

Science, Innovation and Technology Committee

Oral evidence: Government Chief Scientific Adviser and departmental Chief Scientific Advisers, HC 670

Tuesday 28 January 2025

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Members present: Chi Onwurah (Chair); Emily Darlington; Dr Allison Gardner; Jon Pearce; Steve Race; Dr Lauren Sullivan; Adam Thompson; Martin Wrigley.

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Witnesses

I: Professor Lucy Chappell, Chief Scientific Adviser, Department of Health and Social Care; Professor Chris Johnson, Chief Scientific Adviser, Department for Science, Innovation and Technology; Dr Nick Joad, Director, Defence Science and Technology, Ministry of Defence; and Professor Tamsin Mather, Senior Strategic Scientist, Ministry of Defence.

II: Professor Dame Angela McLean, Government Chief Scientific Adviser, HM Government.

Examination of witnesses

Witnesses: Professor Chappell, Professor Johnson, Dr Joad and Professor Mather.

Q1 Chair: I would like to welcome our witnesses to the session today to talk about the role of the departmental chief scientific advisers, particularly in the run-up to the spending review, and the role of science advice in government. The Committee has a role in ensuring that Government policies and decision making are based on solid scientific evidence and advice, so we are very pleased to have the opportunity to speak to you today, as chief scientific advisers, or representatives, from the Department for Science, Innovation and Technology, the Department for Health and Social Care, and the Ministry of Defence.

I have an opening question for each Department in turn, and will start with Professor Chris Johnson as the representative of the Department for Science, Innovation and Technology. Chief scientific adviser is a fantastic title, which I would love to have, some day. That is not a bid for a job, by the way. I just think “chief scientific adviser” sounds fantastic—it sounds great. Not every member of the public may understand what you do, your role in government, and how you work with everybody else in the Departments and Ministries—Secretaries of State, etc.

We do not have a lot of time, so if possible try to be brief, but I should like each of you to start by introducing yourself, and then to tell us the structure of your team or teams. How many people are there, and who do they report to in the Department? What benefits do you see to your Department from a chief scientific adviser? Do you have a specific example of where you have made a difference either with the delivery of a public service, a spending decision, or the delivery of some other benefit for the British people?

So, that is three questions: structure of your team and teams, the role of the CSA and the benefits they bring, and a specific example. I will start with you, Professor Johnson.

Professor Johnson: First, I was going to offer a job swap, if you would like to, for a few days.

Chair: I may take you up on that some time.

Professor Johnson: That would be great. First, on the structure of the team, the chief scientific adviser is a relatively new appointment within DSIT. Although the Department has been going for almost two years, I have been in post only seven months. Before that, there was the national technology adviser, Dave Smith, who I report to, and Dame Angela, who you will be speaking to later on—the Government’s chief scientist.

Being in the Department for Science, the science organisation is slightly different from that in other Departments. Not only do we have science advice going into policy areas, such as the digital centre of Government or AI, but we, and I, also have a care for the UK’s research environment—both public sector research establishments and



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universities. Although we have a relatively small team, and do not have a large direct budget, as other Departments might, we have a significant say in the way in which we fund UK research on the whole. Of the £13 billion that goes to DSIT, £6 billion funds UKRI and approximately £3 billion goes into Horizon Europe. My role is in providing an interface into those programmes. That is a fantastic strength of UK research, because it means that government does not get involved directly in the decisions of exploratory research. That is done through the other agencies. Is that sufficient to begin with on the first question?

Q2 Chair: Did you have a specific example?

Professor Johnson: Oh, a specific example of benefits: well, obviously DSIT has multiple roles. Part of the role is in looking after the UK research environment. I have worked really hard to build up relationships between the Departments, UKRI, the research councils and public sector research establishments, but I think the thing I am most proud of from the first few months has been working on the recovery from CrowdStrike, because the other part of our role is the digital centre of Government, and machine learning.

It was observed that CrowdStrike initially looked as if it might have been a cyber-incident, with so many companies affected; but in fact it was related to a patch of a piece of protective software. That raised questions that sat between many different Departments of Government, in the sense that DSIT, looking at how we deliver the digital economy, is involved even though it is not necessarily a cyber-incident. We were looking at things like—here is a piece of software; most people who use it did not even know they had it in their system, because it was buried. They had not bought it; they bought a product in which it was embedded. If we set up too rigorous or narrow a contingency response and the cyber team say, “Well, it’s not cyber,” we have a clear problem.

It is probably interesting for the Committee that there have been examples in the past where malware has been disguised to look like a bug. You do not think it is a cyber-attack, but it is actually a bug. The distinction between routine software error or a malicious attack is very blurred. So, DSIT, with the intelligence agencies, the National Cyber Security Centre and the Cabinet Office, has worked to provide a more harmonised approach, so that we do not automatically make a decision about cyber or another form of response. I believe that after six months we are in a much stronger and more flexible place to respond in an integrated way.

Q3 Chair: Thank you for that. Dr Joad and Professor Mather, you are doing a job share for the Ministry of Defence, so which of you would like to respond?

Professor Mather: I will respond to this one, and Nick will come in on some later ones.



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As some background, we are in the process of recruiting a new CSA for MOD. In the meantime, I do two days a week as senior strategic scientist, covering 50% of the role. Usually, we would have somebody four days a week, and 80% seconded. We are in the process, at the moment, of rolling the CSA nuclear role back into the general CSA role, which is a considerable change. We had to split that out because of a nationality—"issue" is the wrong word, but a nationality conflict, perhaps, with the previous CSA. That is an interesting development. We will be rolling those roles back in.

The CSA within MOD has various different functions. We advise the Minister on science and technology issues, and innovation as well. We also look at approvals and advice in terms of procurement and things like that. We also manage the portfolio budget—the CSA core budget—of about £500 million, which is about 15% of the total MOD R&D investment.

I have about 120 to 140 people in Defence Science and Technology, who fulfil various roles, including policy work, commissioning and other aspects. We also have a network of about 60 scientists and engineers—the SCIADs, or scientific advisers—who are dispersed through the MOD structure: into frontline commands through head office, Strategic Command and DE&S—Defence Equipment and Support—which is the defence procurement arm.

I stress that we are in a period of change within defence. We are undergoing a process known as defence reform, where we are working on how to structure our scientific advice and innovation through the new structure that the MOD will put in place quite shortly. We also have the strategic defence review, which has yet to give its full read-out. So we are in a period of some flux, where we are working out how best to do it. That was the first example I was going to give you of how the CSA role has brought benefit. I have spent quite a lot of my time since coming into this role on 1 October engaging with that organisational change and making sure that science, technology and innovation are well represented in terms of how we thread that through.

Two other examples I was going to give you were the Salisbury Novichok incident. The ChemBio capability is something that we steward within MOD, and the CSA stewards that capability. Most of the time, fortunately, we do not need that capability, but sometimes we need it desperately, so we steward it within country but also within theatre, for our troops, should we need it.

The third example I was going to give was the Morpheus procurement, which the CSA and the Defence Science Expert Committee stood down, because it was not going to deliver what was required. That was based on science and technology advice. It stopped a piece of expenditure that would not have given us the capability that we needed.

Q4 **Chair:** Thank you very much, Professor Mather. Professor Chappell, you



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represent the Department for Health and Social Care. I will just mention that it has a £2 billion science spend and the Ministry of Defence has £1.8 billion.

Professor Chappell: Thank you very much. I am seconded into government at 80%, similarly to the Ministry of Defence, as the chief scientific adviser for DHSC. As you have heard, and similarly to the other Departments, I am there to give science advice to Ministers, very much in concert with the chief medical officer, who I report to, both within the Department but also as a crucial role across Government. The network of CSAs has a fantastic role, and I am sure that you will hear more about that from the Government CSA in the next session.

With that, as you say, comes responsibility for the R&D spend. I am chief executive officer of the National Institute for Health and Care Research, which was set up in 2006, under a previous Labour Government, by Dame Sally Davies, and which has gone from strength to strength. It is the main mechanism by which we execute our research and delivery.

My third role is as director general. I am responsible for three directorates: one is science, research and evidence, one of whose roles is to administer the funds through the NIHR; the second is the chief analyst directorate—Chris Mullin is our chief analyst and chief economist; and the third is the chief data officer, Lucy Vickers, who, again, works with all the other chief data officers across Government. The headcount for those three teams is 370.

I work 20% as a professor of obstetrics. I am a clinical triallist. I do trials on pregnancy and am a consultant obstetrician in the NHS. I still work on the frontline for both of those.

How do I think we make a difference? In the last eight months or so, NIHR has looked at how we make a difference through four routes: impact, innovation, investment and inclusion. I have some examples of impact, because if I cannot show examples of impact our R&D has not achieved what I think it should.

One that I would choose is providing the evidence for a shift to virtual wards, shifting care from hospital to home. That was done through a randomised controlled trial, which showed equivalent clinical outcomes, better patient satisfaction and cost savings.

Another is supporting innovation, which we see as a crucial part of our role, such as the Brainomix AI for stroke imaging, which reduces the time from door to needle for those who need interventional treatment for stroke. Another example is providing evidence for the diabetes prevention programme.

Those three examples that I have chosen mirror the three reform shifts that we seek in our health and growth mission. I have chosen them on purpose because NIHR already has a track record.



The fourth one is supporting the life sciences industry, through a range of partnerships, which we see as a crucial part of our work.

Our innovation is across what we do. We have reported our return on investment as £13.60 for every pound invested in health research. As to inclusion, we really welcome what the Government have been saying and doing about an inclusion approach, because we believe that if research is to have an impact on health outcomes it can tackle inequalities only by ensuring that we make research available to all our population.

Q5 Chair: Thank you very much, Professor Chappell, and all of you. I think we all have a better idea of the role of a chief scientific adviser. I have another couple of questions for each of you in turn before I hand over to the rest of the Committee.

I was somewhat surprised to read the previously given guidance describing the role of the departmental CSA as a “licensed dissident”. As a science champion, I think science should be part of the infrastructure, the establishment, the system, and not on the outside looking in, which is, to a certain extent, what a dissident implies. I would like each of the representatives in turn to say whether you are a dissident; what that means to you; and, as part of that, whether you can see Ministers when, and as often as, you judge necessary. Specifically, when was the last time you saw one of your Ministers?

Professor Johnson: I feel slightly uncomfortable about that “licensed dissident” quote. I have seen it many times, and I think there is a tension in terms of how I view research and science in the UK. Part of it is the need to collaborate and co-operate, to optimise finite resources; but, also, the European Commission published a report last year with a title something like—I am going to get it wrong so this is approximate—“combine, focus, align”. I just thought that that is totally the wrong thing. For me, a key strength of science and engineering in the UK is the diversity of views and the ability to disagree, but, at the same time, to be collegiate and collaborative. Our strength really comes from our ability to combine that diversity and not to throw the toys out of the pram when we are wrong. That has been my watchword in the Department.

Specifically, I was in a meeting with Minister Vallance last Friday, so that is four days ago. We were discussing how we can maximise the benefit of public sector research establishments in the UK, which I think is a fantastic opportunity for growth and development, aligning with both industry and our traditional strengths in universities.

To give you a very specific example that I really like, when the CEO of Aria, which is a kind of blue-skies research think-tank, gave the introduction to its recent achievements, he talked a lot about the challenge to thinking. I was really surprised about the strength of the delivery coming through, which often goes through more traditional sources, like UKRI or public sector research establishments. As a chief scientific adviser, encouraging that challenging thought, but then, really,



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the traditional approach to science and engineering, which has been our strength and is based on diversity and collaboration, those are the things that are in my soul about this job, and why I did it in the first place.

Q6 Chair: Thank you. Who is going to answer on behalf of the Ministry of Defence?

Professor Mather: I will, again. Language is a wonderful thing, isn't it? Dissident: we often look at it more as a critical friend, in the MOD, but the challenge function is really important. One of the strengths of the CSA roles is that we are people who are seconded in for a period of time. We are not career civil servants, and we provide independent challenge and a view from the outside—and networks from the outside, as well. There have certainly been times when we have had to give uncomfortable advice, but I hope it has always been given in a friendly way, rather than a dissident type of way. The challenge role is absolutely vital. You can badge it in whatever way you like, but it is important to be able to ask the difficult questions, and tell difficult truths, sometimes.

You had another question, I think, about the last time I saw a Minister.

Q7 Chair: Can you see Ministers whenever you want, and when is the last time you saw one of your Ministers?

Professor Mather: To be fair, I have been in this role only since 1 October. I have not asked to see a Minister yet; nor have I seen a Minister. I think that is a very factual answer to your question.

Q8 Chair: Thank you. We appreciate facts, here. Professor Chappell.

Professor Chappell: Thank you. I think Tamsin has put it very elegantly, and that reflects my role very much. I see our role as science into policy, and policy into science, so that role of understanding how we can present science as informing policy, practice and guidelines, across the health and care system, is a crucial one. That is partly by reaching Ministers, but it is also by reaching policymakers, and understanding how we present that in an accessible way.

We are definitely encouraged to challenge, particularly by the current set of Ministers. One of the difficult things is how we all deal with uncertainty, and how we represent it. For example, do we not have the evidence? In that case we should be open about it. Do we have the evidence without being sure how to implement it? If you think about the covid pandemic, when presenting the uncertainty was really challenging for everyone and we attempted to do it through a sort of evidence-informed way, that is a good example of what we are trying to do, not just for that pandemic but across all our areas.

I see our Ministers very regularly—both the Secretary of State and the Minister for my portfolio, who is Baroness Merron. That might be in one-to-one meetings, for accountability, it might be where I am an accompanying civil servant for external meetings, and it might be on



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visits. There are very strong working relationships between the chief medical officer, who is acting as our permanent secretary at the moment, and our ministerial team, and I welcome that open dialogue. In addition, for any of the other Ministers we often feed into briefings or meetings on research, science and the evidence base, or from my role in charge of the analysts and the data team that might be relevant, so for us it is a very constructive relationship at the moment.

Q9 **Chair:** Did you see your Minister more recently than Friday?

Professor Chappell: What have I been up to? What day of the week is it? It is Tuesday. I saw the Secretary of State last week and Minister Merron earlier in the week, because on Fridays they are often out and about.

Chair: Very good. Thank you very much for those answers. You have helped us understand your role. I will now ask Adam to carry on.

Q10 **Adam Thompson:** Good morning, everybody. Thank you for coming here today. The Government Office for Science guidance suggests that a departmental R&D strategy forms the basis of research funding plans broadly. I put this question to each of you: is there an overarching strategy that forms the basis of your department's R&D spending? Within that, how can big spending departments like yours, with many arm's-length bodies, ensure that R&D spending has a strategic focus? Perhaps we can start with Professor Johnson.

Professor Johnson: When I first arrived we did not have a science plan, and that was the first thing to do in my job description. We had it approved by exec committee last Thursday, so that is all going ahead. What that plan documents is another aspect of a job that has not been covered so far, which is care and concern for the science profession in the civil service. You will know that there is a need to attract and retain scientists and engineers. Often, the benefits that you gain from working in the civil service are not financial. So there is a clear public service concern for people, especially within DSIT, where we rely increasingly on large numbers of people in areas like machine learning.

In my case, I could talk about the work we do with UKRI, for instance, in the delivery of the global science picture, but I have already referred to that. I would rather talk to you now about the aspects of the science plan that deal with the development of skills and the retention of staff. When I came into the department I took the position of building on what was already there. There was already a staff group called techs, which had run a series of talks and so on.

It is also important to say that DSIT, like many other Departments in the civil service, is distributed throughout the UK now. I have been making it my duty to visit as many of the sites as I can and make sure that any development that we offer is open to them as well, as far as the opportunities allow. I am about to embark on a skills audit in the sense that we have to look in more detail at what the mapping of scientific and



engineering skills is presently and then start future casting, for example looking at the industrial strategy and our responsibilities within that. We also have to be able to support new initiatives like “Humphrey”, the AI tools, and digital wallets and so on. It is a fantastic time to be innovating in government in DSIT, and the science plan has to adapt both to the national aspects of the industrial strategy and the internal commitments to deliver to the public a new experience in attracting the Government.

Q11 Adam Thompson: Before we move on to colleagues from the MOD, you have talked extensively about the R&D strategy that you are currently developing. To what extent is that going to define DSIT’s spending specifically?

Professor Johnson: It will influence the spending, especially in the staffing area, but as to the overall budget allocation, because we are the Department for Science, I am in negotiation with Treasury and then the Secretary of State. There is a pipeline, or formal process, which we follow in consultation with UKRI and the arm’s-length bodies that deliver the science and engineering. I said at the start that things like the Haldane principle and so on are there to protect curiosity-driven research. My position is slightly awkward, in that I can inform but I do not want to be too interventionist in dictating, if you like, a Government or civil service view of what research should be done.

Q12 Adam Thompson: Perfect; thank you. I turn to your MOD colleagues.

Dr Joad: We have a science and technology strategy that we published about four years ago. We will be updating that in light of the defence review and also the changing technology climate.

Picking up your point about how we ensure that we are aligned with our S&T strategy, we run our S&T investment using various portfolio management techniques, which we have done for quite a long time. We were probably the first people in government to pick up that approach. What we do with that is capture requirements across the whole of the MOD. That comes back to Tamsin’s point. Half of my staff are now embedded with the users of S&T. We have used them to capture what problems or things we want from our S&T investment. They are capturing things called problem books. We then pull together the problem books and the S&T strategy, and we then construct a portfolio of investment, which typically lasts for about four years, sometimes five years, depending on Government funding cycles and that sort of thing. We are just about to go into the next phase of a change in that in light of what comes next.

That portfolio, which is about half a billion pounds a year, is then structured into about 30 different programmes, which are generally of two types. Either they are programmes aimed specifically at solving users’ problems—there might be one aimed at the top five or 10 problems that the Navy needs to sort out—or they are technology-driven



programmes that are about pulling through low-maturity technologies into the MOD system. That is how the portfolio looks.

That is then commissioned by my organisation and into DSTL. DSTL is the MOD's inhouse research organisation. They then put half of that stuff out into industry and academia, and they deliver that. The trick we are trying to pull off with our investment is addressing as many of our users' requirements while at the same time meeting the strategy, and there is a whole load of Government requirements to do with prosperity, policy notes and stuff. That is part of how we pull all of that together and build a portfolio to do that.

Q13 Adam Thompson: Before I move on to Professor Chappell, what role do you play within your departments' R&D spending decisions?

Dr Joad: The CSA is responsible for it; the money is delegated down to them. I look after the portfolio. I have a set of things I have to do around the portfolio. It is probably worth saying that the portfolio itself is quite dependent on its engagement internationally and with other Government Departments, because we are trying to pull off that classic trick: we only want to invest in things that we have to do, not stuff we can get from somewhere else. Those are the broad roles.

Q14 Adam Thompson: Professor Chappell, perhaps we can go back to that "strategy" question.

Professor Chappell: The strategy is defined in "Best Research for Best Health: The Next Chapter", which is the strategy document that my predecessor, Chris Whitty, and Louise Wood published in July 2021, with my knowledge, which was the month before I started. It turned out to be extremely prescient, not surprisingly. It defined six core workstreams. We fund programmatic research; infrastructure, including research delivery; partnering with patients, which we see as crucial underpinning; capacity building for our researchers across the country; collaborating with funders, industry and charities; and our sixth core workstream is our global health research using ODA funding.

The other aspect of this was seven strategic focuses. Because of how they were positioned, they turned out to be the real health needs of now, which is why they have been so relevant: learning from the covid pandemic; building capacity in prevention health and public health and social care research, which we have seen as real areas of development; improving the lives of people with multiple long-term conditions, which is an area in which Dr Gardner has been involved; thinking about underserved regions and using research as a tool to tackle inequalities; thinking about research inclusion, which I have touched on; strengthening careers, and in the health and care workforce at the moment that is particularly relevant; and the last one is working with the life sciences industry.



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When I came into post it was clear that people did not want upheaval for the sake of it. That strategy document was so powerful we just got on with delivery, because it is easy to write strategy documents; it is what you do with them that counts. With the new Government, we chose to use that as a framework, but to pivot to the health and the growth missions. Our spending review settlement in October was very much put against the pillars and goals of SR1, looking at an NHS that is there when people need it, so it is very much that timely access point; fewer lives lost to the big killers; and a fairer Britain where everyone lives well for longer, so it is healthy life expectancy, coupled with how we support the growth mission, driving economic growth in a whole number of ways. That was also back in September what we put for SR2.

Q15 Adam Thompson: What is your personal role within the spending decisions?

Professor Chappell: I am responsible for the R&D return to Treasury. I have sight of all the R&D spend across DHSC, including other areas, but, as we have heard, the huge bulk is through NIHR, with delegations from Treasury.

Q16 Chair: The Department for Health and Social Care is a large spender on innovation and research. There are well-known barriers to driving innovation through the NHS. We do not take up new and innovative drugs, MedTech and so on as quickly as other countries. What proportion of the spend drives actual innovation in the NHS, and are you working to address those barriers?

Professor Chappell: The R&D spend has to be Frascati-compliant by the Frascati manual, which is the OECD manual that covers many countries. All of us who spend R&D are very used to assessing spend against what is in that. That tells us what is and is not eligible under the R&D banner. Our role is to fund the R&D that will drive that innovation and provide the evidence for it, and then to work with system partners, such as the MHRA—the Medicines and Healthcare products Regulatory Agency—and NICE, which are the ones that do the approvals, and also to think about how we help drive that adoption, which we are doing in a number of ways through the R&D spend.

We want to present this particularly to partners in life sciences as being a pipeline or translational circle that helps drive that innovation adoption. Through our R&D spend, we do that in a number of ways. We have an i4i programme, invention for innovation, where we fund directly particularly into small and medium-sized enterprises—SMEs—to develop their products. We also work on what we might call implementation research barriers. If you have a product but it is not being adopted, why? How would we do R&D that better understood those barriers?

You then have responsibility for the spend by NHS England on that scale-up. I work very closely with Vin Diwakar, director of transformation in NHS England, who heads up the innovation, research and life sciences



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directorate, and colleagues in DHSC, such as the director of MedTech, David Lawson, to see what mechanisms, such as having a rules-based pathway, would address what they are doing.

Professor Johnson: Can I come in for a second to support what you are saying? One of the things the Committee might be interested in is that, with the advent of the missions, CSAs have been appointed across Government Departments. I work with Lucy on the healthcare mission. I am a software engineer and data scientist by background. Part of the reason GO-Science and Dame Angela have done that is to put new ways of thinking and innovation into these complex situations. I remember the first day I was asked to look at the healthcare mission. One of the outcomes was to endeavour to eliminate the use of ambulances when beds are blocked. As a software engineer, I had never looked at that. I never thought that that would have been within my field of interest. So I think it is important to understand that the CSAs' value collectively is greater than our individual Departments. Although the questions have been in individual Departments, we work very much as a team. Another example would be Tamsin—

Q17 **Adam Thompson:** These are the last couple of questions from me before we move on. Perhaps you could give a blunt yes/no answer to the first one. Summarising everything that we have just been through, in your respective Departments is science advice informing the budgets?

Professor Johnson: Yes.

Professor Mather: Yes.

Professor Chappell: Yes.

Q18 **Adam Thompson:** Excellent; good stuff. This is the final question from me, which is a little more open than the previous one. Moving forward and talking about the spending review, as we move forward into the next few months, what discussions have you had in your Departments about how R&D spend is going to function within the context of the spending review?

Professor Johnson: I have been involved in all of the initial discussions. As I mentioned earlier, the process is well defined, and we do a certain amount of scenario planning, as you would expect.

Dr Joad: Just picking up Chris's point, it is quite a well-defined process in the Department. We have been very engaged in putting together proposals and bids into that process. It is probably also worth saying that quite a lot of work has gone into looking at the spending review and engagement with other Government Departments. We have a very close relationship with our intelligence and national security colleagues. Joint things are being written to go into that process.

Professor Chappell: I would echo what Nick said. Our SR within the Department is very closely aligned to our health focus and health and



growth mission, because that has been the very clear steer. That inevitably means, through GCSA-convened meetings, looking at how we all get cross-linkage so that it really is mission-led Government. But there are a number of other strategies. I have named the AI action plan; the life sciences vision; the 10-year plan, which is starting to look at a health and care system fit for the future; CBR—chemical, biological and radiological—so bio-security, which is a very cross-government endeavour, but also how we work with UKRI. The best outcomes and impact will happen when, for example, our closest partners are the Medical Research Council and also Innovate UK, where we see that join-up and do not have valleys of death for science funding. We have the opposite; we have bridges and opportunities for everyone across science and research to deliver.

Adam Thompson: Brilliant. Thank you, everybody.

Chair: Thank you for that very illuminating answer. I will now ask Allison to take us forward.

Q19 **Dr Gardner:** I will start with a short one to you all. Given constrained public finances, what trade-offs do you expect in the upcoming spending review?

Professor Johnson: Everybody has concerns on which they focus and also opportunities, and it is really a matter of not being overwhelmed by the former so that you obscure the latter. I will talk first about a concern I have on which we are working actively and, secondly, about a totally new opportunity that I see coming through.

The concern I have is how, with limited resources, we look to the next generation of scientists and engineers, and make sure that we have sufficient capability that is at least in some approximation appropriate for where we want to be in five or 10 years. If we leave it to pure chance, or the choice of the students, put bluntly, that may not align with where we need to be. How we can manage a national dialogue about the skills that we need, I think, is the appropriate way forward. It is not up to me as chief scientific adviser to say, "This is how it should be," but we do need to be more up front about the kinds of skillsets that we need going forward and that, at least as a minimum, we make sure that we have enough telecoms engineers to implement the successor to 6G. That is the kind of thing that concerns me.

I will also talk about an opportunity. Last week I was with Minister Vallance at the Royal Academy of Engineering. They have started a scheme where venture capitalists from UK companies can embed themselves and have a course about deep tech. The idea is that you get people with financial skills being introduced to the problems of the next generation of technology. I note that the founders of DeepSeek, which is all over the newspapers this morning, have come out with a venture capital company. The spending review is constrained, but that does not mean that as a country we should be constrained; we should look to what



are the leading practices in other countries for innovation and move with it. When a learned society like the Royal Academy of Engineering does this, it is a fantastic and positive sign for the country.

Q20 **Dr Gardner:** It is an opportunity. I quite like that.

Professor Mather: On concerns and opportunities, let me start with the concerns. We have various things that we need to do as defence. We have talked about some of them in terms of keeping the homeland safe. We also have continuing operational requirements that we have to answer. We have a list of what we call national sovereign capabilities. Some of those have been underfunded over a period of time and some of the infrastructure is creaking. If I am honest, what keeps me awake at night in terms of the constrained budget are things like that. With the constrained budget, we risk losing some resource for that forward look as well to keep us at the forefront as a globally mighty military force. I am concerned about technologies in other nations getting ahead of us. In order to do that, we need to keep our eye to the future; we need to keep our eye on innovation and things like quantum technologies. I very much hope that we will be the first military to deploy quantum for position, navigation and timing. We should be able to, but this is of course dependent on resources. Direct energy weapons are another thing that we are very close to being able to have. Those things would not have happened without my predecessors, decades in the past, looking forward and seeing them on the horizon. As resources get constrained, I worry that we will not be stocking the shelf of innovation to keep us competitive in the future.

I also worry about our engagement with the industrial ecosystem. With the growth agenda it is incredibly important. I am talking about SMEs, for example, and our ability to put out contracts and keep that ecosystem ticking along.

As to opportunities—I promised some—we need to focus on what we need to do as defence, and we can work better with other Departments across Government. We can work better with universities and industry to outsource some of the things that might be better done there, but this is an opportunity for that.

Professor Chappell: There are difficult trade-offs, particularly in health and care, but we have to repeatedly show how R&D investment pays off. We have to do that by demonstrating the impact. That is why the return on the investment analysis piece of work that we did was so helpful to making our case.

As somebody who works in the NHS, I feel very strongly that we cannot just carry on doing what we have always done. We have to improve, innovate and evolve our health and care system, and R&D is the driver to do that. For example, everyone is familiar with R&D driving new interventions, but we should also be asking what we can stop. We have done some evidence collections. For example, if you have a hip



replacement, you can safely stop routine follow-up from one year to 10 years because it doesn't add value. It is identifying, as a different example, where we can do replacement pathways rather than just additive pathways. It is very easy to think of health and care as layering one thing on another, but, if we look at AI, we have huge opportunities in doing replacement pathways. That is R&D where we can really show our value. If you look at the switch from treatment to prevention, that should be powered by evidence.

The other aspect of this is where R&D supports growth within health and care—for example, supporting industry investment in clinical trials and thinking about how we produce a healthy workforce and tackle the issues around productivity, both within health and care itself but also addressing some of the big challenges, whether it is in musculoskeletal disease or mental health, where we improve the productivity of the country. There are also areas like health security whereby, investing in R&D that helps us to plead with MOD colleagues to look at health security, we can drive that.

The budget for DHSC is around £200 billion. While the DHSC R&D budget is seen as one of the most generous ones in government, if you look at it as a proportion of our total spend, it is absolutely essential that that R&D investment continues to drive improved outcomes for the future.

Q21 Dr Gardner: I think you may have hinted at some of your spending priorities. My next question will be about your spending priorities in the upcoming spending review period. In answering this question, I will in all niceness explain that previously I worked at a DHSC-funded project with NICE. From year to year we did not know whether we would get the funding. Even with three-year projects, they are just about to take off, funding is cut and something new comes along. There is a bit of wastage in that. In your next answer I would be quite interested to know what you want to continue to fund to make sure it really does get beyond that initial stage, and any new initiatives. What are your spending priorities for the next spending review period? I will start with Professor Chappell this time.

Professor Chappell: It is a crucial question for this Committee because you very well illustrate the difficulties with on/off funding. We consider that it is a real strength of the UK Government to do sustained longer-term infrastructural funding that gives our amazing scientists and researchers some of that certainty. That does not mean we keep inefficient and ineffective research running. We have ways of terminating contracts, but the funding towards our infrastructure is crucial, and that infrastructure includes our talent base. I was at a JP Morgan healthcare conference in San Francisco a couple of weeks ago where the global CEOs really rated that. One of the reasons we will attract inward investment in the UK is that investment in our infrastructure, and that is where we work very closely with UKRI.



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So there is that foundational science. We should see it as insurance against emergencies, shocks and pandemic preparedness for biosecurity, because, if we switch that off, we would not have been able to do what we did in covid and be the world leaders for therapeutics, vaccines and other areas.

We are still able to pivot to incoming Government priorities under the R&D funding arm of DHSC. I see that as a crucial part of my role. For example, we have explicitly done that against both the missions in terms of the goals but also against the shifts: so hospital to community, analogue to digital, and treatment to prevention. We run that sort of blend of sustained longer-term infrastructural funding with that ability to pivot.

Q22 **Dr Gardner:** Over to Dr Joad.

Dr Joad: Perhaps I could pick a few examples out—

Chair: I am afraid we are going to have to move on quite quickly. Perhaps you could give one example.

Dr Joad: There are things I need to pull through into service; you talked about direct energy and quantum; we talked about hypersonic weapons. Those are all things that have come out of long-term research sustained over probably a decade or 15 years. I need to finish those off and pull them through. At the same time, as we think about the generation after next, I have to start filling the cookie jar with new stuff as well. That is my challenge in terms of what I have to sustain.

Q23 **Dr Gardner:** Briefly, Professor Johnson.

Professor Johnson: DSIT funds a large number of long-term commitments, including within the infrastructure for science and engineering in the country, so the room for manoeuvre is relatively or surprisingly small. I think the main priority for DSIT is to maintain those commitments but also have the space to innovate through Aria, through the missions and the 10-year commitment that we have been instructed to develop for funding, which takes away that short-termism for long-term basic research, which I think is essential. It is that mix.

Q24 **Dr Gardner:** What can this Committee do to ensure that the spending review supports science? Very briefly, what would you like us to do to support it?

Chair: One word.

Professor Johnson: One word? I can give you six: call us back in six months.

Dr Joad: That is great. I wouldn't add anything more to that. Show your support and interest. That is all we need.

Professor Chappell: Champion the value of R&D.



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Chair: Great. Thank you very much for your answers. I will ask Emily to take us on to the next question.

Q25 Emily Darlington: I am really conscious of time, Chair, so I will try to ask these questions quite quickly. They are concerned specifically with the MOD. Obviously, we have the strategic defence review coming. What has been your role in that? What is the role of R&D in that? Linking it with the defence futures work that has been done by the MOD, how forward-looking is it within that R&D timeline and horizon as to future threats and opportunities?

Dr Joad: We wrote a piece to go into the defence review. That was all about what things we thought the MOD had to do now, frankly, to make the best uses of opportunity in the technology space. We have talked about quite a lot of them already in that sort of area. We have been very involved in that. We have given evidence to the reviewers in that sort of space. One thing that has certainly come out is getting the balance right in keeping things stocked up, long-term things, but also the geostrategic situation is pretty bad. There are some things that, frankly, we just need to get on and do. One thing coming out of that is how we work much better with the diversity of our supply chain. There is stuff in there concerned with how we do a better scale-up and manufacturing of our R&D going into that, as well as all the other things we talked about. It is very involved in that sort of space.

Q26 Emily Darlington: That leads me on well to the next question. I am part of the Armed Forces Parliamentary Scheme with the RAF. It has been really interesting to me to see the co-location of so many industrial partners on each of these sites in terms of development. There are key supply chains like microchips that people do not even know are there. I think Huawei owns 75% or 80% of the patents on the microchips for 5G enabled. How do you see the development of that strategic industry in the UK, particularly in relation to security around the stuff that the MOD and our intelligence services are developing in terms of those interoperabilities?

Dr Joad: I think you are right. Quite a lot of work goes on in the MOD worrying about the robustness of its supply chains, and it is not just in some of the technologies that you might mention. Electronics is a classic example and we have talked quite a lot about AI and that sort of thing. But there are even some specialist chemicals in the CB world and, frankly, there is only one place you can get them. MOD is looking at all of that process in terms of its supply chain.

There is also something in there about deciding where you get the biggest payback for your investment. We are not going to onshore the world's global supply chains; that is just not going to happen. We have to be quite selective about where we invest our money, and that is to do with things like the impact of lack of diversity in the supply chain and its fragility. Quite a lot of people are looking at that in the MOD at the



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moment. Do we have the answer to that? Not yet, but that is what we are working on.

Q27 Chair: Following on from that, specifically the Ministry of Defence's CADMID cycle—the concept, assessment, demonstration, manufacture, in-service and disposal cycle for procurement—does not have innovation in there. How quickly can you draw through from low-technology readiness to deployment? Is the procurement cycle supportive of drawing through innovative, new and potentially British-based providers?

Dr Joad: At the moment, there is a piece of work going on in the MOD called the integrated procurement model. That is trying to address some of those issues about how you pull things through quickly. In particular, a lot of it is majoring on how you do spiral development or acquisition. What I mean by that is that, rather than buying things in one go, how do you buy things and then do the technology insertion? The advantage of that is that it helps our supply chain. The problem is that, if you have a very spiky procurement of things, that is a very difficult business model for companies to deal with. So there is work going on in that space. I am sure that Chris is really eager to jump in.

Professor Johnson: I promise to be quick. It is important to see the CSOs as a network and we support each other. Some of those questions about semiconductors are front and centre of what DSIT does, and we work with MOD colleagues in that space. I would also point the Committee to some of the funding schemes within UKRI that are supply chain-focused and are specifically about pull-through. An example would be that both nuclear fission and nuclear fusion are supported by research grants where there is a nexus that goes from Harwell through Oxford, all the way up to Cumbria. That makes a huge amount of sense to me in being able to do exactly what you are suggesting in terms of having the very best science leading to deployment in areas which have a big impact on the economy, or should do. That is within UKRI funding.

Q28 Emily Darlington: Just to close that off on the MOD, first, do you think Ministers properly understand some of those strategic risks in terms of supply chains and where you are getting materials and the opportunities? Secondly, in the strategic defence review, are we going to see some of this absolutely laid out? I know you say you suggested some stuff, but does this form part of the strategic defence review that will eventually be published?

Dr Joad: I cannot say exactly what is going to be in the defence review until it has been published because I have not seen all of it. It talks quite extensively about the need to have an integrated set of capabilities, and part of that is integrating the contribution that industry makes. All these things about changing our procurement models and the way we engage with them, being much more open with industry and saying, "These are our problems. How can you help us?", because that is the way we get stuff back, have all been themes in there. In terms of your specific



question, I am afraid I don't know, but those are definitely the themes that have gone in.

Q29 **Emily Darlington:** Do you think Ministers are aware of some of these?

Dr Joad: Yes.

Chair: Great. Thank you very much. Steve will now ask a very important question. I know we are running out of time, but it is important that we spend some time on this. We do not have to finish exactly at quarter to.

Q30 **Steve Race:** Thank you, everyone. It has been a really interesting panel so far. I am going to ask two questions together so that I can just pass them both on to you, and I will start with Professor Chappell. We talk about the UK being a science superpower. There is some debate about to what extent that is true, but, obviously, we want it to be true. What are the capabilities from skills to investment elsewhere that we need in this country either to get to or maintain our capability as a science superpower? Secondly, I want to touch on sovereign capability. We have slightly skirted around the topic there. Within your respective areas, where do we need to do more to develop sovereign capability so that we are successful as a nation in the future?

Professor Chappell: I will start, but, actually, this could not be more of a cross-cutting issue if we tried. While I can talk about skills and investment for health and care research and for our wider workforce, the responsibility for skills and some of that investment will sit firmly with DSIT. As CSAs, we have responsibility for our sector, but we also very much look to DSIT for the overarching perspective.

From a DHSC perspective, NIHR chooses to invest in equipping the health and care workforce for every person—whether in secondary care, primary care, social care, social work or public health, nurses, midwives and allied health professionals; anybody who is delivering health and care should see how they have a path in research. NIHR has run a number of campaigns such as “Shape the Future” and “Your Path in Research” that really encourage everyone on the frontline and in any aspect of health and care to be part of that. I would argue that it is not just from the workforce but we should be doing a big pull from patients as well asking for participation.

As an example, NIHR funds employers for the Research Delivery Network, RDN, which is our funding of about 11,000 individuals across all our hospital trusts and in primary care, and in some agile delivery teams to go out and deliver research. That is a resource that is not just for NIHR studies but for UKRI, charities and industry; it is seen on an international level as a highly enviable way. Rather than the short-termism of hiring and firing for each grant, you have a much more efficient workforce and you are investing in your people. If we look at recruitment and retention in health and care particularly, we know that those who are research-active have lower burnout and higher satisfaction. Then there are broader



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areas about investing in our science base, which we do particularly through our experimental medicine, our biomedical research centres and our healthtech research centres, and much of that foundation infrastructure investment that we touched on.

Do you want me to go on to sovereign capabilities, or do you want to hear from colleagues first about skills and investment?

Q31 Steve Race: Do sovereign capabilities and then we will move on.

Professor Chappell: Sovereign capabilities, again, is a very shared area. In fact, I could name several. The Government CSA team in GO-Science is seen as a shared endeavour. We could talk about high-containment laboratories or sovereign capabilities in AI. Both of those areas are very much cross-cutting. We have to ask ourselves why we are seeking sovereign capabilities. What is it about that area? We have heard about other critical technologies such as quantum and engineering biology. Are we going to be doing it all? Should we look at the UK's competitive advantage? I really welcome the work by GO-Science, which is choosing to take a strategic look at sovereign capabilities rather than a chasing-the-ball approach. Those are examples where we can only do them in concert across Government rather than taking a deeply departmental view. I am happy to pick up any of those. I think they are very much shared, and also the GO-Science approach is one where we need to show followship as well as leadership. We need to take responsibility for our particular area and contribute across all of these to look at the pull-through—for example, quantum for health.

Q32 Steve Race: MOD.

Professor Mather: I believe we are a science superpower at the moment, but there are some threats to that. University finances and university funding models are one of the threats. That is outside our remit within MOD to sort out. That is very much a cross-government issue. I would re-emphasise that all these skills things are completely cross-government. We are very good at ideas but not as good at pull-through in terms of getting into industry. We are getting better. There are specific funding streams on that. That is something I would definitely concentrate on.

There are some specific skills things within MOD that are a challenge in using the university sector to deliver. Part of that is security and nationality. If we want to be able to skill up people, we need them to be UK nationals rather than skilling up the world.

I will give you an example. We looked at radar skills a few years back and found that the majority of master's students in this country being trained in radar were Chinese. You can draw your own conclusions from that and think about some of the issues that we might have down the line. We are absolutely cued in to the skills agenda. The MOD funds about 130 PhD students every year in our critical areas.



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Coming back to the SDR, which Emily mentioned, one of the things we are expecting as a strong output from SDR is working more closely with the universities and UKRI. It is music to our ears. We are happy to do that, we want to do it, and it is a great opportunity to have that extra impetus as well.

Regarding sovereign capabilities, I think I have already touched on some of them. They keep me awake at night. They are incredibly important, and getting the skills for those is also incredibly important. We are about to have a push on our skills training in this country on nuclear. We are also talking about ChemBio and how to skill people up in that. I could give you some other examples. I also really welcome Lucy's comment about international collaborations. Something that is very important is for us to look at NATO and which parts we should deliver compared to our NATO partners. Of course, there is lots of discussion about that right now. AUKUS is also an exciting, relatively new opportunity. Thank you.

Professor Johnson: The sovereign capability issue will be addressed and is being addressed, but it is really important that we keep clarity over what distinguishes us from other countries and what makes us unique in our science and engineering endeavour. It should be a real focus not so much on technology but also on ethics and what we believe in terms of the value of the application of technology and who we are. The issues of fairness, transparency and equity permeate almost everything that we do with technology. If we get that right, we have a message that we can transfer into schools, which will encourage the next generation, that science and engineering will have a meaningful impact on people's lives.

I am a machine learning specialist working in safety critical systems. If we do not do that, we run the risk of devaluing everything that the country has achieved to this point. Whether you talk about machine learning, autonomous vehicles, healthcare equity or regional and devolved status, these are the values that define us. People ask me what the measure of my success is. At present, the public attitude to science says that 70% of the public approve of our R&D spend. I have taken over responsibility for, or the sponsorship of, that survey, and I hope if you invite me back in six months it will be a larger figure who approve of what we are doing. Thank you.

Chair: Thank you very much. I speak for the whole Committee in saying that I found your answers very illuminating, and I have a much better understanding of the important role that chief scientific advisers play. I am very heartened to hear of the way in which you work together and the values that you represent. We have not been able to talk very much about the diversity in terms of gender, race, disability and so on of your respective Departments and their science staff, but we will write to you. I am sure you share our ambition that science should represent the people of this country in those respects. We have really enjoyed having you speak to us.



I feel that you are not dissidents. You are wearing a hat of being outside and inside your Departments at the same time, which is very important. I also thank you, Professor Johnson, for bringing up DeepSeek. I do not believe that the Treasury should take the model of being able to develop technology for a 100th or a 1,000th of our existing technology in terms of the spending review that is coming up. I hope that the Treasury will be listening to and reflecting on the concerns that you have set out. Thank you very much.

Examination of witness

Witness: Professor Dame Angela McLean.

Q33 **Chair:** Welcome, Dame Angela, to this public session of the Select Committee on Science, Innovation and Technology. We have just heard from departmental chief scientific advisers for the three biggest science-spending Departments in the Government. We are very pleased to welcome you, as the Government's chief scientific adviser, to the Committee. Thank you very much for sharing your time with us.

You were appointed, Dame Angela, in 2023, and there have been a lot of changes since then, not least an election, and changes in the machinery of government. You have said that you were more interested in delivery than in the shifting and changing strategies and priorities. I looked at the org chart for scientific advice across Government, and I had to flee to the simplified version that was delivered to this Committee a couple of years ago. Even from the simplified version—you can see from a distance that this is what I am talking about—it is incredibly hard for me as an outsider to understand how scientific advice can be co-ordinated across the Government. It must be challenging for you to keep a grip, if you like, on scientific advice and all the new strategies while focusing on delivery.

Could you just talk a little bit about how you manage to focus on delivery in a shifting scene with the complexity of the scientific advice, as we have heard from the chief scientific advisers and as we see from the organisational information that we have?

Professor McLean: Thank you very much for that. That is a great opening question. It does not feel complicated where I sit, and I hope you can see that I have good reason to have great confidence in my network of departmental CSAs. They do not directly report to me, quite correctly. Each one of them reports to their own permanent secretary or elsewhere into line management in their Department, but they all have a dotted line to me. I sit on the appointments panels for them and I meet with them regularly. I meet with them every week as a group and frequently individually. I view them as mine.

My job is to make sure that excellent science advice is at the heart of all decision making in government, and, of course, most of that is delivered through the departmental CSAs. As you heard from them, sometimes things arise that are really better handled at a cross-Department level.



That is the first rule for GO-Science: when should we get involved? When things are deeply pertinent to more than one Department at a time, that is when we think GO-Science is needed here; let us get in there and help them to be co-ordinated. I hope you can see from the way they interact together, even though Chris has only been here for a few months, that it is very much a team. So, yes, it is a complicated requirement, team response.

Q34 **Chair:** Great. How do the new Government and the changing strategies affect delivery of your priorities?

Professor McLean: The mission-focused Government is an absolute gift to us. Before the change of Government in July, we were already working together across the CSA network to map how R&D in different bits of government fitted together. We had had to make up our own categories. When a new Government arrived and said, "Right, here are the five missions and the few underpinning ones, including defence and security," that was just like, "Okay, great, we'll work with that." We straightaway wrote from GO-Science to the SROs of the five mission boards saying, "We want you to have one"—

Q35 **Chair:** SROs?

Professor McLean: Senior responsible officers or owners; probably owners. I am displaying my MOD background. Basically, I wrote to the senior civil servant in charge of each of the missions saying, "I want you to have one, or sometimes two, CSAs on your mission board," because as soon as we got this cross-cutting set of tasks across Government my departmental set of CSAs needed to get embedded. That is how we would solve what I would view as a many-to-many issue. Each of those missions needs to be talking to many Departments. I already have a team of CSAs. I can just put one CSA, or sometimes two, in each mission to reach out to the others who they know.

Some mention in the last session was about how we have been using missions as a source of focus for R&D in the SR. I must admit that, for me, this is one of the favourite bits of my job. We hold mission boards—we are on the third round of those now—for each Department's SR bid. Spending review bids will still go in from Departments, but we want to make sure that they are well aligned, properly prioritised and evidenced across Departments, and we have been using missions, basically, as a focus to do that—missions and defence and security. We have a separate one on adaptation as well. We have done quite a big pivot towards using missions as an organising principle for cross-government R&D.

Q36 **Chair:** Great. Does that mean that you will consider the achievement of those missions as part of your key performance indicators in terms of this Committee holding the science advisers to account?

Professor McLean: Yes. At this stage, the question to ask of missions is, "Have you focused on what are the R&D requirements for this mission?" What we need is for mission boards to say, "In order to deliver our



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mission, what R&D do we need, what has already been done, and what gaps are there that still need to be filled?”

Q37 **Chair:** I have a quick question before I hand over to Adam. We heard from the health CSA that their R&D budget was £2 billion out of £200 billion. That is 1%. As we know, the Government’s overall science spend is over £20 billion, which was protected in the Budget. Do you have a view—yes or no—on whether the country is spending enough on science?

Professor McLean: No. That is like asking a farmer if the weather is good enough.

Q38 **Chair:** So you can’t answer the question.

Professor McLean: Any GCSA would argue for strong spending on R&D. I would not be doing my job if I did not do that. At the same time, I recognise that we are in a constrained fiscal situation.

Chair: Thank you.

Q39 **Adam Thompson:** Good morning, Dame Angela. Thank you for joining us today. Shortly after your appointment about two years ago, you talked about meeting the leaders of the 10 strands of science and technology framework, and you made a statement about understanding the blockers to delivery. In the couple of years that you have been in post now, what have you learned about the blockers in government?

Professor McLean: This issue of working extremely well within Departments and it being more difficult across Departments is a blocker. I was an academic before I came to work in the MOD in 2019. There are all these jokes about how academics spend their whole life flying around the world talking to the same people but in different places. There is a wonderful set of novels about it. What that is about is making sure that everybody is up to speed with whatever is going fastest. It is basically about careful and respectful copying so that you learn from the person who is making the fastest advances.

I see less of that here in the civil service. What I see in the civil service is an incredibly strong culture of collaboration that happens in a different way. Great civil servants do it with cups of coffee and telephone calls. They spend a lot of time checking in with each other, but I don’t see a strong conference culture. Perhaps that is not the right way to do it. I think we could spend more time networking, hence my—and GO-Science’s—big investment in time on keeping our networks strong and together.

Q40 **Adam Thompson:** Great, thank you. That is fascinating. It sounds like you have had some good progress in dealing with that blocking thing that you identified a couple of years ago. To what extent are you working on improving that collaborative nature? Is there anything that you think we as a Committee should be examining in dealing with the blockers?



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Professor McLean: It is not my thing, but missions are per se cross-government missions. They are an attempt to get across Government in order to solve the real problems. Gosh, if you would ask missions what they are doing for R&D, that would be fantastic.

Adam Thompson: Okay, brilliant. Thank you very much, Dame Angela. That is a wonderful call to action for us.

Chair: We will.

Q41 **Dr Gardner:** I want to move on to science and technology for resilience and dealing with the risks that we face as a country. You have talked about building foresight capacity across Government and having the “right data, the right science, and the right experts”. Which of those areas needs the most work?

Professor McLean: What did I say? The right data—

Q42 **Dr Gardner:** You said right data, right science and right experts. Which of those three?

Professor McLean: Of those three, gosh, I would say data is a fundamental substrate—I know everybody always says that—but especially the right data. There is an old saying now about data being the new oil. Over the years, we got really good at using all of oil, didn’t we? We ended up hardly throwing any of it away. We had even figured out how to turn the really cruddy black stuff into roads. I do not think that is true at the moment with data. Having the right data is a big issue. Actually, it is a real strength for us as a country. I think having the right data requires you, first of all, to be clear about what your question is. What is my policy question? What science questions arise from that policy question? What data and analysis, which would include some modelling, am I going to have to use to answer the policy question that I need to get at, sometimes very quickly, from the data that I have? If you do not have the data, there is no workaround.

Q43 **Chair:** Just on that, similarly, there were many concerns about the way in which oil has been extracted from both countries and people, and the development consequences of that. Is there a concern about the extraction of data as the oil of today?

Professor McLean: That is a super question. Whose data is extracted? We need to take our citizens with us on the move to the way the future will be, as data is gathered in many ways about all of us. Citizens have every right to ask, and should ask, questions about who is using my data about me and what they are doing with it. Our responsibility is first and foremost to our own citizens. We should also ask those questions about all citizens of the world.

Q44 **Dr Gardner:** That links to the follow-on question, so I am glad you mentioned data. I want to quickly touch on the National Data Library. Will that give us the right data? I was going to ask about the assurance to



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citizens as well as looking at where we might be missing key data to deal with certain issues. How involved have you been in the development of those proposals for the National Data Library?

Professor McLean: That has more been assisted by my trusted colleague, Dave Smith, the national technology adviser. He sees the National Data Library. It would be a great idea to have a conversation with him about it. I have pretty strong opinions about data. My working academic life was as a mathematical modeller. We can do nothing without good data. You would know about that, too, from your previous professional life.

We should think about our history as fantastic gatherers and curators of data. I will give two examples of that. One is the Ordnance Survey. A map is a fantastic way to visualise deep and complicated data about place. Another would be the Met Office. One of the things that I sometimes say more often in this building than elsewhere is that I am not sure everybody realises that not every country has a Met Office like ours. We are very lucky in that we have two amazing sets of weather forecasters and climate understanders. That is an absolutely fundamental gathering, curation and analysis of data that has gone on to provide an absolutely vital service about what the weather will be like tomorrow, and now about what the climate will be like as it changes in the future.

Q45 **Dr Gardner:** That links quite nicely to addressing risk, developing our resilience and understanding our risk strategy. What external experts do you have to create a system to feed up the risks within Departments? Has this made progress? What mechanisms are in place to ensure that scientific advice about risk and preparedness feeds into policy making and budgets?

Professor McLean: Very good. I expect you know that the National Risk Register now updates itself on a rolling basis. It used to be something that got written and not looked at continuously. It is now continuously updated. We have just recently put into place a set of expert science advisers for that process. That is a Cabinet Office exercise that has been done with help from us in GO-Science. That is about the ask that comes from module 1 of the covid inquiry, which says, "Well, hold on a minute. You need science advice day in, day out, not just on the day that the disaster crystallises."

I met with the chairs of those groups of experts last week or maybe the week before, and they were in the Cabinet Office doing a similar job to what CSAs do, specifically as expert, scientific, critical friends for the risks in the National Risk Register. The big new thing is that the risks are continuously updated. The second thing is the arrival of the objective advice.

Q46 **Dr Gardner:** I have a final quick question on that. We partner with the private sector quite a lot, and a lot of our risk with the private sector is that they are not as prepared as they should be. What is the relationship



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within government and the private sector that we partner with to make sure that they have that infrastructure to be resilient?

Professor McLean: That is a great question. I am struggling with that one. What do we do with the private sector?

Chair: You can write to us.

Professor McLean: Okay, I can write to you. Thinking back to covid days, we worked closely with the private sector. They were fantastic providers of data for us. We were desperate to know about human mobility, and we got that data from the private sector. In terms of companies' own resilience, I think they would get more of that—I shall write to you.

Chair: Thank you very much, Dame Angela. We have to move on, but I know that Lauren and Emily have quick interventions now.

Q47 **Emily Darlington:** Picking up all those strands and bringing them together into that original question about building foresight, we have several different foresight activities within different Government Departments. How much do you think that those horizon-scanning insights get brought together and there is an understanding at Cabinet level?

Professor McLean: That is a very good question. We have a foresight unit within GO-Science, and they are very active in running the networks of people who work on foresight right across Government. I gave one of my prizes to that unit at our GO-Science awayday last year because they had done a fantastic job of taking what used to be their face-to-face training and turning it into an online service so that it could be much more efficiently delivered right across Government. I have here—I could dig for it if you like—the number of people who have been through that training. The point I would really like to get to is that we are very mindful that lots of bits of government are very interested in these skills, and we have had so many that we have had to change the way we deliver them. They are well networked via GO-Science. GO-Science runs that network. Do I think Cabinet Ministers are aware? I think Cabinet Ministers will be aware that they have foresight units within their Departments. The single Department that I know best is the MOD, and, for sure, MOD Ministers would know about the foresight units inside the MOD.

Q48 **Dr Sullivan:** You touched on data and the explosion of data and right data. It has often been said that we measure what we value and we value what we measure. There are pockets of missing data, and sometimes the human experience cannot be captured through numbers. How do we reach through that and beyond that to identify those bits that we really need to change to make things better?

Professor McLean: Talk to people. I do not think data replaces the need to listen to what people need. I would very specifically say, "Talk and listen." I should not have said talk to people; I should have said listen to



people. That is a really important part of missing data—things that are not captured despite so much being captured about our everyday lives.

The reason I emphasise so much starting with the question you are interested in is precisely for that. If you just gather data willy-nilly, you end up with the data you have. It is much more important to start with: what question did I want to address; therefore, what do I need to know? That is the point at which it becomes clear that I do not have that bit of data. We used to call them the ingredients lists. Imagine the model is some kind of a recipe. Every recipe comes with an ingredients list of the things that you need to know. I think those ingredients lists are very important.

Can I riff on this a little bit? It should be a national data larder, not a national data library. You take many different things from a larder to put them together into a recipe, don't you? It is quite unusual that you would just take one packet out of your larder and make something useful out of it. A larder also requires a lot of looking after. If you do not look after a larder, all sorts of terrible things happen, but I don't think I am really going to win on that one.

Chair: It sounds like you have the Committee's support in that. We will see. Now I am going to ask Martin to take us on to R&D spend.

Martin Wrigley: Yes, but I am still thinking about the larder.

Professor McLean: It is nearly lunchtime.

Martin Wrigley: That is obviously why. Yes.

Chair: There you are there then.

Q49 **Martin Wrigley:** Clearly, your library is Dewey Decimal. You are categorised. You are put in a pigeonhole. You are put on a shelf. You are siloed. In a larder, you are not. Interesting. Thank you for that. Sorry. I will go back to—

Chair: R&D spend.

Martin Wrigley: —R&D spend, which, interestingly, has the same sorts of concepts, I suspect, we have been looking at trying to understand R&D spend across the whole Government. Do you think we have, collectively, sufficient data on R&D spending in general?

Professor McLean: It is quite a civil servicey answer. We have much better data than we used to have. One of the things that DSIT did in its first year was create a list of who was spending what. Interestingly, when I saw that list as Government chief scientific adviser, it had more detail in it than I had ever seen as CSA in the MOD about defence. So it is better—forgive me for being a cracked record. It is not in a great state across Departments. Gathering it up into a way that we can share it across Departments, which clearly we must do, is a lot of work. It is



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probably quite a long project to get it right. Therefore, we should think about why we want this data in order, to decide in what order we are going to ask Departments to do the work to get this data into the state that we need it to be in.

For example, I think a bad question is to ask Departments how much they are spending on AI. Sometimes it is useful to substitute the word "statistics" for "AI". Be very careful when you do it. We would never ask that question. You would think, "Oh, that's a daft question, because there will be that sort of analysis woven through everything that everybody does." One of the questions we would love to know is where our R&D money is being spent, but then you ask, "What do you mean by 'where'?" We want to know where the person whose job is supported by this R&D is actually working. You have to be very careful not to just get the invoice address and that sort of thing.

The short answer is that it is better than it was. There are still many ways in which it could be better. I think there is an important prioritisation question about what questions we want to answer next. Currently, basically, what we have is by Departments, by years, and with some subdivisions within Departments, but not very fine-grained.

Q50 Martin Wrigley: That is interesting, thank you. It is nice to know that nothing changes. I spent many years building data warehouses out of relational database systems and trying to combine things to ask sensible questions, which is very much, "What is the question that you want to know?", which is where you started.

You have talked about your foresight units, which is fine. The question I always like to ask people is: what does success look like? That is the classic one, because that determines where you are at. I live in a town called Dawlish. You may know Dawlish from the railway line. You may also know Dawlish for its black swans. I am interested in black swan incidents. That is kind of interesting. In your role, how are you prepared for those? In terms of what success looks like, what does success look like for what you can currently predict, which is relatively straightforward and relatively in the box? How are you taking real innovation—black swan moments coming in, from "move fast and break things", real disrupters coming on board, or a Chinese AI system suddenly appearing out of nowhere?

Professor McLean: Very good. We use horizon scanning of various kinds to watch out for, particularly emerging technologies and emerging risks. There are quite well-established horizon-scanning mechanisms. They tend to be by risk. They will give us warnings of bad things that seem to be going on in other parts of the world. If there are bad things going on here, we would know about them. There is plenty of horizon scanning for technologies, for risks and for ideas.

You have met some of the CSAs. All of them will have a mechanism to reach out into what I would call their own proper generating



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communities, which will be mostly academic communities. Tamsin and Nick talked about DSEC, the Defence Science Expert Committee, which is a set of scientists who are cleared to know really quite a lot about defence and just bring in from all over the place what is going on in their field. I sat on committees like that where at each meeting there was a tour de table and each member of the committee was asked to tell the others, and particularly the Department, about a weird and interesting thing that they had seen recently. That is one of our own in-house mechanisms. We also use wider ones that are available.

The other thing that we can do is be well prepared generically, to know how we will, first of all, gosh, talk to each other if something bad happens. The ones that make us very nervous are the ones that knock out communications. I have copies of what we call our golden hour documents. I live both in London and in Oxford. I have printed-out copies of those in both homes—

Chair: Low-tech.

Professor McLean: —to guard against the day that comms is gone.

Chair: Thank you very much.

Martin Wrigley: May I ask two very brief questions?

Chair: We are running out of time.

Professor McLean: I promise brief answers.

Chair: Very quickly, Martin.

Q51 **Martin Wrigley:** Okay. I am interested in how you stop projects and stop teams. I am also interested in the effectiveness of R&D tax credits.

Chair: Two great questions.

Professor McLean: On the effectiveness of tax credits, I am going to write to you, because you probably need numbers for that, and I do not have them to hand.

How do we stop things? We look at whether they have had the impact that they wanted. If they have not, they stop or they go on notice that they are going to stop.

Q52 **Chair:** Regular project reviews or something.

Professor McLean: Yes, we have them.

Q53 **Chair:** Thank you very much. Thank you very much, Martin. I am just going to briefly ask you about growth—going for growth. You mentioned it yourself: the missions; the importance of growth; the importance to our country and to this Government. I have two related questions.

There is a lot of emphasis on innovation driving growth. We have an



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inquiry on innovation, growth and the regions. What is the link between innovation and economic growth? Is there a robust evidence base for it?

Professor McLean: As part of our work on technology adoption, we have been told by academics that that link is not that robust.

Q54 **Chair:** I found it very difficult to find an evidence base for that.

Professor McLean: At country levels, you can see that countries that invest well in R&D get good growth, but it is very hard to untie where that link is. You can get case studies. You can say, "Here's some money that went into this particular innovation or R&D project, and here is GVA that I can attribute to that." That is about as far as it goes. I think it is for the following reason: it is not usually a straight pipeline that goes from, "I invented a thing, I developed the thing, I got my way across the valley of death, and then I drove improvements in productivity this way." Certainly, you would see in the MOD that things that got invented 20 years ago were sometimes so clever that nobody knew what to do with them, and then they sat on the shelf for a while—fortunately, we had quite well-labelled shelves—and then suddenly you see what it is for.

Q55 **Chair:** Yes, there is a history of that to innovation in science. I do think it is important to build up that evidence base. I hope you would agree with that.

Professor McLean: I completely agree.

Q56 **Chair:** Excellent. On the Treasury driving growth, the Treasury does not have a chief scientific adviser at the moment. Rather, it has a director general. Do you think it is important that it has a chief scientific adviser?

Professor McLean: I would say it has a CSA. The DG for growth acts as the CSA in the Treasury. She is more of an adviser in some ways for the rest of the CSAs. It is the CSA in Treasury who helps all the other CSAs understand how to interact with Treasury.

Q57 **Chair:** Rather than providing scientific advice to Treasury.

Professor McLean: That is right.

Chair: That is very interesting.

Professor McLean: That is an important role, and we would not be without it.

Chair: Thank you very much. We want to hear from Jon and Steve—Jon first.

Q58 **Jon Pearce:** Thank you, Chair. Dame Angela, you have been asked to lead on the review of technology adoption for growth, innovation and productivity. I appreciate that it is still very early days, but what can you tell us so far? The previous innovation review looked at regulation. What other barriers will this review be looking at? Will it be considering the tensions between the risks and rewards of technology adoption?



Professor McLean: Thank you. You are right; that study is absolutely in flight. What I can tell you about it is that we are very clear about what it is going to address. It addresses the eight growth sectors of the industrial strategy. I won't bore you by reading those out. There are things like defence and advanced manufacturing plus six others. It is absolutely focused on UK companies. It is not about the public sector. It is about technology that you could have today. It is not about emerging technologies. We have been very clear about the boundaries of what we are going to work on.

The public consultation is still open. I mentioned a roundtable with academics who work on precisely this question, and who, as so often, are fantastically generous with their time and expertise, as are the sectors. First of all, I should tell you that I am doing this with Dave Smith, the national technology adviser. Dave has led on most of the sector roundtables. He has been going around the country holding sector roundtables to hear directly from people working in the sectors what the barriers to adoption are. We are hearing that delivery is probably going to need to be sector-specific. I might have to come back and say, "Oh, we changed our mind," but that is coming out pretty loud and clear. Of course, not surprisingly, costs and skills are barriers for any business looking to choose where to invest.

Q59 **Jon Pearce:** Great, thank you. I just want to move on slightly to a related topic. Shortly before the Budget, you wrote to the Chancellor about scale-up finance. Could you explain the background to that letter and the research behind it?

Professor McLean: Yes. One of the great things that GO-Science does—and it was all set up before I got here so I can shout about how great it is—is a really good set of data analyses about our comparative advantage in different technologies. It looks at 52 technologies in all countries in the world scored by a large number of metrics that boil down into four dimensions. You see in that data pretty much over and over again that we are really good at research. We publish fantastic papers that are highly cited and have a lot of impact. Actually, we are not bad at patents, and we are really quite good these days at spin-out. What we are bad at is growth. What we are bad at is the £100 million ask. That is the point at which our wonderful spin-outs from all sorts of places, not just from universities, go abroad. That letter was largely about putting a finger in that hole in the dyke, basically. That is the problem that we are set to solve.

Steve Race: Could I ask a follow-up on that question?

Chair: Yes, it is very important.

Q60 **Steve Race:** You have mentioned the Met Office already, which is based in Exeter, and we have the University of Exeter, and they work very closely together. We have a great spin-out culture developing because of that. Your letter did not reference regional scale-up funding and



financing. According to the BVCA, the south-west in totality, including Bristol all the way down, gets about 2.7% of all private equity and venture capital funding per year, which is minuscule. London and the south-west obviously suck up about 60% to 65% of all of that. Do you view the regional aspects of this as particularly interesting or important at all, or do you think it is a national challenge?

Professor McLean: I have heard that same issue referenced by the group of nine northern universities. Not really jokingly, I suggest they buy a helicopter.

Q61 **Steve Race:** They are quicker.

Professor McLean: Yes. One of my CSAs, who is not here today, worked in venture capital before he became a CSA. He is splendidly direct about the world of venture capital. He says they don't really like going very far. We can't move the south-west closer to London, but perhaps—actually, I think we should do something about it. I was very taken with your point about showcasing technologies. That is another thing we can do. We can bring some things to London, but largely it seems to me that we need to find a way to make it easier to get investors out to the regions, because we are not that big a country, let's face it.

Steve Race: The south-west is only two hours away.

Q62 **Chair:** Newcastle is only two hours and 50 minutes away. This is a very good point. I think 2.2% of venture capital goes to female-founded companies. I don't think you are going to suggest that they buy helicopters. There are clearly structural issues with how venture capital is distributed, and I imagine that is something that you are looking at.

Professor McLean: Yes. It was not in our letter. You are right; it ought to be addressed on the basis that there is probably a ton of opportunity getting missed there. At the moment we do not have specific schemes to address that, but I hear you.

Q63 **Steve Race:** Just a final point on that scale-up financing, I think I am right in saying that you are more likely to get foreign direct investment through venture capital and private equity into the regions than you are UK-based, which is really interesting—from America and elsewhere. They are more interested in the regions.

Professor McLean: Indeed.

Q64 **Steve Race:** I just want to touch on public trust. You have touched on it already about bringing people with us. It is incredibly important that we bring people along with us in terms of both scientific advances and support for spending, which remains high at the moment, which is good. As to actual deployment of technology like vaccines and then getting people into science as well through the skills pipeline, could you tell us what you think the biggest challenge is for science around that public trust to bringing people along with us?



Professor McLean: It has to be misinformation and disinformation, which is clearly a large and growing problem. I am making myself a hostage to fortune because I don't know the answer, but it is a big and important question. I used to think that getting sensible, evidenced answers out into the mainstream press where it would be referenced by social media was enough, and I don't any more. That is nearly as far as I have got.

The other thing that I completely recognise is that I particularly really do not know about social media. Many of us high up in various bits of Government are not native-born users of social media. I wonder if this is a place where we really ought to sit down with some younger people and listen to them. I am not a great fan of youth councils that are done in a performative way, but when there is a whole section of society that knows a ton more about something that is proving to be a problem than we do, I start to think that we had better ask some people who use this stuff all the time. But that is as far as I have got.

Q65 **Steve Race:** You should try to get on TikTok, except we are probably not allowed on TikTok, which is where lots of people are.

Professor McLean: I am allowed on TikTok on my own phone.

Q66 **Steve Race:** On your own phone, yes, exactly. Thank you. Just a final question from me. You lead a master class for Ministers, I believe. What is the most important lesson that you think politicians, Ministers and people such as us can learn about science, from your perspective?

Professor McLean: A good scientist will always try again to explain if you did not understand the first time. There is no shame in saying, "I didn't understand that. Could you please say it again?" That is really important, because there is a fair bit—it goes on all over the world—of people saying things they have heard elsewhere, perhaps particularly in technology at the moment because it is rather fashionable. People who are just repeating something that they have heard cannot explain it to you in different words if you did not understand them. It serves two purposes. One is that you might have a better chance yourself of understanding it, but it is also quite a good way of finding out just how expert this person is.

Chair: Yes. We have to normalise asking people, "What do you mean by that?" Science can be a cover for snake oil, basically. That is part of the job of this Committee. On your point about misinformation and disinformation, that is part of the inquiry that we have also launched looking at algorithms and social media in the wake of the riots, understanding how misinformation particularly is spread. While I hear what you say about not being in favour of youth councils, we need to find ways of getting the insight of this younger generation. Our "Under the Microscope" inquiry—another inquiry of ours—is asking people in general, including young people, what they think we should be looking at. I am sure that social media will come up there. We really need to hear what



young people are saying about these important issues—so maybe not a youth council but an evidence session or some kind of engagement.

Q67 Emily Darlington: I have a final question for balance. We asked this of the previous panel. You are the Government chief scientific adviser. When is the last time you saw the Prime Minister or members of the Cabinet? Do you feel that if you request to meet him or them you would get that meeting?

Professor McLean: The last time I saw the Prime Minister was in the middle of December. I am seeing the Chancellor a week today. They are not Cabinet Ministers, but I saw more junior Ministers in the Cabinet Office yesterday and DESNZ last week. I see Minister Vallance pretty much fortnightly. Yes, I do.

Chair: That is a really important question, Emily. As well as the change with the Government bringing the digital centre for Government into DSIT, everything that we have heard this morning emphasises the importance of scientific advice being understood, respected and acted on within each Department across Government. Having political support for your position to drive that through is very important.

That is a great note on which to end. Thank you so much for your evidence. You have been an excellent witness. We really appreciate you sharing your experience and your views with us. We hope this is the beginning of a very constructive working relationship.