

# Science, Innovation and Technology Committee

## Oral evidence: The work of the Government Chief Scientific Adviser, HC 1613

Wednesday 5 July 2023

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Members present: Greg Clark (Chair); Aaron Bell; Dawn Butler; Rebecca Long Bailey; Stephen Metcalfe; Carol Monaghan; Graham Stringer.

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### Witness

I: Professor Dame Angela McLean DBE FRS, The Government Chief Scientific Adviser (GCSA), Department for Science, Innovation and Technology.

## Examination of witness

Witness: Professor Dame Angela McLean DBE FRS.

**Q1 Chair:** The Committee is very pleased to have a one-off session on the work of the Government chief scientific adviser. Dame Angela McLean today makes her first appearance before the Committee in that capacity, although she has helped the Committee in her previous roles.

Professor Dame Angela McLean was appointed as the Government's chief scientific adviser on 20 February this year and took up her role on 1 April. She is the 14th Government chief scientific adviser since the role was created in 1964, and the first woman to hold the post.

Previously, Dame Angela was the chief scientific adviser for the Ministry of Defence. During the pandemic, she regularly attended SAGE and appeared before this Committee to give evidence.

Dame Angela is a professor of mathematical biology in the department of zoology at the University of Oxford and is a fellow of All Souls. Her research interests lie in the use of mathematical models to aid our understanding of the evolution and spread of infectious agents.

Welcome, Dame Angela. Congratulations on your appointment. Thank you for coming so early in your tenure to share your thoughts and plans with the Committee.

Given how recently you were appointed, and the interest of this Committee in promoting science and looking at how more people can take an interest in it, will you tell us about your background and how you first embarked on a scientific career?

**Professor Dame Angela McLean:** Gosh, yes, with great pleasure. I was thinking about that this morning. I think science is more or less my mother tongue. Both my parents are doctors. I think that my dad, frankly, would have been a biologist, but as an immigrant child, being an academic biologist was probably a bit unknowable, so he became a doctor, too.

I grew up in a house where we always talked about science and where looking at nature was part of what one did. I am still very happy crouched over a rock pool looking at what is going on, but it did occur to me, thinking about it, that there was this big debate about whether I needed to do Latin O-level—I am that old that I did O-levels—in case I wanted to do English at university. Actually, I ended up doing maths at university, and that served me very well in a career as a scientist.

**Q2 Chair:** Your route to this post came through being chief scientific adviser for the Ministry of Defence—not necessarily an obvious place for someone with your interest in zoology and biology.

**Professor Dame Angela McLean:** And in modelling and good use of data. Of course, you would really have to ask them, but I think that is one of the things I had to offer when I applied for the job: here is



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somebody who knows how you can use data and arrange through modelling in decision making, which is of course a bigger issue.

- Q3 **Chair:** I am interested in that because of what it illustrates. Sometimes, people think that if you become a scientist you specialise in a quite specific field, and that will be your field for the rest of your life. Those of us in politics are used to wearing different hats and taking an interest in lots of different subjects, but your career demonstrates that that is open to scientists as well.

**Professor Dame Angela McLean:** Absolutely. We quite often talk about T-shaped careers, where you start as very specialist in one thing. The great thing about that is that you know what it is to be a world expert in one thing—to understand one thing absolutely; but some people then choose to take that way of understanding and use it much more broadly, knowing that they will always have to turn to other people for the depth of knowledge in other subjects.

Quite often, when I talk to people in universities about whether they might be interested in playing some part in the advisory process—all sorts of people advise the Government—they say to me, “Yes, but my science isn’t something the Government really needs to know about.” I say, “Well, really what you are needed for is that way of thinking—that systematic way of using and challenging evidence.” That breadth is very useful.

Personally, I think that having depth in one thing is very useful, because in one way it means you can be very aware of how much depth there is under you, when you are out on the edges of the T.

- Q4 **Chair:** This is evidence week in Parliament. Lots of different scientific organisations are coming together to brief us and to inform us about their research and its relevance to public policy. Given your experience, what would your advice be to your academic colleagues on how they can best influence public policy from their field?

**Professor Dame Angela McLean:** First, do not think that writing scientific papers is the thing. Understand that you will have to put a lot of work into finding out what the policymakers need to know; it may not be what you think. That would be the first thing: really understand what the questions are and making some attempt to understand why your idea might be difficult.

Then you must spend the time getting to know the people who you hope will use your advice. There are a lot of ways to do that. Many of our Departments have science advisory councils—external people who might come in four times a year; or there are colleges of experts. I would recommend people look in those places. I have done that in the past.

There are all sorts of things. There is your Parliamentary Office of Science and Technology: we send lots of graduate students on three-month appointments there, very early in their careers, to understand how



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science and technology can be made available to law makers and other policymakers.

What else could you do? I would say that the main one is to understand that you are going to have to do a lot of work in order to reveal the thing that you think is important in a way that is useful to a different community of interested people.

**Q5 Chair:** As Government chief scientific adviser, you follow in a distinguished line of people. What do you hope to achieve during your term in office?

**Professor Dame Angela McLean:** Thank you for that invitation. May I take a few minutes to describe a few things that I am hoping to achieve?

**Chair:** Please do.

**Professor Dame Angela McLean:** Thank you. I thought I would describe my top five priorities: three structural issues and two subject-specific topics. The five topics are science and technology for resilience; the science and technology framework; a more scientific civil service; artificial intelligence; and climate change.

Before I get to those, let us remember what my role is. As GCSA, my role is to provide independent scientific advice to the Prime Minister and members of the Cabinet on aspects of policy and on science and technology, and to ensure the quality of scientific evidence and advice in government. That is a very broad remit. Nevertheless, I believe that the first duty of government is to keep our citizens safe, and for that reason, my first priority is to promote the use of science and technology for resilience.

We need to learn from our covid experiences to make sure that the Government are ready to respond to the next emergency. That includes having the right data, the right science and the right experts. I shall focus especially on understanding which risks in our national risk register are the ones on which scientific input can have the most impact. That includes building foresight capacity across Government.

I am interested to convene science resources across diverse disciplines from both inside and outside Government. We know we need natural science, behavioural science and data science. We need all those things so that we can build coherent plans that will be ready right through what we might call the risk cycle.

My third thought is that we must implement the specific lessons that will be learned from the covid pandemic and from some more recent exercises, to improve the way in which SAGE supports our country in a crisis.

The second priority is to support the Government in creating conditions where our citizens can thrive. Not surprisingly, my particular interest is in using science and technology to drive our nation's economic growth. We



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have the science and technology framework, the new Department for Science, Innovation and Technology, and the prime ministerially-chaired Council for Science and Technology. We now need to use these structures to support the Government in delivering their ambition to be a science superpower in 2030.

That is why this is an important time in our country for science and technology. It is a huge task. Fortunately, lots of people are involved in delivering it. I am going to focus on maintaining a really clear commitment to that delivery in the S&T framework. I can see three ways to do that.

First, I want to help SROs in each of the 10 strands of the S&T framework. I will meet them to hear how their work is going and what is blocking them and find out where I and my team can help. In fact, we are already providing them with rigorous independent technology assessments through my technology and science insights function.

Then I want to bring the CSA network to bear on that big set of ambitions. Remember: that is the standing network of senior scientists across Government, already embedded in Departments. I want them to help the SROs to push forward on delivery inside each Department. I have other networks of scientists where I have some extra, I'll call it privileged, access. For example, there is the science and engineering fast stream and the Government science and engineering profession. We can call on these scientists and engineers already across Government and embedded in government to help to deliver the science and technology framework from inside their own Departments.

The third thing is to get brilliant leaders and expertise from outside government to help to drive the framework forward, so I would use my engagement with the S&T community outside government—in academia, in business and internationally—to keep on growing awareness, convene people and support opportunities for partnerships.

We should remember that the S&T framework is about driving change right across Government. That is quite different from what can often be quite siloed ways of working. These networks of change makers—I mean, my CSAs, the SEFS, the GSE profession—are going to be essential if we are going to drive these changes across Government and then right out into the broader public sector.

When they get stuck, I can advise the Prime Minister, CST and DSIT SoS, so that we can figure out where we need to go further or align better, or perhaps change emphasis—because we should always remember what an ambitious whole-systems approach we have designed in the S&T framework. That is theme No. 2.

Theme No. 3: underpinning all of this, we need a Government with the skills, capability and culture to drive this big change. That is why my third priority is to support building a more scientific civil service. I want to build on what is already in place, including people, laboratory facilities



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and systems for science advice already in our Departments. I want this to get even stronger, with more people who are better able to ask for science advice and use it when they are given it, to use technology to innovate and, ultimately, therefore, to take the best-informed decisions.

How should we go about this? No.1: we should keep the CSA network strong. There are always about four CSA posts in play. Keeping on finding more excellent people who will come in and carry out those important jobs is a big task.

Secondly, I would like to find more ways to recruit STEM specialists into the civil service, making the most of cutting-edge expertise in academia, business and, of course, our own labs.

Then we need strong skills in how to ask for science and use it, everywhere—a civil service with scientific literacy at every level that looks at science as a key pillar right across all areas of policymaking. My fantasy is that I would like every permanent secretary to collar me and say, “Angela, how can I make my Department a great science Department?”

Those are the three structural issues. More briefly, there are two hot topics that I am working on now—and, I expect, always will be. The first is artificial intelligence. As GCSA, right at the moment my priority is to help to deliver the Prime Minister’s objective to establish the UK as a leader in safe and effective AI. I will do this by providing independent scientific advice, ensuring that there is breadth and depth of expertise supporting the foundation model taskforce, and providing constructive challenge for them.

Finally, the primary enduring science and engineering challenge for Government is climate change. Climate and biodiversity loss are both already well established as major challenges and our net-zero ambitions are an important part of facing this challenge. It is essential that we pay attention to adaptation and biodiversity loss.

The UK has a well-established system for climate change advice, most notably through the Climate Change Committee, so my role is to make sure that Ministers hear that advice and can draw on science and engineering right across the community to develop actions for delivery. I can help to achieve that with convening power, with the independence of my role and of GO-Science, by attending the Domestic and Economic Affairs (Energy, Climate and Net Zero) Cabinet Committee and through working with the CSAs and the Council for Science and Technology. The climate change agenda is the defining issue for our age and I look forward to working on it with you, and will welcome the opportunity for ongoing discussions.

Those are my five priorities spelled out. I hope that you will appreciate that these are still early days and I am still very much in learning and listening mode. I am interested to hear about your priorities and areas of focus. I am very keen to be able to work closely with this Committee, as I



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think that this interaction is an important part of the system to help us to establish and achieve our priorities.

- Q6 **Chair:** Thank you very much indeed, Dame Angela. That is very comprehensive. You are going to be busy, I think, if you are to discharge all those responsibilities. We are grateful for your offer to work with the Committee. We have had very good working relationships with your predecessors, and, indeed, you have been very helpful in your previous role.

Before I turn to my colleagues to go into some detail in their questions, may I ask one question about what is in the scope of your role? You are the Government chief scientific adviser. The research councils include those for arts and humanities and social science. Does your responsibility extend to the deployment of research in the arts and humanities, and social sciences?

**Professor Dame Angela McLean:** We are of course particularly interested in growing our capability for advice on behavioural science. That, of course, is particularly true in that resilience area that I talked about first. That is an area where we feel that there is a need to grow capability. That, of course, falls completely within the remit of that part of the research councils.

- Q7 **Chair:** What about the Arts and Humanities Research Council, for example?

**Professor Dame Angela McLean:** When we spend time with the research councils we always include the Arts and Humanities Research Council, partly because that approach to knowledge is so important for understanding how we will interact with our world as it changes.

- Q8 **Rebecca Long Bailey:** Thank you, Dame Angela. One of the priorities that you mentioned was unlocking our science potential in relation to growth, and another was resilience. Something that feeds into that is ensuring that we can develop new technologies and scientific discoveries at pace and at scale, but without compromising safety or environmental protection.

In relation to the pro-innovation regulation of technologies review that you and your predecessor have been undertaking, how will you support Government to ensure its successful implementation? Do you have any general thoughts around the review itself, and where it could go?

**Professor Dame Angela McLean:** It is coming along pretty well. Two had been delivered before I arrived—on digital tech and green industries. Since I arrived, we have delivered another two—on life sciences and creative industries.

It is worth going back and remembering what my predecessor Patrick Vallance said he thought were the five overarching problems. In many ways, they are certainly very interesting. One of those was fragmentation. As technology evolves and changes, it is not always very



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clear that the way we have set up our regulators matches the way new technologies are being developed.

There was also the issue of pacing. With technology developing so fast, it is hard for regulators to develop as fast. Remember: the regulator has to be developing as fast as the fastest of the companies at any one time.

Then there are skills: regulators require the same very in-demand skills as the companies that are developing new technologies. Another problem is incentives. We have rather complex patchworks of incentives that we ask our regulators to trade off. Sometimes, that can lead to prioritisation of risk minimisation rather than supporting innovation.

The fifth one is capacity. Resource constraints can mean that regulators do not have the capacity to innovate themselves—to innovate in the way they do regulation.

Those are five enduring themes that run through all the reports. As I said, we have just delivered two more, and the final two, on advanced manufacturing and cross-cutting issues, are in their final stage of being written by us.

So far, all the recommendations that have been put into those reports have been accepted, and many of them are already in development for delivery—I think that would be the best way to put it. At that point, I do not think that is my job any more, because I am an adviser. Obviously, one always takes a very great interest in what is going on with the delivery of advice. There was an overarching ambition that these things should be ones that can be changed reasonably quickly. So, yes, I am watching. Mostly, what I am watching is the delivery of the recommendations from the two before I arrived. The other two went in during May and June.

**Q9** **Graham Stringer:** That is a long to-do list, but if you get it all right and the reports and advice are perfect, you then have to deal with politicians. There was recently a survey of MPs in which they were asked, “If you flip a coin twice, how many times does heads come up?”, and 50% of the MPs got it right, and 50% got it wrong. I have asked a number of science Ministers over the years the CP Snow questions: “What is the second law of thermodynamics and what is the difference between weight and mass?” By and large, they do not get it right.

You have all this advice. How do you deal, when handing it over, with scientifically illiterate MPs and Ministers?

**Professor Dame Angela McLean:** Patiently. I spent my working life teaching biologists mathematics, which they do not want—until they realise that they do.

I think that the first thing to do is to try to set things up so the person you are advising understands why this advice is something they need. I think it makes it much easier for all of us to listen to something if we have some sense of why it would be useful to know it.



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The second thing I would say is that those of us trying to advise on science always need to hone our ability to be brief and find the right picture. One of the things that is super-interesting and quite difficult is visualisation. We often talk about data visualisation, but it is not always data. Sometimes, it is ways to visualise a scenario or something like that.

I take your question extremely seriously and I think it is very hard work. GO-Science also takes it very seriously. One lesson that we have all learned is that the 40-page report six months later is not often the right thing. Perhaps the thing I did not include is timeliness. Doing things at the right moment, so that you are relevant to the issue of that moment, is also very important.

**Q10 Graham Stringer:** How much time have you spent with the Prime Minister since being in your post? You need time to do these things, whether it is the Prime Minister or Cabinet Ministers.

**Professor Dame Angela McLean:** I attended Cabinet very soon after I arrived, for an early discussion about AI, and the Prime Minister came to the Council for Science and Technology last month.

**Q11 Graham Stringer:** Can I take that to mean no time on a one-to-one basis?

**Professor Dame Angela McLean:** That is correct.

**Q12 Graham Stringer:** When Sir Patrick was here a few weeks ago, he said he wanted to take a systems engineering approach to climate change and regretted he had not had more time to spend on it, because of covid. Systems engineering is all about decision making and costs scheduling so that the right decisions can be made by the decision makers in the end. What is missing from that process at the moment? Do we have all the technology ready? Do we understand the costs? If we do not, how are you going to get there?

**Professor Dame Angela McLean:** We have most of the technology. There is an IEA estimate that says that 80% of the 2030 targets for net zero can be met with technology that is already available—I mean really available; you can go out and buy it—and that we can hit 50% even of the 2050 targets. So, although there are some science and technology issues still to face, that is not the blocker.

I think that the issue of how we make the decisions and financial commitments fast enough is really where it lies. I believe that the energy Department is in the process of building a road map to net zero that would lay out which technologies we are going to employ, and where and when, to deliver on those commitments.

**Q13 Graham Stringer:** Have you looked at the staffing as well as the technology? There are papers on the internet saying that we have nowhere near enough engineers, even if we understood the technology and even if we had carbon capture and storage and the right battery technology, we do not have the engineers to deal with the change in the national grid, let alone those developing technologies. Have you looked at



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that problem, analysed it and approached getting a solution to it?

**Professor Dame Angela McLean:** As I am sure you know, one of the strands of the S&T framework is skills. There is a paper in development—it is actually in the DFE, so it is not by me—to address that issue across the piece. Of course you are absolutely right that this is at least as much about engineering as science. That work is being done, but not specifically by me.

- Q14 **Graham Stringer:** My last question is about the economy, to follow Becky's question. Kate Bingham, who played a starring role during covid, was excoriating about the civil service and what is happening in the biology and pharmaceutical sectors at the moment, where businesses are leaving or investing in other countries and not this one. Can you tell me what you think about Kate's comments and, if you accept them as objective, what you can do about it?

**Professor Dame Angela McLean:** Like many people, I am a huge fan of Kate Bingham. She and I sit on a board together. I think her statements about companies leaving were statements of fact, and I accept those.

What to do about it is largely an economic issue, but, again, from the science aspect—forgive me for going straight back to the S&T framework—theme five is to change patterns of investment in this country so that there is more opportunity to grow a spin-out company into a big company here. As you know, there is discussion about that right this week, isn't there: about setting things up so that more of the money—actually, it is all our money, isn't it—that is tied up in pension funds will be available to invest for growth?

- Q15 **Graham Stringer:** I said that was the last question, but if innovative companies were saying that one of the reasons they were going to invest in Ireland or elsewhere was the tax regime relating to innovation, would you think that was within or without your remit—to say to the Prime Minister, "You need to look at the tax regime because we are losing really good scientists and businesses"?

**Professor Dame Angela McLean:** It sits inside the S&T framework, which is now being delivered by DSIT. As I have already said to you, I am very keen to support the delivery of it, so I think that is a yes—I would be prepared to weigh in. I think I would have to say I am in support of DSIT there, because DSIT is the lead Department, but, yes, if our terrific companies are moving away because they have found more conducive environments, all of us should want to do something about that.

- Q16 **Chair:** You mentioned that the Prime Minister had been to the Council for Science and Technology recently. Was that for a particular theme or was it a general look across the piece?

**Professor Dame Angela McLean:** No, it was across the piece. It was to come and meet them. He had actually met them before.

- Q17 **Chair:** Before your tenure.



**Professor Dame Angela McLean:** Yes.

- Q18 **Carol Monaghan:** Dame Angela, you have talked a lot about plans for your tenure and the science and technology framework, but this Government love their strategies. There has been a whole pile of science-related strategies published over the past year and a half, anything from space, measurement, cyber, AI, quantum to semiconductors. How will you have oversight and make sure that strategies do not just stay strategies but move towards delivery?

**Professor Dame Angela McLean:** There is a hope that the S&T framework is one strategy to rule them all, and perhaps we could stop the strategies, particularly the big, overarching ones. We have got one; let's deliver it.

However, if engineering biology is one of our five critical technologies, we probably do need a plan. What is it that we are going to deliver? We will work with what OSTS became inside DSIT. That is the part of DSIT that will be doing what you might call the sub-strategies, particularly for the critical technologies.

- Q19 **Carol Monaghan:** Are we going to see more strategies over the next year?

**Professor Dame Angela McLean:** We will need an engineering biology strategy.

- Q20 **Carol Monaghan:** How will you monitor delivery or progress on them?

**Professor Dame Angela McLean:** How will I monitor progress? Through the SROs. That is a way to monitor what is going on with delivering the S&T framework. I would say that for anything that sits inside the S&T framework it is now very clear how we monitor it. We know who the SROs are; we know where they are; we know who to talk to and, perhaps most importantly, to whom we offer help. If I want to talk to the person who, let us say, is delivering the quantum strategy, I know exactly who it is and I know which CSAs to take that person to in order to make sure they get the help they need.

Under the overarching S&T framework, I think that is in a very good place. There are many other strategies. I do not think I can stop people from writing strategies, but I can ask them, "Are you sure you don't have a strategy you can deliver?"

- Q21 **Carol Monaghan:** My question is more about the fact that these things keep being churned out. How do we make sure they will not just sit on a shelf? A lot of the strategies do not have specific or detailed timeframes attached to them, which means they could literally sit on a shelf for the next 10 years.

**Professor Dame Angela McLean:** I completely agree with you. I hope you notice that I have not sat here and said I am going to do this and that strategy. I have sat here and said, "You know what I'm going to do? I'm going to take the strategy my predecessor created and help deliver



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it." I completely agree with you. We are fine with big strategies. I do think there is a bit where we ought to have a think about what we are going to do before we do it, even within the S&T framework.

Basically, I agree with you. I am more interested in the delivery of what we have already planned, which does have a date, 2030, than writing more strategies.

**Q22 Carol Monaghan:** Would it be 2030 without milestones along the way?

**Professor Dame Angela McLean:** There are milestones along the way. I think the day after tomorrow the SROs will be delivering their plans for each of the 10 big things with milestones along the way.

**Carol Monaghan:** You will keep an eye on that.

**Q23 Aaron Bell:** It was obviously a very busy time for science in February and March, with your appointment but also the creation of the Department. How do you see the creation of the Department? How have you observed it in its first few months? Do you think it is a fundamental change in the way Whitehall addresses science, or is it just moving different civil servants into different buildings?

**Professor Dame Angela McLean:** Gosh, no, it is much more than that. Having many, not all, of the people with responsibility for science that cuts across Departments in one place is an excellent move, so it is great from that point of view.

It is important to understand that it does not mean any other Department is doing any less science. You heard me say that my fantasy is that every permanent secretary asks me, "How do I make my Department a great science Department?" DSIT's role is to co-ordinate and convene the cross-cutting issues, but other Departments will still have to deliver their own science.

One thing I know from my own academic work is that you can do mathematical biology in maths departments—fantastic work is done there—or you can do mathematical biology in biology departments, and then you get mathematical biology that is very specific to the questions of biology. We should think of that model for science across Government. We really need science embedded in Departments with people who have the local cognate knowledge of the real problems.

**Q24 Aaron Bell:** Are you seeing DSIT already using that convening power, or is it still finding its feet a bit?

**Professor Dame Angela McLean:** Completely. I have a meeting with the CSAs every Wednesday morning. They were there this morning talking about co-ordinating R&D spend.

**Q25 Aaron Bell:** DSIT does not yet have a CSA, does it?

**Professor Dame Angela McLean:** No, but I think the advert is about to go out. We are in the process of appointing a national technology adviser.



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I very much hope that we have nearly finished that process and I am very confident we will find somebody fantastic.

- Q26 **Aaron Bell:** Thinking about where DSIT sits, and not wanting to put more on your plate, is there not a case that perhaps you should be doing that ex officio at DSIT, driving everything, or do you definitely want to get at specific CSA for DSIT as well?

**Professor Dame Angela McLean:** We definitely need a specific CSA for DSIT. Remember that UKRI is in DSIT and all the digital bit of DCMS is in DSIT. It desperately needs its own CSA.

The departmental CSA job is different from a Government CSA job. My job is to do that convening role and advise the Prime Minister and Cabinet, but DSIT definitely needs its own CSA as well as the NTA. One of the things that we figured out in the past few months is that it must have an NTA and, reporting to the NTA, it needs its own CSA as well.

- Q27 **Aaron Bell:** When the Department published the framework about two weeks after your appointment, it said it would have a clear action plan for each strand in place by the summer of 2023. Is that what you refer to as happening in two days' time?

**Professor Dame Angela McLean:** Yes. I do not want to commit them. Perhaps they are sending them to me on 7 July, but it is definitely in train, and I view that as being on track.

- Q28 **Aaron Bell:** Presumably, we will see them before recess.

**Professor Dame Angela McLean:** I am not going to commit to that because those people do not work for me.

- Q29 **Aaron Bell:** What assessment have you made of the resources that will be needed to implement those action plans, and what reassurances have you had from the Government and the Prime Minister that the resources will be available?

**Professor Dame Angela McLean:** I think that, as much as resources, it is a shift of understanding about how we work together. I do not think we can deliver the S&T framework without very strongly networked co-operation across Whitehall. You will know better than I do that some bits of Whitehall work incredibly well across Departments, but others do not. Within the arena of science we need to make that absolutely standard. We know we can do that because of the CSA network, but we need to bring in many more working scientists and other civil servants. There are many civil servants whose job it will be to deliver what we are asking for in the S&T framework who are not themselves scientists.

The people are there and what we need is this network culture.

- Q30 **Aaron Bell:** With regard to the 2.4% of GDP target, this Committee has taken evidence about the statistical anomalies that we have seen over the past year. Sir Patrick said in his valedictory session with us that the UK should be focusing more on outputs than specific numbers. Would you



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urge the Government to establish a set of metrics to look at outputs rather than just focusing on the input number?

**Professor Dame Angela McLean:** Yes, definitely. I am really an S&T framework cracked record this morning, am I not? In each of the 10 things, one of the things we are aiming for is to have some metrics to ask ourselves how we are doing and how we are getting on with this.

Q31 **Aaron Bell:** The headline input number is useful, too. Would you be in favour of 3% as a new stretch target, or are you happy to continue to work with 2.4% given where we are with the uncertainty about the stats?

**Professor Dame Angela McLean:** Three percent sounds fine. Asking scientists whether they think we should spend more money on R&D is like asking farmers if they would like better weather.

Q32 **Aaron Bell:** What is your assessment of the status of the Horizon negotiations?

**Professor Dame Angela McLean:** My understanding is that discussions are moving forward and that association is our preference in a way that works for UK researchers, businesses and taxpayers. It is all held very close. I know about as much as the newspapers know.

Q33 **Aaron Bell:** Do you think that the Government are committed to trying to associate? There has been some reporting in newspapers that the EU is saying it is not certain how committed we are.

**Professor Dame Angela McLean:** I have no reason to think that is true.

Q34 **Aaron Bell:** The alternative is Pioneer, which UKRI and DSIT are moving forward with—understandably. Even if it is not explicitly plan B, you have to make progress with it if you are not making progress with plan A. They were sent out there seeking ideas on 19 June. Do you think that is sending the correct signal to the scientific community that we are progressing with Pioneer, or is it just sensible contingency planning?

**Professor Dame Angela McLean:** I think it is sensible contingency planning. We would be crazy not to have a contingency plan, first, from the point of view of, "Boy, will we have to get on with it?", if it came to that, and, secondly, if we want to be credible in negotiations we have to make it very clear that we do have another plan.

Q35 **Chair:** I am interested that you know as much about the Horizon negotiations as the newspapers. Who is conducting the negotiations?

**Professor Dame Angela McLean:** I cannot remember whether it is the Treasury or Prime Minister. I do not know.

Q36 **Chair:** But it is at that level; it is at the centre, as it were, rather than the Department for Science, Innovation and Technology.

**Professor Dame Angela McLean:** I think so. I genuinely cannot remember if I ever did know. I am not prevaricating. I thought it was the Treasury.



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Q37 **Chair:** I am a little surprised that the chief scientific adviser would not be part of the negotiating team. Do you think you could help them?

**Professor Dame Angela McLean:** It would be a very hot seat. That is a very interesting question. I must admit that that had not occurred to me. They have not asked me.

Q38 **Chair:** On scientific advice, we have seen through the pandemic just how important science is across so many areas of government. You mention two other fields: climate change and AI. My recollection of Cabinet is that quite a lot of people attend sitting around the outside of the room: policy and communication advisers. Do you think the chief scientific adviser should be in attendance in the room at weekly Cabinet meetings?

**Professor Dame Angela McLean:** I think it would be a great idea.

**Chair:** We will put that to people who can do something about it.

Q39 **Stephen Metcalfe:** Over the years, this Committee has taken a very keen interest in the departmental chief scientific advisers. Will you update us on the health of that network across all the Departments? Where are the vacancies, and where do you think weaknesses are appearing?

**Professor Dame Angela McLean:** I would say it is in rude health. We spent teatime yesterday together. Patrick invited us to the Natural History Museum: we had a couple of hours in session together talking about this issue and shared research priorities across Departments, and then we visited the Titanosaur.

This is a group of people who are very used to talking to each other. We are together once a week for an hour to talk about what we are doing. An awful lot of people want to come and talk to us, but we are trying to limit that.

We are in fine fettle. There are about 20 of them and they stay for five years, so at any given time we are looking for the next four. That is just the arithmetic of it. At the moment, we are looking for new CSAs for DSIT and the Ministry of Justice, and we are looking for replacements. Tom Rodden from DCMS will finish his five years. We will need a replacement for me. By fantastic good fortune, a former MOD CSA, Vernon Gibson, has come back to look after MOD in order to give us a good amount of time to run a search for that post.

We are always looking for more. I do not view that as any sign of ill health; it is just that posts turn over.

Q40 **Stephen Metcalfe:** There are no long-term vacancies. All the positions are filled other than the ones you are trying to fill at the moment.

**Professor Dame Angela McLean:** That is right. I think that has been an issue in the past. Was it DLUHC that was empty for a long time?

Q41 **Stephen Metcalfe:** Departments had not bothered to do this, for whatever reason.



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**Professor Dame Angela McLean:** Everything is in plan.

- Q42 **Stephen Metcalfe:** That is great to hear. Can you tell me how the process works? Do you and the team look for people to fill these roles, or do they apply? Is it a push or pull?

**Professor Dame Angela McLean:** Both. The Department makes the appointment. I like to be on the appointments panel. It will quite often hire professionals to help it to do that. I view my role as helping to find people to feed into that system, but it is the Department's decision. I think it is very important that it is the Department that chooses who should advise it, but I have input into it. An expert adviser is a very annoying thing, is it not? It is very important that the Department is invested in that individual and wants to have them there.

- Q43 **Stephen Metcalfe:** So when you became the chief scientific adviser in the MOD, it approached you, and that was why you were not clear why they wanted to approach a mathematical biologist.

**Professor Dame Angela McLean:** Did they approach me? No, I applied.

- Q44 **Stephen Metcalfe:** I think you said earlier that you were not sure why they had appointed you.

**Professor Dame Angela McLean:** Yes, but I and a load of other people applied. They could have chosen one of several people. I have not had a conversation with the people who appointed me, all of whom have since gone. I have never sat down and asked why they appointed me.

- Q45 **Stephen Metcalfe:** Do you think that the network of advisers is comprehensive enough in its skill base when advising Departments and Governments about particular challenges? Specifically, do you think that there is potentially a role for either a chief engineer or chief mathematician to augment the network that you already have?

**Professor Dame Angela McLean:** I think that the appointment of the NTA is a very important addition. Remember that the national technology adviser is somebody whom we are very much hoping will help us with reaching out to businesses, both large and small. That is an important next step.

My view is that we need to get that appointment made and embedded and figure out how we are going to work together before going on to further additions. There is no reason at all why a mathematician could not be one of the CSAs. I would view that as a terrific appointment, if we could find an able mathematician who wanted to be a CSA.

- Q46 **Stephen Metcalfe:** What about engineering? Engineering is vital to the economy; it is vital to tackling some of the challenges that have been laid out, but engineering is slightly different from technology. There is a lot of focus on AI and the technology around that. Engineering goes beyond that. We are going to engineer solutions. Do you think that there is enough engineering advice? One of my complaints generally is that we talk a lot about STEM; we have great science, technology and maths, but



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engineering is a bit of a silent “e” at times. Where can we find the engineering advice to Government?

**Professor Dame Angela McLean:** That is a very good point. If I had 100 engineers, I would put them into delivery because delivery is the thing we find so hard and that is what they are so brilliant at.

I am extremely happy to appoint engineers to departmental CSA posts. I have not sat down and thought, “What we need is another whole network of chief engineering advisers.” If we were to go that way, it would be to broaden the CSA network to have more engineers in it.

Q47 **Stephen Metcalfe:** Do you see that as part of your role? If engineering is so important and we recognise that it is not represented, how will we get it represented? You are right about delivery. Taking the issues around climate change, most of the technology already exists. What we need to do is scale it up and roll it out.

**Professor Dame Angela McLean:** I am head of the Government’s science and engineering profession, so I am not completely focused on science. I share your view that delivery is incredibly important and that engineering is a very important part of delivery.

I am not going to do it, but I could dig out a list and ask, “Are any of these people engineers?” I just have to reiterate what I said. I am more than happy to appoint engineers as CSAs in our existing network. Beyond that, the next thing I would do is have more engineers in government doing delivery.

Q48 **Stephen Metcalfe:** What I want to challenge you about is whether perhaps you need to take a more active role in getting in engineers and banging the drum for engineering, making sure that the Government understand its importance.

**Professor Dame Angela McLean:** When you say “in”, are you thinking of my network?

Q49 **Stephen Metcalfe:** Your network—that the advice is being delivered to Government that there is an engineering aspect as well as the science.

**Professor Dame Angela McLean:** I take that suggestion and will remember it.

Q50 **Stephen Metcalfe:** Beyond that, there is the civil service supporting the Government. The Cabinet Secretary has said he would like 50% of civil servants who are on the fast-stream intake to be STEM graduates. Will you assist the Cabinet Office to achieve that goal, and how do you think it can be achieved?

**Professor Dame Angela McLean:** I have a Cabinet Office document that says that its initial analysis makes it believe that that will be achieved.

Q51 **Stephen Metcalfe:** The 50%?



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**Professor Dame Angela McLean:** The 50% will be achieved, by its analysis. I am tremendously devoted to the fast stream; I think it is fantastic. We help particularly with the science and engineering fast stream. There is a lot of support for that from my office.

One of my favourite engagements is to spend time with what we call Assess, so we are already very engaged with them.

Q52 **Stephen Metcalfe:** You have an active role in pursuing that.

The answer is bound to be yes, but do you think that the wider civil service would benefit from more people with a STEM background coming into it at all levels?

**Professor Dame Angela McLean:** At all levels, I do. One of the things I am very interested to pursue is whether there are ways in which we can bring in people a bit later in their careers than the fast stream. I talked about this in my opening when I mentioned finding ways to bring in people from academia, industry and our own labs who had worked as scientists. Perhaps they have had 10 years' research in science or engineering and join at a slightly more senior level.

I look around. More diversity of thought among the fantastic generalists that we have would be a great thing. The thing that will be hard for people who come in is that they will have to become generalists—generalists with a deep science background. There is then a number of extra skills that you have to learn. I would very much like to find a way to do that.

Q53 **Stephen Metcalfe:** I have a final question about your five top priorities. I will return to the resilience issue. It goes without saying that climate change is one of those, but you referred to AI, which I know is a particular passion of the Prime Minister. Are these your top five priorities, or are they crafted with the Prime Minister? Do you agree that AI is more important than some of the other areas?

**Professor Dame Angela McLean:** AI is an absolutely fundamental underpinning technology. It is quite hard for all of us to grasp how much it will go on changing our lives. Sometimes, you have to stop and think how much it has already changed our lives. Tons of things that used to be very difficult are now very straightforward. Frankly, it has only just begun. I think our lives will change in lots of ways, most of them for the better. I am a real AI optimist. Making sure that it works well for people and effectively inside government will occupy all of us for the rest of our working lives.

Q54 **Stephen Metcalfe:** There is not necessarily great public understanding of AI. Do you see yourself having a role in promoting understanding of what AI is and what it is not, and where the threats and opportunities are?

**Professor Dame Angela McLean:** I am very happy to do that. Yes, is the short answer. I think that is an important part of the GCSA's role.



Q55 **Chair:** That is a good segue into questions on AI in particular.

You say that you are an optimist about AI. This Committee has taken a lot of evidence from different applications in medicine, education and others where positive changes are taking place, but the Prime Minister has shone a particular spotlight on what he calls AI safety and convened a summit for the autumn of this year.

On the question of safety, one of his advisers, Matt Clifford, said recently that you could have very dangerous threats to humans that could kill many people simply from where we would expect models to be in two years' time. What do you make of that statement?

**Professor Dame Angela McLean:** We need to be careful, because these capabilities are developing very fast. What is making many people feel a bit anxious is a sense of surprise among those who built the most recent generation of AI models at how capable they are. That is a bit different from what we normally expect from engineers. We normally expect an engineer to build something and know exactly what it will and will not be able to do. It has caused, rightly, pause for thought, so this is a good moment for us to have a focus on safety. I am very keen that it should not be at the cost of delivery and exploitation.

Q56 **Chair:** The difficulty is that, if you say many humans could be killed given where we expect models to be in two years' time, it is hard to take things slowly. Presumably, that implies that there is an urgent regulatory response and that we do not have the leisure to think over a period of time about the right things. I am not subscribing to that view, but it seems to me that, if that is a view of someone advising the Government, surely that requires a pace of regulation that is different, if most of it is upside and there are some long-term threats that we need to worry about.

**Professor Dame Angela McLean:** Regardless of that statement, there has been a change of pace. There has been a lot of work done since I arrived on threats from this class of model, generative AI, leading up to the idea of having an international summit on it in the autumn. It is a fantastic idea.

There has been a big step up in capability, so let us make sure we have the capability to measure how safe these products are.

Q57 **Chair:** I had the opportunity to ask some questions of the Prime Minister about this at the Liaison Committee yesterday. It seems that there are two ways of thinking about the summit. One is whether this is a genuinely global summit. You mentioned climate change. We have COP, which unites almost all the nations on earth; we have other international bodies that try to get everyone around the table, but, given security concerns and the relationships that we have—this came out of the visit that the Prime Minister made to Washington—there are also like-minded countries in terms of their values and respect for the law. Do you, as the Government's adviser, have a view on what we should be aiming at? Should we be convening the world, or looking to get together those



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countries that believe in liberal democratic values?

**Professor Dame Angela McLean:** I might start by saying that I have a scientific view and I should probably keep my geopolitical view to myself. My scientific view is that these risks will not respect borders, and that would call for you to be as wide as you possibly can be in who is involved in these discussions.

Q58 **Chair:** Given that science does not respect borders, as we know, from your scientific background and training, how would you assess the possibility of full global agreement on AI safety?

**Professor Dame Angela McLean:** I heard a suggestion as part of all these discussions that maybe what we should be aiming for is an IPCC rather than an IEA, so more of an assessment. The IPCC has grown very large, so something that would give us an authoritative global assessment of risks would be extremely useful.

I think that a proper statement available to everybody and shared by everybody would be a very useful way to go, and we would not have to worry about whose values will lead them to stick to this or not.

Q59 **Graham Stringer:** In the production of carbon dioxide around the world and in the economy, one of the sources of carbon dioxide that often remain forgotten or not mentioned is computers and servers. They are responsible for a huge amount of carbon dioxide. That is going to increase massively because of the energy demands on training and refining artificial intelligence. Are the Government attempting to estimate what that increase in energy use, and therefore production of carbon dioxide, will be?

**Professor Dame Angela McLean:** I do not have those calculations, but I know that when I asked about that, it was pretty easy to get what seemed like a very sensible answer about comparisons of the new kinds of query tools with existing query tools.

My answer to you is I think so, because when I asked I got an answer back very fast, and I imagine it would have come from the energy Department.

Q60 **Graham Stringer:** I suppose this is the same question, so I guess your answer will be similar. Are the Government expecting or doing themselves a cost-benefit analysis of the costs in the public sector?

**Professor Dame Angela McLean:** Yes. We talked about that yesterday. Getting an answer with the new methods, the generative AI models, leaving aside the huge expense of building the model—when I say expense, I mean energy expense—once you have it, each time you use it, it is a little bit more expensive than a straightforward, old-fashioned search. Of course, if it is much better, it is not necessarily more costly. Are you with me? I do not know what the exact numbers are, but let us say it is 10 times more costly in energy than your normal Google search. If you only have to do one tenth as many, you are all right.



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You are absolutely right to raise the issue. Maybe that is something we should be looking into. Perhaps we might do some scenarios work about how these technologies are going to spread and be used.

- Q61 **Graham Stringer:** I do not know if this is a question for Government and the public sector or the private sector, but is work being done to try to increase the efficiency and sustainability of the use of AI and the way it is being done?

**Professor Dame Angela McLean:** Yes. I know that in both universities and the labs, which is what the companies call themselves, there is a lot of work being done to do these calculations with much less intensive use of computer power, because it is just so expensive in terms of buying the computer power and the energy that is drawn. It is lots of work.

- Q62 **Dawn Butler:** I know that you are an AI optimist, and we can all get excited about what AI might be able to deliver in the future, but I want to focus on the threats.

You said in your opening that you want to ensure that we have safe and effective AI in the UK and that your scientific view is that risks will not respect borders. I agree that we need a global assessment of risks. That would be quite informative for every country. How do you feel the White Paper is delivering around the fact that the risks will not respect borders?

**Professor Dame Angela McLean:** The regulation White Paper?

**Dawn Butler:** Yes.

**Professor Dame Angela McLean:** That has been out for consultation until just recently. I think consultation closed last week. I have not read that bit of it, actually—let me be honest with you—so I am just going to leave it at that.

- Q63 **Dawn Butler:** We could come back and pick it up.

Do you know when we can expect a response to the AI White Paper consultation?

**Professor Dame Angela McLean:** I do not know. I checked and could not find out.

- Q64 **Dawn Butler:** Did you feed into it at all?

**Professor Dame Angela McLean:** No, because it was first published at the end of March. I do not quite understand what the process has been. I think that the publication date was the end of March, and that was before I was in post. Then it went out for consultation and the consultation closed. I think that that would have been handled by the Office for Artificial Intelligence inside DSIT.

- Q65 **Dawn Butler:** Can you give us any insight into the agenda of the international summit on AI, which will happen, as you said, later this year? Are we all invited?



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**Professor Dame Angela McLean:** That is a great question. Shall I ask for you to be invited?

**Dawn Butler:** I think it will be useful for the Committee to be invited.

**Professor Dame Angela McLean:** I do not think I am going to own the invitation list, but I can ask, and I will. Yes, I agree with you.

I do not know what the agenda will be. I have clear ideas about what the agenda might be. One of the things that I really hope will be on the agenda, as well as very technical things about what metrics we should have and what guardrails we should have, is a discussion about public acceptability, because that is very important.

Q66 **Dawn Butler:** What do you mean by “public acceptability”?

**Professor Dame Angela McLean:** Do you remember what happened with GM crops? Let’s not do that again. That is what I mean.

Q67 **Dawn Butler:** In order to get the public to accept AI, we have to ensure that the public feel safe and that legislation is strong enough and robust enough that they feel safe. I think that the White Paper at the moment is a very light-touch approach to regulation around AI and safety. I do not think it will instil the security that the public need at the moment. It will be interesting to pick this up again.

**Professor Dame Angela McLean:** Thank you. That is really interesting to know your opinion. Can we pick it up another time?

**Dawn Butler:** Brilliant. Thank you very much.

**Stephen Metcalfe:** You said you do not hold the invitation list. Let us get it on the record: we need to make sure that the public are involved, and that it is not just lots of academics, experts and luminaries talking about what the public should and should not do and understand. They need to have an active role. People do not trust what they do not understand. Until we have better understanding, they are not going to trust it, and that could damage any economic benefit that this could deliver.

Q68 **Dawn Butler:** Chair, may I just say that Stephen is Chair of the all-party parliamentary group on AI? I just wanted to let you know that.

**Professor Dame Angela McLean:** Is the Big Bang Fair still yours?

**Stephen Metcalfe:** Yes.

**Professor Dame Angela McLean:** That is also a pretty good public understanding of science activity, right?

**Stephen Metcalfe:** It is, yes.

**Chair:** It was a great success, was it not, Stephen?

**Stephen Metcalfe:** It was. It was fantastic.



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**Chair:** Absolutely.

**Professor Dame Angela McLean:** It was fantastic. I went.

Q69 **Chair:** Dame Angela, you said quite rightly that the White Paper on AI was published before you took up this post. The response to the consultation will be during your tenure as Government chief scientific adviser. Would you expect to be involved closely in the Government's response to that White Paper?

**Professor Dame Angela McLean:** The Government's response to the White Paper?

**Chair:** To the consultation on it.

**Professor Dame Angela McLean:** I would expect to have clear and useful discussions with the DSIT officials who are going to be doing that, yes.

Q70 **Chair:** You said that this is an office within the new Department. What is your engagement with that office, given that it is one of your top priorities, as you have shared with us today?

**Professor Dame Angela McLean:** I would say close on daily. We speak all the time. They were very cross with me yesterday because I went off in the afternoon to hang out with my CSAs, and they thought I should have been doing something with them.

Q71 **Chair:** Excellent. They are clearly making use of you. Would it be reasonable to expect that, when the Government respond, what they say in response will have your confidence? It would be odd for them to say something that did not have the confidence of the chief scientific adviser.

**Professor Dame Angela McLean:** Well, hold on. I can advise them. They get to say what they want to say.

Q72 **Chair:** Right. If your advice turned out to be different from how they intended to proceed—in other words, they took your advice but decided to ignore it—would you agree that there is a public interest in you being open about your advice on such an important issue that you have underlined this morning?

**Professor Dame Angela McLean:** Yes, public interest is a very important consideration.

**Chair:** Thank you.

We will turn to some other big matters—emerging diseases and some reflections on the lessons from the pandemic.

Q73 **Rebecca Long Bailey:** In your view, how does the new biological security strategy improve on the previous strategy in addressing emerging biological threats and ensuring the safety and security of the UK?



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**Professor Dame Angela McLean:** It has a better structure across Government, going back to the issue about having to get out of silos and work across Government.

One of the bits that I think was a stroke of genius on the part of my colleague, Alex van Someren, who was CSA for national security, was that we would have a CSA who chaired the cross-CSA group specifically for that, and that it should be a rotating post. He would do it to start it, with somebody else taking it over now.

In my old job, I sat on that subgroup for one particular meeting, and it was very powerful.

There is that. There is also the appointment of an SRO. One of the DNSAs will be the SRO for the BSS. Gosh, listen to me with my acronyms. I am sorry.

Q74 **Chair:** The DNSA is deputy national security adviser.

**Professor Dame Angela McLean:** Thank you. It is going to be the responsible owner for the biological security strategy. That is very important.

There is also a small ministerial group. I think that the Deputy Prime Minister is probably going to be the Cabinet member in charge. All that is very important. The way in which it is set out with its four very clear pillars and one Department in charge of each pillar is a good, clear explanation of how we plan to work together.

Q75 **Rebecca Long Bailey:** Do you think it is resourced adequately?

**Professor Dame Angela McLean:** It would have been very encouraging if it had been resourced more.

Q76 **Rebecca Long Bailey:** Is there anything that you would change or add?

**Professor Dame Angela McLean:** Surveillance is always the thing where we worry whether we are doing enough. It is pretty hard to have too much surveillance.

Q77 **Rebecca Long Bailey:** How will you ensure that the implementation and governance of the new strategy are sufficiently guided by scientific advice and scientific evidence?

**Professor Dame Angela McLean:** I will get on to my CSAs. That is fine. I know how to do that.

Q78 **Stephen Metcalfe:** You talked about resilience, and this is all part of that. Part of the way we deal with resilience is through the national risk register. What is your involvement in identifying risks that should be on the register, and do you regularly review it with others? How do you make sure that you are thinking beyond what might normally be considered to be a risk?



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**Professor Dame Angela McLean:** That is a great question. We have a strong foresight capability inside GO-Science. That is a really important part of that. It feeds into those. I sit on the resilience bit of the National Security Council for officers.

I have just set up a new thing with my chairs of science advisory councils. Many Departments have an external group of people who try to get to know the Department. They work advising the Department for several years, but not like a CSA; they come in a few times a year, and the idea is that they should stay very external and not be sucked into the civil service machine, but nevertheless know enough about our issues to give us relevant advice.

When I last met the chairs of those groups, I asked them each to create a system to feed up risks to us, and I asked them to do it in a very unfiltered way. You know how it is: if you filter things, the really weird stuff gets averaged out. My only worry is that we are going to end up with a lot of stuff, so I have asked them to keep it very brief. I have asked the chairs to ask their science advisory members, probably once a year, "What do you think we should be worried about? Why? What should she read and who can she talk to?" I do not want them to do any averaging. I do not care if the rest of the committee thinks that is completely ridiculous.

**Stephen Metcalfe:** I know what you mean.

**Professor Dame Angela McLean:** We need to see some of the stuff that only a few people will have the insight to understand why it is important very early on.

Q79 **Stephen Metcalfe:** Presumably, part of your role in the wider civil service is to come up with mitigation strategies for things on the risk register.

**Professor Dame Angela McLean:** Yes.

Q80 **Stephen Metcalfe:** Even though you have seen some of the more outlandish, perhaps far-fetched risks, there must be a balance to be struck between how much mitigation you will research and discuss. Presumably, the probability of something happening, the impact, etc. is plotted on some sort of graph. Is that you on your own? Is that your scientific adviser network?

**Professor Dame Angela McLean:** I am very keen to work with the bit of resilience machinery to build more science advice into those preparation steps. We have a pretty good national risk register. It is a lovely register. We need to do more about preparedness. Science has a big role to play in preparedness for many of the risks. There may be some where there are not many science questions, frankly, but for the "science" ones I would like to see us do a lot more.

The problem with the risk register is that we could spend the entirety of all our money several times over preparing for those risks, and we do not



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want to do that. There are other things that we want to do with our money. In terms of preparedness, we need to look for things that we can do that are not expensive and can be scaled up fast when they need to be, and one of those is to create networks of external scientists who are already working on these risks.

I know that there will be plenty of scientists across our universities getting grant money from Government saying, "I am working on a policy to prepare for risk X." In my view, if you are doing that, you can come in once a year probably, get to know a group of other scientists working on this, and say, "Right, okay, what should we do about it?"

**Q81 Stephen Metcalfe:** And that is a relatively new development.

**Professor Dame Angela McLean:** We have got it quite well for some and not others. We should look at the risk register and ask, "Which of these do we not currently have that in place for?", and we need to put it in place.

**Q82 Stephen Metcalfe:** How often is the risk register looked at or reviewed? Are there things that would trigger a review, and what would the evidential base for that be?

**Professor Dame Angela McLean:** It used to be reviewed every other year, I think, and it is now reviewed on a rolling basis. I completely agree with you. One of the questions in those risk descriptions—I do not know if it is there—should be: what is the warning that would make us come back to this right now? That is a very interesting use of profound expertise. Profound experts will know what it is that I should be watching for. What is the thing that is not actually the risk crystallising and the bad thing happening, but is the thing that says, "Get that file down and see if it is up to date, because this might be coming now"?

One of the things that we learned from the pandemic is that you can have stages of risk escalation, but you do not go through them all at the same timescale. You can go from level 3 to level 6 in the blink of an eye.

**Q83 Graham Stringer:** Do you read this Committee's reports?

**Professor Dame Angela McLean:** I read a bit online about your interviews with some insect people, but, no, I do not read all your reports. Do you think I should?

**Graham Stringer:** No, reading all our reports would take a lot of your time. I just wondered which reports you had read, if you do read them.

**Professor Dame Angela McLean:** Right. That was the first one I went to because it is such an interesting question. You had a session in early June about insect decline.

**Q84 Graham Stringer:** That is right. You have not read our reproducibility and research integrity report.

**Professor Dame Angela McLean:** No.



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**Q85 Graham Stringer:** One of the reasons we did that report was that some scientists think that there is a crisis of reproducibility and integrity in science at the moment. Do you think there is?

**Professor Dame Angela McLean:** We know that in some bits of science there is a crisis of reproducibility. I have not come across a crisis of integrity. There are lots of bits of science where it turns out you cannot reproduce it. The structures of incentives for working scientists do not greatly repay the undigging of experiments that cannot be reproduced, which is a problem.

**Q86 Graham Stringer:** That was one of our conclusions. Something should be done about that.

**Professor Dame Angela McLean:** Was one of your conclusions the stuff that we have done in Departments about integrity? There was a concordat about scientific integrity for Government Departments, which I thought was a good thing, actually.

**Q87 Graham Stringer:** How are you going to approach this problem, recognising it is a problem, on reproducibility?

**Professor Dame Angela McLean:** We can learn a lot from those parts of science where they have worked hard to deal with this. I am thinking particularly of clinical trials. One of the things you can do is you get people to declare their experiments before they even do them. Basically, you make it a condition of publication. You say, "I will not publish your results if you cannot show me that you declared that you were going to do this experiment before you started." That is to stop people running a bunch of experiments and cherry-picking the one that they like the answer to. That is one thing you can do.

I think the literature has become better, but not yet good enough, at dealing with underpowered studies—studies that are not big enough. They are an absolute bane of one's life if one is trying to summarise a large scientific field. There will be very large numbers of studies that did not look at enough subjects, whatever those subjects were—often, people. They can find out all kinds of weird and wacky things with what look like statistically significant results, but it is just that it was a terrible study to begin with. It is getting more difficult to publish those sorts of studies, which is a good thing because they should not be published. They should never be done.

**Q88 Graham Stringer:** One of the issues we have approached tangentially in respect of covid is the origins of covid. There appears to be an increasing amount of circumstantial evidence that it was laboratory initiated rather than being a zoonotic transfer. Do you have a view?

**Professor Dame Angela McLean:** I know you talked to Patrick about this the last time he was here, or before. I am going to pretty much repeat what Patrick said, which is that there are three possibilities: it arose in animals and there was a direct transfer to people via some part of the food chain, or it arose in animals, was in a lab and then transferred to people, either with or without modification.



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**Q89 Graham Stringer:** One of the worries appears to be that the scientific establishment both in this country and in the States, the *Lancet* in particular, came out very strongly against the laboratory hypothesis at the beginning. It did not look good, really. It did not chime well with Sir Patrick's answer and now your answer that, "There are three possibilities. How do we assess them?" It was, "No, it has not come from a laboratory." Are you concerned at the way the establishment approached that problem?

**Professor Dame Angela McLean:** We always have to look back on how we have behaved and ask, "Were we open-minded?" I do not think that is an unfair challenge. We ought to accept that zoonotic transfer from animals to people is common. It happens a lot. It does not usually turn into a global pandemic. Pathogens transferring from animals to people is not an unusual event. Usually, it does not go anywhere. To be honest, most of the time it happens we probably do not even know. Usually, what happens is that that person then never infects anybody else, or you get something that never blows up into a big pandemic. It is a common occurrence. You know that old saying: what is commonest is quite likely what happened.

**Q90 Graham Stringer:** Yes. We are doing an inquiry into emerging diseases—not specifically covid, but looking at what might happen in the future. One of the bits of evidence we are getting is that we do not have enough high-level containment laboratories. Do you think that is a real worry? What can you do about it? What can be done about it?

**Professor Dame Angela McLean:** Clearly, access to high-level containment laboratories is absolutely essential. At the moment, we have access. The most important thing is to make sure that those laboratories remain available for us to use. Yes, I think I have a role in that. As Departments come into the centre and make cases for replacing laboratories, yes, I think GCSA should very much have a role in assessing those cases.

**Q91 Dawn Butler:** I have a question on how we responded and the manufacturing of the vaccines, which we did really well in the UK. Everybody worked well together—all the different levers, Government, scientists, etc. Do you feel that there is a lot to learn in how the UK and Government ensure that if we invest so much into creating a vaccine we keep the IP rather than allowing big pharmaceuticals to take it and sell it on? If we are going to prepare ourselves for a global pandemic, is it not best that the Government take a more active role?

**Professor Dame Angela McLean:** In the manufacture?

**Q92 Dawn Butler:** In the manufacture and retention. The Government played quite a big role in the manufacturing, but not in the retention of the intellectual property.

**Professor Dame Angela McLean:** I am a bit troubled by this being framed in a covid way, because of the inquiry. As you know, we are all



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extremely committed that the inquiry should run well and teach us many lessons.

- Q93 **Dawn Butler:** In general, would it make more sense that we had more intellectual property so that we can get vaccines out globally and deliver them at cost rather than trying to make a profit when we are trying to save lives?

**Professor Dame Angela McLean:** Yes. There are ways we can do that without keeping the IP ourselves. There are manufacturers who will manufacture very cheaply. I am thinking of the Serum Institute of India.

My understanding from talking to various bits of the Government both here and in the US is that, on the whole, you are better off handing over the IP to companies that will do great things with it and then taxing them. I agree that the whole issue of the management of IP is a big one.

From people whom I have spoken to who work very hard on what you might call IP scouting ventures, on the whole, the advice I usually get is, "No, leave the IP with the people who are going to build the business because Government owning IP does not do much good."

- Q94 **Dawn Butler:** Are you saying that, if we have another pandemic and we need to get vaccines or whatever out there quickly, we tax big pharmaceutical companies more?

**Professor Dame Angela McLean:** We already tax them. No, what I am saying is I do not think it is a completely straightforward answer like, "Yes, we must always keep the IP." It is quite a complicated answer to do with who is incentivised to do what kind of development and scale-up, which is also a difficult problem beyond the creation of the IP. From the point of view of creating large volumes of vaccine, we know that there are companies that can do that very cheaply.

- Q95 **Dawn Butler:** Do you think that we should invest more in UK laboratories of different scales that can produce and help and maybe link it more to universities?

**Professor Dame Angela McLean:** Yes.

**Dawn Butler:** Great, thank you.

- Q96 **Carol Monaghan:** Dame Angela, there are a few things that you have not mentioned that I hoped you would mention somewhere—for example, antimicrobial resistance, which we have been considering. Is that in your view at all?

The other area you have not mentioned today is one that this Committee has taken a lot of time considering: space technology and the UK's plans with space.

There is a third thing that I want to talk to you about in a bit more detail, but maybe we can start with those two things. Are they in your crosshairs at the moment?



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**Professor Dame Angela McLean:** AMR should be in everyone's crosshairs if they have any interest in infectious disease. Whatever we do would need to be co-ordinated with what is happening in Health. We have a Health Department. We have a CSA for health. We have a chief medical officer who is very interested in this. Whatever we do on that would always be in support of what they are doing or at their request. If they wanted to use one of our particular skills—perhaps our foresight group or something like that—we would, of course, respond.

In terms of space, what are we doing on space? We stand ready to support.

Q97 **Carol Monaghan:** It is a technology that the Government have put an awful lot of effort and funding into.

**Professor Dame Angela McLean:** Yes.

Q98 **Carol Monaghan:** You can write to the Committee about this. What role do you see yourself having? Are you happy for that to run its own course?

**Professor Dame Angela McLean:** No, I am going to forget the name of it, but I have just been asked, and have accepted, to sit on a space committee. I do not know here at this exact moment what it was called. I have a role, and I would happily accept your offer to write and tell you exactly what it is.

Q99 **Carol Monaghan:** That would be useful.

You have mentioned the Department of Health and Social Care. Do you see yourself mainly as offering advice to DSIT, or do you see yourself as having a broad governmental role?

**Professor Dame Angela McLean:** I offer advice to the Prime Minister and Cabinet Ministers—right across.

Q100 **Carol Monaghan:** Right across.

Another issue that has come up in this Committee is the cost of visas, particularly the global talent visa. I know that the Royal Society produced a report showing some pretty shocking figures. It showed we were about six times more expensive than comparator nations. What are your thoughts on that? What advice will you give to the Government on that?

**Professor Dame Angela McLean:** I would read the Royal Society report on the cost of visas. I had heard that visas are very expensive in this country. I would advise that if we want a lot of talent to come here we should address the question of comparisons between this country and others.

Q101 **Carol Monaghan:** The costs are pretty shocking. It is £623, which sounds okay, but you might have a spouse, which is another £623, and children also pay the £623, and then there are the NHS costs and everything else. It quickly adds up to an awful lot of money. Coming from an academic background, you will understand the international nature of it. This has been raised by the Committee many times. I just



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want to take this opportunity to put some of those figures to you so that you are aware of them.

Moving on from the issue of global talent visas, we recently published a report on diversity and inclusion in STEM. We had a rather underwhelming Government response, which our Chair described as “a plan to have a plan”. It did not fill us with great confidence.

If we are looking at diversity in STEM, what thoughts do you have on that? How are we going to increase diversity in the area?

**Professor Dame Angela McLean:** You can only fish in the diversity you have, so we need to build the pipeline of diversity in STEM. That is why I like the Big Bang Fair so much. I was there the week before last. The people who run it had done a really fantastic job of making sure the kids who were there—it is aimed at 11-to-14-year-olds—were from a truly diverse pool.

The thing that made my day was watching a queue of little girls who had just made—it was not very high-tech—paper aeroplanes, and they had to fly them through a series of three hoops, which was actually very difficult. Huge effort had gone into choosing which schools were invited, and a lot of training had gone into the staff who were on those stands to make sure that everybody got a go. I have been at fairs like that where you see, frankly, a really heartbreaking thing: all the boys are doing stuff and the girls are watching. It is pretty shocking that that is still happening.

I feel pretty strongly that “science is for everyone”, and it is something I am very keen to help promulgate. Thereafter, what can we do? We can make sure that when we make appointments we are making a fair representation of the pool we should have been fishing in. I do not think you can ask more than that.

Q102 **Carol Monaghan:** We know that these are areas of great practice, and all of us here are very supportive of that work. Initiatives such as the Big Bang Fair took place when I was at school, and that was a number of decades ago. The number of girls, if we just look at girls, going into STEM has not increased brilliantly—a few percentage points in the last 40 years. These initiatives have been ongoing. Are we at the point that we have tried the carrot and now need the stick?

**Professor Dame Angela McLean:** No, I do not think so. Are you saying we are going to tell girls that they have to become scientists?

Q103 **Carol Monaghan:** No, I do not mean in terms of the young people themselves. I mean in terms of policymakers, companies and where funding goes.

**Professor Dame Angela McLean:** You need to be really careful with that. I can tell you this, having on many occasions been told, “Oh, yes, you got that job because you are a woman.” That is a flipping difficult place to be in, and that is where you get to when you say, “You have to



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have this many women.” I am much keener on the carrot. That is my opinion.

Q104 **Carol Monaghan:** There is a cross-governmental action plan to “ensure a more diverse range of people enter the science and technology workforce by 2030”. That was given in the response to our report. What role will you have in that?

**Professor Dame Angela McLean:** The main thing I can do is talk to girls and young women of all ages about going into it and sticking with it.

Q105 **Carol Monaghan:** You do not see yourself having a policy development role. You are a role model for young girls going into science—it goes without saying—but do you have a role in developing this policy?

**Professor Dame Angela McLean:** I can engage with that in an advisory way. At the end of the day, it is not me who makes policy.

Q106 **Rebecca Long Bailey:** The response to the Committee’s report said that a plan for implementing the Prime Minister’s “maths to 18” ambitions would be published later this year. Do you think that a similar target should be published for STEM subjects?

**Professor Dame Angela McLean:** That is a great question. I would focus on developing and delivering a “maths to 18” plan. My undergraduate degree is in maths. It is pretty hard to predict exactly what skills we are going to need. The language we are going to need people to have is the language of mathematics. If you have the language of mathematics, diversifying into other bits of science or engineering is not that difficult. If I could choose between a wider policy about STEM or delivering a policy about maths, I would deliver the policy about maths.

Q107 **Chair:** Dame Angela, we are very grateful for you coming so early in your tenure. We would be very grateful if you came back from time to time. You have a purview across the whole of government, and we take a very active and enthusiastic interest in promoting the take-up of science and the application of good scientific knowledge in government.

You have heard about a number of reports that we publish from time to time. We would be very grateful if you undertook to read them and reflect on them so that when you do come back we can ask you what your views are on our conclusions. Would that be okay?

**Professor Dame Angela McLean:** How many are there?

Q108 **Chair:** Some are longer than others.

**Professor Dame Angela McLean:** I will do my best.

**Chair:** Thank you very much indeed.