the regulators need resourcing, money and upskilling. This is not to criticise them; as you said in your question, it is very difficult to stay ahead of the game in these areas.

Mark Bustard: I would echo that; it is very important that we stay close to the regulators and educate them. One of the best examples we can point to is how the MHRA behaved around the Covid vaccine, and how the industry managed to inform it and work in partnership. We are obviously not dealing with something as severe as that, but each regulator is dealing with its own challenges. Resourcing is an issue, certainly in terms of being able to engage with them. The forum that has been described will be very useful going forward, provided it is structured appropriately and resourced effectively.

We have an additional matter to deal with in that we have Scotland-based activity around environmental policy and so on—SEPA, for example—which is interesting. There is certainly an opportunity.

Lord Borwick: What is the advantage of keeping confidential the identity of regulators in these networks?

Dr Martin Turner: I have no idea; you would have to ask the Minister.

Lord Borwick: Was this a decision by the Government? Are there any examples in other industries where they keep the identity of the regulators secret?

Dr Martin Turner: Not that I am aware of.

Lord Borwick: It does seem to be a somewhat bizarre conclusion, does it not?

Dr Martin Turner: Yes; we would certainly like to know who the regulators are.

The Chair: Are there any instances you know of where companies have moved overseas because of a regulatory environment that was perhaps faster moving or better for them?

Dr Martin Turner: You heard in the previous session that other countries—the US, Singapore—have regulated lab-grown meat faster, and therefore attracted those companies to set up there. That will also be the case in other sectors, but we do not have a full view of it at the moment.

The Chair: Mark, do you know of any examples?

Mark Bustard: There is the challenge in engineering biology of GM regulation and what countries do about that. The SNP and the Scottish Government have decided that they are not in favour of GM and have made that quite clear. That makes it quite difficult on certain applications; GM for health products is fine, but GM on anything else, such as environmental application, is not acceptable. We would clearly like that to change, to give some of the companies an opportunity.

The Chair: There are extra challenges in Scotland.

Viscount Stansgate: When you talk to the Government, who do you talk to?

Dr Martin Turner: There is an engineering and biology team within DSIT—the Department for Science, Innovation and Technology—that mainly deals with the non-health applications. You then have the Office for Life Sciences, which also deals with health.

Viscount Stansgate: Trade?

Dr Martin Turner: Yes. About two years ago we published a guide to UK engineering biology, along with the Department for International Trade at the time.

Lord Berkeley: Going back to the regulators, they are normally set up by legislation, which will say the terms of reference and who they report to. Surely, they also have to say whether they are in the public domain and their conclusions. Beyond that, it would not take much to find out who they all are, and you could ask them whether they talk to each other. If that is the case, could you write to us with a bit more information?

Dr Martin Turner: Yes, but what information?

Lord Berkeley: Who the regulators are and what legislation set them up. Maybe Mark could do the same; it may be different in Scotland, after all.

The Chair: It is around this issue of there being a network of regulators, and you not knowing who the members of the network are. If you could write us a very short note to explain the situation, that would give us the opportunity to explore it with the Minister if we choose to. That would be very helpful. Let us move on to the skills and Lord Strasburger's question.

Q39 **Lord Strasburger:** We have already heard about how access to a skilled workforce is crucial to the growth of technology and R&D-intensive companies. Are there any major skill shortages affecting the sector? If so, why do you think that is and what should be done about it?

Mark Bustard: We do a lot around skills, and we work across the piece. Engineering biology is such a multidisciplinary subject that we need to work hard at these really ground-breaking initiatives where disciplines work better together, consistently and over a long period of time. We embed the culture and the knowledge, so biologists are working with computer scientists, data people, engineers and so on, which is critical.

In terms of even the sheer numbers of the workforce that will be needed if we look at where we believe the industry will go, we really need to ramp up on the skills across the piece. With manufacturing, I am thinking about more technical and hands-on skills. We have seen a massive shortage in fermentation, bioprocessing and purification—very process-focused skills—in bio-based. Other disciplines adapt towards that, such as chemical engineering, chemical process engineering, mechanical engineering and others, but that needs to swing and we still need to make sure the numbers of workforce are available.

Hands-on, in our facilities, we have trained over 260 people on fermentation and purification of bio-based processes. They all get hoovered up, and companies are still lacking access to the skills. We support an HND programme across Scotland, a master's degree with an industrial placement that we generated, which is based at the University of Strathclyde. We have supported a cohort of IBioIC PhD studentships and there were 122 PhDs, all co-funded by business, which shows that building critical mass and the appetite for business to access fantastic skills are critical.

It is often relationships with particular universities. UCL is a great example; the biochemical engineering department there does a

wonderful job at leveraging its alumni, and a lot of universities could certainly learn from that.

Skills are absolutely critical. If we want to grow engineering biology, we need to get those disciplines working closer together right from the outset, and not think of it as an end where we have somebody with bioscience that needs to learn computing, for example. This needs to be embedded in our thinking moving forward if the UK truly wants to lead in engineering biology globally.

Lord Strasburger: Why do you think those particular shortages have arisen? I congratulate you on trying to fix them yourselves, but how could you be helped to perhaps fix them by the Government?

Mark Bustard: Again, it relates to having space and facilities. More could be done. A lot of universities stopped doing the hands-on training for fermentation, so only a handful of universities train up in fermentation. We are helping to transition early-career researchers who have come out of, for example, brewing and distilling or food processing courses into higher value. It is certainly improving, but we could do a lot more.

Support for the skills programme is critical—things such as the BBSRC and the landscape awards. It is really positive to see EPSRC working right at that interface with life science as well, having an appetite to do more, and an appreciation from Innovate UK funding that the skills side of things could be supported in terms of support for business. Not that it just comes from research councils for universities; there are other entities that could actually help with business-led training.

Dr Martin Turner: I agree with everything that Mark said, especially about the interdisciplinary nature of engineering biology. We have great fundamental skills and university courses, but it is when you are trying to bring them together. The University of Bristol's centre for doctoral training in engineering biology was recently announced, which was really welcome and is aiming to integrate technical skills to drive the industry forward. There is only one of those in the country; there are 15 for AI.

A greater focus on commercialisation and entrepreneurial skills would definitely be welcome in these areas. If we are to create these companies, we need people who have not only the scientific and technical skills but the business acumen and drive.

It is not all about universities; we have already heard about the role that apprenticeships can play, especially for the manufacturing side of things in bioprocessing. That is really exciting, but SMEs need more support to be able to access apprenticeship training programmes that are designed for them.

Q40 **Baroness Northover:** As was said in the other session, the Government have announced that engineering biology is one of their five priority technologies and have set out their strategy in the *National Vision for Engineering Biology*. I am sure it has been welcomed, so that is probably the answer to that one. But the Government have announced a headline ambition to spend £2 billion over the next 10 years. Assuming that this is new money, how should that spending be prioritised?

Dr Martin Turner: We would prioritise it on supporting infrastructure, access to finance, including grants and equity instruments, and supporting the regulators to do more in this space, although I do not think that requires much.

We do not quite know how the £2 billion was arrived at, and it would be interesting if the Government could explain which departments they envisage allocating this money to and what they consider to be engineering biology. I would guess that £2 billion would not involve health engineering biology, because it would be a much bigger figure if it did.

In comparison, quantum is getting £2.5 billion. AI does not have a 10-year funding programme as yet but has £500 million over the next two years, on top of an existing £300 million. We would like to see a more ambitious target for investment.

Mark Bustard: I would echo that, based on what you have probably heard me say a few times. There is a need to invest in infrastructure and training, so combining those things has an impact, as well as initiatives that drive translation out of universities. There are some academics who are particularly strong in working with business and at the business interface, and there are other academics who are better suited to blue skies research. Finding the balance is important, but funding and initiatives that enable collaboration and training to happen with the growth of the infrastructure, which will enable scale-up and acceleration, is critical to the success.

Lord Drayson: You had a meeting about engineering biology with the Ministers at No. 10 this week. What concrete action came out of it that you would like us to follow up on when we meet the Ministers?

Dr Martin Turner: Last Tuesday, many of our members went to Downing Street. That type of event is really great to show that the Government at the highest level are interested in supporting engineering biology. I am not aware of concrete decisions that came out of that meeting; it was more of a celebration of engineering biology. We would like to see the Government commit to doing more events like that, and there is mention in the vision of a roadshow or something that would bring together large companies and small innovators. We would certainly like to see that happen this year.

The Chair: That brings this session to an end. I would like to say thank you very much to both our witnesses; your time has been very much appreciated by the committee. Just to remind you, Dr Turner, you are going to send us a short note, which would be very helpful. If you think of anything else that might be useful, we would be very pleased to receive it. This session is formally closed.