

Science, Innovation and Technology Committee

Oral evidence: Sir Patrick Vallance—Valedictory, HC 1324

Wednesday 3 May 2023

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Members present: Greg Clark (Chair); Aaron Bell; Tracey Crouch; Katherine Fletcher; Stephen Metcalfe; Carol Monaghan; and Graham Stringer.

Questions 1 to 76

Witness

[I](#): Sir Patrick Vallance, former Chief Scientific Adviser to the UK Government.



Examination of witness

Witness: Sir Patrick Vallance.

Q1 Chair: This meeting of the Science, Innovation and Technology Committee is in session. I am very pleased to welcome Sir Patrick Vallance, who was, in his tenure as Chief Scientific Adviser, the most frequent attender of this Committee of all his predecessors, for which we are very grateful. He stepped down from that role in April—last month—and he has kindly agreed to join us to reflect on his tenure.

Sir Patrick is well known to not just the Committee but the nation. He is a fellow of the Royal Society. He was Government Chief Scientific Adviser from April 2018 to April 2023. Prior to that, Sir Patrick was president responsible for research and development at GlaxoSmithKline from 2012 to 2017, having joined the company as head of drug discovery. Prior to joining GSK, Sir Patrick was a clinical academic. He was professor of medicine and leader of the Division of Medicine at University College London, and he was a consultant physician in the NHS. All those experiences and attributes we saw drawn on during the covid pandemic.

Sir Patrick, you served for five years as Government Chief Scientific Adviser, from April 2018 to last month. It was not, it is fair to say, a quiet time. You had covid, of course, and you had the biggest ever increase in public resources in this country devoted to research and development—the annual budget increasing from £10 billion a year to £20 billion a year by the end of this Parliament. Artificial intelligence also burst on to the scene with a certain prominence, to which you have contributed. Looking back over the last five years, how would you say that UK science looks, compared with what you inherited?

Sir Patrick Vallance: Perhaps I can tackle that in three domains. The research base of the UK—the academic and independent research activities—is very strong and has always been strong, and we probably rank third in the world overall in performance, but I don't think we can take that for granted. Many countries are moving very fast; countries that one would not think of as being scientifically enabled are becoming very scientifically enabled, and some are extremely advanced, such as China and others, so we should not rest on our laurels. The recent report from Paul Nurse illustrates quite clearly that there is work to be done to make sure we do not lose that position.

The second domain I would think about is industry. There, I think we have a much more healthy start-up culture. There are many start-up companies, and there looks like a good range across different areas of science and technology. We also have some very significant major companies—I think AZ is now the biggest company in the stock market, and it is a very science-driven company.

Where I think we are not doing as well is scale-up—in other words, going from start-ups to scaled companies. It is a very, very important area to



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get right; otherwise, our start-ups end up going overseas, disappearing or getting acquired. Some of them will do that anyway, but we have to be better at getting that scale-up, and that is one of the things that the recommendations that went to the National Science and Technology Council are all about.

The third domain is Government itself, where I think there is a very good set of Chief Scientific Advisers who work extremely well as a group across Government. That is an effective organisation, and each Department now has a much more structured science system, so it is clear how the science adviser sits in a system inside Departments. I feel much more confident that that is in a good position, from the perspective of the specific Chief Scientific Adviser and his or her team.

What is also good, but there is definitely work to be done, is that back in 2019 when I wrote the science capability review together with Treasury, we pointed out that something like 10% or 11% of the general fast stream had a science or engineering degree. I am pleased that there is now a target for 50%, but we have to reach that target, and progress against it needs to be quite rapid now, because it is still not where it should be.

Recruiting scientists and engineers into the civil service is really important at all levels, as well as enabling the people who are in the civil service to become better users and customers of science and interactors with science. There is still work to be done, but there is definitely a pull now—it is not a push; it is a pull—and that is very important. There are areas that need to be progressed to get the Government fully enabled to be a science, technology and innovation-capable Government, and this is happening right the way across the world. So again, we should not assume that because we are headed in the right direction, that is enough. We need to be really good at this.

Q2 Chair: There are lots of areas there that we will go into through colleagues, but looking back on the last five years, what are you most proud of during your tenure in the post of Chief Scientific Adviser?

Sir Patrick Vallance: On things that I look back on and think “Well, that felt very good”, there is no doubt that the Vaccine Taskforce falls into that category—the ability to pull together industry, academia and Government to push something forward that effectively. Obviously, Kate Bingham was spectacular and others involved in that, such as Ian McCubbin, were brilliant at getting that going. The fact that I had some background in that and was able to set that up in a way that pulled on industry and other experts—I feel that yes, that worked.

I feel pleased with the Chief Scientific Advisers network, which I have already mentioned. I think that works well and is an effective network. On climate, I think COP26, where I acted as Chief Scientific Adviser, was good. There is still much more to be done, so there is lots of unfinished business in all these areas. The 100 days mission that we published as part of the G7 has formed a framework that is being picked up around the



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world to try and get vaccines, therapeutics and diagnostics out within 100 days of a new agent.

Those are some of the areas where I think there has been some progress. On the innovation front as well, particularly with the formation of the National Science and Technology Council, that has a focus now that it did not have before. As I said, there is lots of unfinished business. I would not for a second claim that any of those are finished work or that they are total successes, but I feel as though some progress was made in those areas.

Q3 Chair: Thank you. In complementary terms, what are the areas that you wish you had done differently or had had time to give greater priority to?

Sir Patrick Vallance: I came in with an objective to focus on three things, which were the science system inside Government, climate and innovation. I decided I would do slightly less on biomedicine. That did not exactly work out.

As for the progress against some of those areas, let me take public sector research establishments, which I think are an unheralded part of our science system. Those are the publicly funded labs that perform services for Government but also push forward many areas of science. There is a lot that could be done there and I would have liked to get my teeth more into that than I did. Similarly, on climate, I am very keen to see more engineering in that, particularly because I think systems engineering is key to getting net zero delivered. We made some progress, but I did not make as much progress as I would like to have made in that area.

As I have alluded to, I feel that there are several bits of unfinished business. But—I think this is important—I feel quite strongly that the Government Chief Scientific Adviser role is a five-year role. The whole point is to bring somebody in who is from outside who brings a different perspective. That turnover is quite an important feature of the role.

Chair: That is very helpful to hear. Let me turn to my colleagues who will go into some more detail on some of these themes.

Q4 Graham Stringer: First of all, Sir Patrick, I have just read through all your appearances before the Committee, so thank you for appearing so many times. Outside of war, it must be the most difficult time to be a Chief Scientific Adviser. Your background is in the development of medicines and drugs. Do you think it makes much difference what particular discipline the Chief Scientific Adviser comes from? We have had physicists, surface chemists and population experts. In one sense, you could say you were fortunate; you knew a lot about drugs and medicine, and we had an epidemic. Do you think it would have made a difference if it had been a physicist or a surface chemist?

Sir Patrick Vallance: The role of the Government Chief Scientific Adviser is not to be an expert, except in the application of scientific principle and method to what the problem is; the ability to convene others; and to probe and try to make sure that the uncertainties are properly revealed



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and the current state of knowledge. I think the expertise does not matter in one sense. The example I will give for that is that I was asked to be the chief scientist for COP26. I am not a climate scientist, but I was able to bring climate science to a prominence through that role.

Generally, the answer to your question is no. The reason I am being slightly cautious about this is that there are times when it did matter in the role I was in. So it did matter that I had expertise in industry and the ability to understand how to make a vaccine and drugs and so on—that did matter for that specific thing. With the network of Chief Scientific Advisers, if you look around, we have people ranging from behavioural scientists through to physicists through to chemists and others. They can be pulled on as needed, and experts outside—including from the learned academies—come in at the drop of a hat to help.

The short answer to your question is that I do not think, when searching for a new Government Chief Scientific Adviser, one should search for a specific area of expertise.

Q5 **Graham Stringer:** One of the areas that this Committee has been critical of during covid was exactly the areas you are talking to—the breadth of the number of scientists on SAGE and the transparency of issues. We thought that there were not enough economists on SAGE and there were too many—to use a very loose term—public sector scientists on there, and there was not a breadth. Do you think that was a fair criticism from this Committee and others?

Sir Patrick Vallance: I think it is completely wrong in relation to economics. I think the notion of bringing together all the sciences and economics in a single advisory board is incorrect, because it leaves Ministers not having to make the trade-offs that they need to make. They are ministerial responsibilities in a democratic society, so I think it would be a mistake to end up with a single integrated advisory board. There is a separate question about whether economics and other things should provide inputs to that side of the equation for Ministers to consider.

The breadth of scientists involved in SAGE was actually pretty wide. It ranged right the way across from engineers to fluid dynamic specialists, virologists, epidemiologists, public health doctors, chemists and bacteriologists. There was a pretty wide group of people, and a very wide group if you look at the sub-groups as well.

Did it have enough people from industry? I think that is an interesting question. We tried to do that where it was necessary to do it, but we did not have standing members from industry. In some ways, that is a bit more difficult to do for something that is demanding—as it did, for many of those people—all of their time, because industry people might not have been able to do that. We did, in the Vaccine Taskforce, pull in lots of people from industry very quickly.

Q6 **Graham Stringer:** The Chair asked you for things that you wish you had done differently or could have done better, I suppose. There were a lot of



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areas of controversy during the covid period. Masks and your original view on herd immunity were two of the areas of particular debate, for want of a better word.

The latest evidence seems to show that, at the very least, there is no solid evidence that masks are effective, which I think was your and Chris Whitty's first view on them. I thought you were unfairly criticised on herd immunity, because if we had not got vaccines, that would have been the only way people got any sort of resistance. Would you reflect on those debates?

Sir Patrick Vallance: Obviously, the inquiry is going to look at all these matters, and I don't want to pre-empt that. An observation that I have made publicly before, which I will say again here, is that in my experience, during covid, the louder the voices, the lower the evidence base. That is important to remember as we go back, because there were lots of uncertainties and lots of strong opinions on all sides. The evidence itself is quite difficult in some of these areas. Certainly, the evidence around the effect of masks changed and grew over time. It pretty much ended up with what lots of people thought at the beginning, in terms of where they might be most effective. Evidence changes, and you need to be able to change with it.

On the question of population immunity, the mistake I made was to answer a question that was put to me about herd immunity. The point I was trying to get at was not that there needs to be a strategy to get that, but that fundamentally that is how you end pandemics: people get immunity. They get immunity through vaccines and through catching infections. Ultimately that is where you get to, and ultimately that is where we got to.

That is absolutely not the same as saying, "What you want to do is deliberately go out and get people infected." There was definitely very clumsy wording in my answer to the question, which led to a misunderstanding, but my position was clear right from the beginning. It was that ultimately that is where you get to in a pandemic. Immunity grows, and hopefully that stops it. Now, that is not true for all infections. It hasn't been true for HIV, which needed drug interventions, but it is generally true for these sorts of infections.

Q7 Graham Stringer: You and Chris Whitty helped this Committee pursue a policy of more openness, both on the membership of SAGE and the transparency of the evidence it was looking at. My personal view is that the Government still is not as transparent in its scientific investigations as it should be. I would be interested to know whether you think that is a fair reflection.

You may not be familiar with the detail of this, but there has been a Government investigation into the dying off of molluscs in the north-east, and it is very difficult to get the full details of that—well, it is secret. Do you think the Government is as open as it should be when it has had scientific investigations?



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Sir Patrick Vallance: I am very clear that I think the science advice in reports should be published. We have to go through a process of permission, of course, to get to that, but I think that is important. The various reports that were produced during my time in Government have all been published, even though for some of them we had to battle a bit to get through the system.

We did get to transparency as soon as we could, in terms of the output from SAGE. Again, we need to go through permissions, as you are aware, to get to that. Yes, I believe the science advice in reports should become public. In fact, I think it did on the crab deaths that you are alluding to. DEFRA set up an independent panel, which published its findings.

Q8 **Graham Stringer:** I thought there was still work to be published on that. I will check.

Sir Patrick Vallance: There might be. I don't know. All I know is that an independent panel was set up. I worked with Gideon Henderson, the DEFRA CSA, who set that up, and the report on that matter by a group of independent scientists was published.

Q9 **Chair:** On that point, I think we should record that Sir Patrick caused the SAGE minutes and papers to be published during the course of the pandemic rather than at the end of the emergency, as had previously been the case. That was in response to a recommendation and request from this Committee, and it proved exceptionally useful during the pandemic.

Q10 **Tracey Crouch:** Sir Patrick, I do not have a scientific background at all. Part of the reason I wanted to join this Committee is that during the pandemic, your very clear and comprehensive explanations of complicated science, which were projected to ordinary people like myself, were really interesting. They awakened an interest in the sciences that I had never had. Do you think that your prominence and your ability to convey some very difficult scientific facts to ordinary people may have inspired future generations of scientists?

Sir Patrick Vallance: It is interesting: if you look back to the flu pandemic at the beginning of the 20th century, there was a peak of interest in science after it, and there has definitely been a peak of interest in science during this pandemic, which I hope lasts. I hope that it creates some sort of pull-through from children and others—that they want to engage with this.

Science is not the purview of just a few people who wear white coats and sit in labs; it is something that impacts every single policy area in government. I cannot think of a single area in which science, engineering and innovation would not play a part. In everyday life, it plays a part—whether it is how we move around the country, transport, communication, health, resilience, defence, housing or planning. It is in every single area.

The more that science becomes something that is normal in society, the better. Then people would ask of elected politicians and others, "What are



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you doing to use the latest scientific evidence to solve this problem?” or “How can you improve my life by utilising science, technology and innovation better, or improve the prospects for my children?” This ubiquitous approach to science is important, and if anything over the last few years has made that a bit more likely, that is a good thing.

Tracey Crouch: Funnily enough, I say that there is no problem in this world that cannot be solved by sport and physical activity, so we are on the same wavelength.

- Q11 **Aaron Bell:** Thank you, Sir Patrick, for your service not only to this Committee but to the nation. Let me follow on from Graham’s questions about some of the controversies of covid. I know that you do not want to go into the inquiry’s territory, but on the origins of covid itself, what are your views now about the lab leak hypothesis? What is the probability that that is true, and will we ever find out?

Sir Patrick Vallance: There may be more, but there are three obvious ways in which it might have occurred. One is a zoonotic disease overspill—from bats, probably, into other species. The second is that there could have been, perhaps, a designed virus. The third is that there could have been an accidental leak from a laboratory of something that was taken into the laboratory. I think that the evidence is quite against the idea of a designed virus.

Aaron Bell: Intentionally released.

Sir Patrick Vallance: Yes. The biology of the virus does not look like that, and it would be quite difficult to see that. I think that that is very, very, very unlikely. By far the most likely, from all the evidence that I have seen, is that this is a zoonotic disease that spread from bats. The most recent publication, which was published a month or so ago, suggests that the virus was found in the food market in samples taken in January, and that is in line with that as being the most likely. If you think about it, there are hundreds of millions of chances for that to happen, because of the size of the bat population and the way in which the interaction with other species occurs.

Then there is another possibility, which is whether a sample could have been taken into a lab and then leaked out. You cannot really answer that biologically. It is not a biological question; it is a security question, and one that the security agencies would need to address. I think that it is less likely, for all the reasons that I have given. I think it is much more likely that this is a zoonotic overspill, and it is very likely that something like this would happen again in the future.

- Q12 **Aaron Bell:** Just to press you a little bit further on that, there was a discussion at the very beginnings of the pandemic on a call you were on with Jeremy Farrar, Anthony Fauci and others about the origins. Was there a serious discussion on that call about the possibility of a lab leak? Or was it generally the opinion of most—

Sir Patrick Vallance: Those three things were the three things.



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Q13 **Aaron Bell:** You had that discussion.

Sir Patrick Vallance: That discussion was had. I have to say that, at the time, my interest was not in that.

Aaron Bell: Of course.

Sir Patrick Vallance: It was in what we were going to do about it. Frankly, where it came from was a rather secondary issue. It was not the thing that was preoccupying me at the time.

Q14 **Aaron Bell:** You mentioned a designed virus, or a modified virus perhaps. There was funding—Wuhan Institute of Virology had applied to put a furin cleavage site into a virus and so on. Regardless of whether or not there was a lab leak, or whether the virus had been modified, does this create any questions for the scientific community generally about gain-of-function research and whether, both in the UK and internationally, we need to regulate it more tightly?

Sir Patrick Vallance: It is not a question about gain-of-function research, which is incredibly important for all sorts of areas of beneficial science and therapeutics. It is a question about biosecurity of labs. I do think that there is a need to make sure that biosecurity is properly regulated across the world, that there are decent standards and that there is a standardised approach to making sure it is as good as it can be.

Q15 **Aaron Bell:** Did you advise any additional measures in the UK as a result? We do conduct gain-of-function research in the UK. Could you briefly set out why gain-of-function research is a good thing?

Sir Patrick Vallance: The biosecurity strategy is being worked up through the Cabinet Office. They own that, and no doubt they will come out with their recommendations in due course.

Q16 **Aaron Bell:** Could I just go back to what you said at the beginning about the civil service after your capability review? You said that we have this 50% target and we are a long way towards it, but you also said that we are not where we should be at the moment. Could you say how we have made that progress, what is encouraging people in at the moment, and what more the Government can do to encourage people to join and stay in the civil service?

Sir Patrick Vallance: I think we have not made very much progress against the 50% target, other than that now we have a 50% target. That is my point.

Aaron Bell: Right.

Sir Patrick Vallance: I think one of the reasons was that the science capability review came out in November 2019, and then of course there was not a lot of focus on this for the next couple of years. I am very pleased that there is now a target. As the civil service reform agenda gets under way, it is going to be important to recruit people and give career options for people who come in with a science degree.



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We looked at a number of things. Is the number of people applying with a STEM degree to the fast stream equivalent to the number with a non-STEM degree? Actually, the number of people who apply is not bad. Do they get knocked out in the selection process? It does not look as if there is a differential knock-out of those people in the selection process, but there might be. That is something that needs to be looked at.

Does the time taken to recruit people have an impact? Yes, it does. Lots of people with a STEM degree get offered jobs by businesses very quickly. A point that I think is crucial, right the way across the civil service, is speed of recruitment. You have to move fast if you want to bring in people who have other offers coming in from industry, and you have to make sure that there are appropriate career paths for people.

Most of the people who come in with a STEM background should not be scientists in government, if you see what I mean—they should come in and be generalists, with that background. But then there are some people who come in with a science, technology or engineering degree, and there we need to make sure that we have appropriate career paths for them.

Q17 **Aaron Bell:** Is salary an issue for these people as well?

Sir Patrick Vallance: Salary is an issue, of course, right the way across the civil service.

Q18 **Aaron Bell:** Specifically for STEM graduates.

Sir Patrick Vallance: Yes, it is, but we are never going to equal private sector salaries, so what wins out? Purpose. People actually believe that there is a valuable reason to be in government, to try to make the public sector better and to improve services for people, so there is a feeling of purpose, which is important. I think there are some attractions to the way in which careers can develop in the civil service.

There are things that attract people in, and salary is not the only thing. I do not think we should dream that we have to somehow match private sector salaries, because it is never going to happen, and I don't think it is actually necessary.

Q19 **Aaron Bell:** Finally, the Cabinet Secretary said in February that half the next cohort of the fast stream will be STEM graduates. Is that a quota, is it an aspiration that is going to be roughly met, or are you literally saying, "We have half the slots open for STEM graduates and half not"?

Sir Patrick Vallance: I don't know exactly where they are on that, because I am no longer part of it, but I think that is the target, and it is an achievable target.

Q20 **Aaron Bell:** It will not be done as a quota. It will be just to try and encourage these people in and give them a fair crack—and a rapid offer as well.

Sir Patrick Vallance: Yes.

Aaron Bell: Thank you.



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Q21 Chair: Sir Patrick, you made a point earlier about salaries and about public sector research establishments and respected organisations such as the National Physical Laboratory. They are, in effect, subject to civil service pay and conditions, which means that they cannot compete for talent even with the universities. Is that something that you perhaps had in mind when you thought that some more work should be done on PSREs?

Sir Patrick Vallance: Yes. I think it is important that you get the salary structure right. I am just being clear that dreaming of making this private sector is just not right, but making sure that there are appropriate, competitive salaries for people is an important part of it. But it is equally important to play heavily on purpose, career structure and experience.

Q22 Carol Monaghan: Sir Patrick, can I press you a bit further on STEM graduates in the civil service? Are we properly recognising that there is huge diversity across STEM, from engineering to biotechnology to medics to whatever? Has that been properly recognised in recruitment? Are we trying to get variety there as well?

Sir Patrick Vallance: Yes, I think so. I am not close to the details of how it is being done, but the point you raise is one that many people have raised. We need to be careful: we are not talking about how we need 50% of the intake to be chemists or mathematicians. It is the very broad definition of STEM, which includes some of the other numerical sciences, economics and other areas.

Q23 Carol Monaghan: Different graduates will come with different personal skills and strengths and weaknesses. In the past—maybe not so much now—there have been people coming with particular types of degrees who might be less communicative or might struggle more with particular aspects, but might have strengths in other areas. Has that been taken into account in the interview process?

Sir Patrick Vallance: I think you are getting into an area of recruitment that I have not been directly involved in. That is for the Cabinet Office recruitment process, but if you want my view, neurodiversity and all the other forms of diversity are important as you recruit. People do come with all sorts of different skills and approaches, and the civil service needs to be diverse in that.

My own view on diversity generally is that, given the scale of the problems that you are trying to tackle, any approach that leaves you with a monolithic group is going to fail. You have to be diverse in order to tackle difficult problems, and therefore actively looking for the diversity as part of the recruitment process is important.

Q24 Carol Monaghan: But you are not sure whether that is actually—

Sir Patrick Vallance: I am sure it is, but I don't know the details of it. You would have to ask the Cabinet Office exactly how they run that.

Q25 Chair: On the point about recruitment into the civil service, expanding the number of people with scientific or numerate degrees is clearly beneficial.



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But there is a recognition that we need more STEM-educated and trained people generally, including in teaching. If we are to meet the target, everyone in a secondary school should have a specifically trained teacher in their discipline. We heard evidence in this Committee that two thirds of those studying physics in university at the moment would have to go into teaching simply to meet that target. Isn't there a bigger problem of the number of people being educated at school and then in university in STEM subjects? Have your five years as Chief Scientific Adviser led you to any views as to how we can increase the number of people coming into these disciplines?

Sir Patrick Vallance: I completely agree with the premise that we need to get more people into teaching. That is important. There are three areas that I have been thinking about in relation to attracting people into STEM subjects, and indeed into teaching and other professions.

The first area is relevance of the subject. We do not do a good enough job of explaining and showing why certain subjects matter. My experience, from my time at GSK and in other areas, has been that children in particular latch on to something that they think is relevant to what they care about. I distinctly remember someone having their eyes completely opened when they came to look at the malaria research we were doing at GSK. They suddenly said, "Oh, I understand why we are learning about biology now." Chemistry can also be taught in the context of climate change in the curriculum.

The second area is role models. It is crucial that we increase, at a senior level, the number of role models who look and sound like a wider selection of the population and come from their background, because we still do not have enough. We know that in science and technology we still do not have the diversity that is required at the top. If we do not concentrate on that as well, we will not have the role models for people to pull through.

The third area is resources. We need both the people in teaching and the resources to enable those people to have the tools necessary to deliver against a modern activity. Those are three Rs of a different type, if you like: relevance, role models and resources. They are crucial.

I should make a declaration here that my son is a teacher, so I know something about what this is like. I understand that there is a fall-off in people going into teaching at the moment, which is probably made more difficult by the fact that many people want to have a partial work-from-home culture. That is very difficult to do if you are a teacher, and that makes it slightly less attractive, so that needs to be dealt with.

We also need to deal with specific incentives to get people in. Schemes like Teach First have been absolutely outstanding. We need to ensure that those sorts of schemes are bolstered and get the enthusiasm and excitement behind them that was there when they were first formed.

Q26 **Stephen Metcalfe:** Good morning. Thank you for joining us today. Before I go on to the area I want to talk about, which is the setting up of DSIT



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and its future role, let me ask something about your comments on herd immunity. Do you think they were misinterpreted because you did not communicate what you meant well enough, or do you think they were wilfully misinterpreted by people covering those comments because it was an opportunity at the time to give the Government a good kicking about their policy?

Sir Patrick Vallance: I don't know.

Q27 **Stephen Metcalfe:** You must have an idea. You had a view and it was represented in the media another way.

Sir Patrick Vallance: What I know for a fact is what I was trying to say, and I was not trying to say what got concluded. Moving away from that, I will say that there is a problem generally. Looking at the period of the pandemic and elsewhere, a lot of stories are only stories because they are controversial.

It reminds me of something that happened in medical science many years ago—probably 20 years ago or so now—when there was a recognition that the scientific papers that were published were the ones that were the most titillating or exciting scientifically, rather than all the negative studies, which were very important. You did not get a full picture. I think that led to a change in publishing where people said, "We have got to publish the negative as well."

There is literally nothing in current media, as far as I can see, that would encourage you to publish anything that said, "You know what, this isn't very interesting—nothing to see here." That means that the whole thing is skewed towards excitement and controversy. That is a general point.

Q28 **Stephen Metcalfe:** Which is not great if you are covering the wider sciences. Let's move on.

We throw the term "science superpower" around. Some think we are a science superpower. Some think we are aspiring to be a science superpower. What is your view on the word? If you accept that it is a helpful way of describing UK science, what is the role of DSIT in maintaining or promoting that?

Sir Patrick Vallance: The word is being bandied around as a political statement of what we want to be. Do I believe that science and technology is the route to economic and societal progress and success? Yes, I absolutely do. Do I believe we should be great at it in this country because we have the fantastic basis for it? Yes, I do. This is an important ambition. It is important for resilience, security, economic success and societal benefit.

For the structures in Government, I feel that probably the most important thing that happened was the formation of the National Science and Technology Council—that is, to make this a prime ministerial accountability, because every single Department needs to be good at science and technology, and prime ministerial authority and the ability to look across provide exactly that impetus right the way across Whitehall.



The formation of DSIT then allows science and technology itself—the underpinning broad areas that do not fit into Departments—to be looked after properly and supported, as well as generic measures such as making sure of the financial incentives to create companies and grow them, and pushing things like Government procurement. Those are things that a Department that focuses on science, technology and innovation can make sure happen for the benefit of everyone. That is a structure that can work.

Q29 Stephen Metcalfe: Thank you. You also said earlier that the UK does not have a very good history of scaling up companies—we are great at the innovation and ideas, but not at that. This Committee covered it in its “Bridging the valley of death” report some 10-plus years ago. Have we made any progress towards helping to scale up those companies? What practical difference will the establishment of DSIT make to that?

Sir Patrick Vallance: The “valley of death” is an interesting expression, because if we look at it, people use it for all sorts of different parts of the process. They have looked at different ones. The initial valley of death was that we were not getting things out of universities into start-ups, but that is happening. Scale-up remains a problem. If you look at the 10-point framework for the National Science and Technology Council and DSIT, it tries to deal with the 10 things that I think you need to think about, which include how you unlock at-scale investment.

We are talking about the £300 million or £400 million-plus stage of a company, where significant investment is needed. Pension funds can provide that sort of level of investment, and I am encouraged that people are looking at what incentives there are to get pension funds to do that. The Canadian teachers’ pension fund is a big consolidated fund—therefore it has enough scale to do this—and has invested in science and technology companies. The effects have been that companies have scaled in Canada and, surprise, surprise, pensions have done quite well as well.

There is a real need to unlock some of that financial power. There is a need to unlock things like Government procurement of innovation, so that there is a pull factor, and of course there is a need around skills and technologies. If we work through the 10-point framework, it takes us down the route of trying to make sure that scale-up is better. Are we better at it than we were? Maybe a bit, but it is the area to focus on, in my opinion.

Q30 Stephen Metcalfe: That funding, that investment, is something that has come up over the past decade—it is not a new thought—but the pension funds one is new. Do you think that the appetite in the UK from whomever might have the investment to make is there to invest in science and technology? Although we are very good at doing it, do our establishments want to be part of that growth?

Sir Patrick Vallance: We do not yet have a cadre of specialist investors, and it does need specialist investors. If you look at the US, there are lots of specialist investors. My experience of dealing with the investment community when I was at GSK was quite different in the US from the UK. In the US, people would ask lots of details about specific science, they



would know what the comparators were in biotechs and other places, and they would want to understand what the promise was coming through the pipeline. In the UK, frankly, most of the interactions were people wanting to know whether the quarterly dividend was safe—very different. We need specialist investors, and that of course needs money, because otherwise they will have nothing to invest, which is why I think that unlocking the pension funds will be a really important part of that.

- Q31 **Stephen Metcalfe:** My final question is about the Office for National Statistics. It recently suggested that the amount that the UK as a whole is spending on R&D is higher than previously thought. The Government might well have already met their 2.4% commitment on the percentage of GDP spend. I think that the OECD said that it was 2.93%. What is your view on that? If we are spending that amount, are we getting a return on that, bearing in mind our relatively low growth figures over the last few years?

Sir Patrick Vallance: The first thing to say is that spend as a percentage of GDP is an input metric, not an output metric, so one wants to focus on outputs. If you look at the relationship between percentage spend and productivity, it is actually a positive linear relationship. The revised ONS figures actually then put the UK bang on the line. We are sort of average in terms of the output compared with the input, but if you look across the world, I think the latest data I saw suggested that South Korea is at 4.81%. Israel is at 4.65%, the US is about 4%, Germany is at over 3%, and Japan is at over 3%. We should not assume that our job is done just because we may have gone up a bit because of the ONS reclassification. It is not.

Stephen Metcalfe: Thank you very much.

- Q32 **Chair:** On that, you have talked about the importance of targets and 50% recruitment into the civil service of STEM graduates, and I think you have been a strong supporter of the 2.4% target. Does it follow from what you have said about Israel and South Korea that we should be setting a higher target for investment in R&D?

Sir Patrick Vallance: When I came in and the figure was 2.4%, I was always clear that it was 2.4% going to 3%. We need to keep being ambitious, and this is not all about just public spend. If you look at any country that has increased the percentage spend on R&D, to the extent that we aspire to do so, you have at least a 3:1 ratio of private to public. The measures need to be both funding the UK science—the bit that I think is crucial is not to forget the fundamental curiosity-driven, high-quality science that underpins all that. That needs to be funded. That is the public funding. That is really crucial.

Then, as we look at other investments from public funds, they need to be geared towards how that unlocks further private sector investment to get a ratio of at least 3:1 and ideally higher.

- Q33 **Chair:** That 2.4%, as you say, is both private and public. Given that the 2.4% was set when we thought we were 1.7%, do you think there is a



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case for substituting it with a more stretching target that puts us in line with the best in class, rather than the average?

Sir Patrick Vallance: Yes, and that needs to include measures to look at how we leverage greater public sector—in other words, it is not enough just to say, “We are looking at that number.” It has to go along with, “What are the long-term incentives for people to invest in science and technology in this country and pull it through?” That is why I think the 10-point framework is so important. It starts to tick off all the other bits.

The risk is if you say, “I want a 3:1 ratio,” I am going to say, “I put down a pound; I want somebody else to put down three pounds.” That is not right, because all that does is mean that the only people who can be part of this are the big primes who might be able to do that. You need to think of this, I think, in a longer-term strategy of, “This is an investment leading to a return, because you have growth of companies in this sector.”

If you look at the most vibrant places in the world for this, for the biotech sector it is probably Cambridge, Massachusetts—the Boston area. People are in and out of academia, businesses, local public sector—people move around—and the ecosystem itself benefits everybody. That notion that this is an investment that unlocks further excellence is important.

Q34 **Chair:** So a strategy that has a higher target combined with some steps to create that interactivity would be what is needed here.

Sir Patrick Vallance: Yes.

Chair: Thank you. Katherine wanted to come in on this.

Q35 **Katherine Fletcher:** Thank you. I just want to come back on the Government procurement or stimulation of innovation. I won't name names because they won't thank me, but I have spent a lot of time hanging around the ecosystem of the nuclear industry in the north-west of England. Depending on how many drinks have been imbibed, people can get very cross about SMRs. They describe a missed opportunity for the Government—that the Government perhaps did not stimulate an investment or demonstrate to buyers, which would have leveraged private investment and grown an industry. I know you can't comment on specifics, but I would be interested in your general view about how we learn lessons from opportunities that have been missed and what needs to happen now. Nuclear energy would be of interest. We have an SMR hearing later on—

Chair: SMR being a small modular reactor.

Katherine Fletcher: Yes, thank you, Chair. What do you think?

Sir Patrick Vallance: First of all, nuclear has to be part of the net-zero ambition. In my opinion you cannot achieve it without it. There needs to be a much more direct and deliberate Government approach to which technologies we care about. I am going to move off nuclear and come back to vaccines. At the beginning of the pandemic, we looked at the vaccine industry in the UK and realised it had just sort of withered. It had



not withered because somebody had made a decision about that. It was benign neglect. This is part of the 10-point framework, but I think one of the questions is about what things you know you are going to need as a country, and actively working out what the plan is to try to ensure those industries can flourish. Part of that will be Government procurement pull.

Q36 **Katherine Fletcher:** Can you speculate on what we need to do differently to prevent that withering in two very different sectors?

Sir Patrick Vallance: I think there needs to be an active review of those areas, in a format like the National Science and Technology Council. If you took a very simple view of that, you could say that you go through the national risk register and ask what industries you need to have to make sure you are secure. That might be one way in which you look at it. There will be other ways based on economic potential.

One of the things we set up in the Government Office for Science was the science and technology insights function to try to ask the questions: where is the UK in key areas of science and technology, how does it compare with international countries that are doing very well in that, and which bits are we doing or not doing? We need that as an objective set of data. The reason that was set up as an independent group is to try to stop the expression that we are world-leading, which is used very often.

We hear, "we are world-leading in x, y and z." We want to put some data in there and to have a systematic way of being able to say, "Actually, we are third on publications, fifth on patents, eleventh on start-ups and first on primes"—whatever it might be—so that there is some objective way of looking at this.

Q37 **Katherine Fletcher:** Is there a role for DSIT in that?

Sir Patrick Vallance: Yes, and the Government Office for Science hangs off DSIT in the way it did off BEIS. That is absolutely part of DSIT's role.

Q38 **Carol Monaghan:** I think an interesting take away for all of us is the point about how we classify our success. Possibly that is something we need to look at a bit more.

Two weeks ago we had a session with a number of different individuals. One of the things we talked about was Horizon. We heard from Sir Paul Nurse, who said that our association was crucial for the success of UK science. His views were backed up by Sir Adrian Smith as well. They talked about the letter that had been written by 15 Nobel laureates. We also had some witnesses say that they were expecting association to happen. What is your assessment of where we are with negotiations? When can we expect some sort of decision on this?

Sir Patrick Vallance: I am no longer part of Government, so I don't know where we are on negotiations. I can be very clear though that I think Horizon is essential. The European funding programme took probably a decade to get going well. That tells you how long it takes to set up these schemes. The idea that you can instantly set up something equivalent is flawed. The geopolitical situation of science and technology, as I alluded to



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earlier, is very different from what it was. There are lots of countries that have become very good at this and have huge scale. China has huge scale and the US has huge scale. There are some parts of science that need scale. Horizon brings scale. That is the first point. You cannot replicate that scale domestically.

The second is that if you look at the types of things that get funded by Horizon, an international group of peer reviewers inevitably comes up with different answers from your domestic ones, so you fund different things. That is a good opportunity. The third is that it is a great way of developing talent, and we have been a magnet for the talent that comes through Horizon. I think we would be causing ourselves a problem by not continuing to be part of it.

Horizon is a strong part of the UK need. It is a strong part of the European need to have us as part of Horizon—I think they recognise that. I greatly welcome the comment that Ursula von der Leyen made on the day the Northern Ireland protocol was discussed and looked like it was being freed up. She said, “We would welcome the UK back into Horizon.” That is very positive, and I think it would be a mistake for us not to rejoin Horizon.

Q39 Carol Monaghan: We have heard a bit about Pioneer being plan B. You have already talked about the length of time that it took to set up Horizon. Is Pioneer going to offer a good alternative, or do you think there are deficiencies within it?

Sir Patrick Vallance: I think there are lots of things to like in Pioneer. I would quite like to have my cake and eat it: I would like to be part of Horizon and do some of the Pioneer things.

Q40 Carol Monaghan: What are the good things?

Sir Patrick Vallance: There are some good training schemes outlined in there. I think there are some areas of focus that would be good ones to grow. There are things in there that have definitely been well thought through and look interesting. My view is that Horizon is plan A, and you are better off going with plan A.

Q41 Carol Monaghan: I was going to ask you whether we should be looking at aspects of Pioneer even if we get the association, but I think that “have your cake and eat it” is probably a good way of putting it. Sir Adrian Smith also talked about the talent aspect and visa fees, and the Royal Society have done a good bit of work on this. Can we develop talent properly while we have this big obstacle of visa fees that are six times more than those of competitors—for example, Germany?

Sir Patrick Vallance: We need a quick and internationally competitive visa scheme that is not costing more than others.

Q42 Carol Monaghan: We find ourselves in a situation where the Home Office is now saying one thing and scientists are saying another. How do we unblock that?

Sir Patrick Vallance: That is for you all to sort out, isn't it?



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Q43 **Stephen Metcalfe:** You are the Government's Chief Scientific Adviser. Have you made the point loud and clear about having a competitive visa system across Government?

Sir Patrick Vallance: Yes.

Q44 **Stephen Metcalfe:** What was the response?

Sir Patrick Vallance: Well, I fed my advice in, and it is for Ministers to make decisions.

Q45 **Stephen Metcalfe:** They never feed back to you.

Sir Patrick Vallance: I guess the feedback is the action.

Q46 **Katherine Fletcher:** We are going to do quick-fire scientific nerdery, if that's all right, because we have a couple of ongoing inquiries and time is valuable. Have you been surprised at how fast AI has moved on in five years?

Sir Patrick Vallance: I think everyone has been surprised by how much the large generative models have done things that people did not expect them to do. That is what is intriguing about it—very large datasets, very high compute power, and those models are turning out things that even people very close to the field thought, "Actually, I wasn't sure it was going to do that." It has done it quicker, and it has done it differently. So yes, that has been a surprise for everyone, and it is a very important development.

Q47 **Katherine Fletcher:** It is interesting, isn't it? We are doing an inquiry at the moment, and I can speak for the whole Committee. We would be grateful if you say, "I think you should go and have a bit of a poke at that" or "I'm a bit worried about that." The AI field is huge and broad. What would you suggest are some of the issues that we should make sure we have a good examination of?

Sir Patrick Vallance: Trying to get a feel for people in the field. There is a school of thought that says this all comes towards one massive model. Is that correct or not? If not, what does that mean? The second is, how does a nation get to be competitive in terms of understanding the implications of AI and testing the outputs? What is the core national capability we require? We are not going to invent a new model ourselves—they are going to come from big companies—but you need to be able to probe them and understand them, so what is the core national capability that is required around that?

Then there are—this has been spoken about a lot, so it is nothing new here—three areas of society that need to be thought about. First, with the large models and the potential, how do you determine what is true and what is not, as you can get replication of all sorts of things? Secondly, there will be a big impact on jobs, and that impact could be as big as the industrial revolution was. How are we going to think about that over a slightly longer timeframe? Thirdly, of course, what happens with these things when they start to do things that you really did not expect, and



what are the risks associated with that? That may be a slightly longer-term question, and people have different views on how far that can go. I think that trying to understand what leads people to have those different views, and what assumptions they are making, would be quite important.

- Q48 **Katherine Fletcher:** We have COP26 via the UN for climate; is this big enough that we need a kind of AI conference of the parties to ensure that what one country does doesn't deleteriously affect another?

Sir Patrick Vallance: It is a global issue; you are absolutely right. There is no point in thinking that you can protect yourselves individually against something that you might view as a harmful effect, because you can't. Therefore, there does need to be an international position on how to think about this. Also, in terms of regulation, what do you actually want to regulate? My own view is that you would not regulate the advance of the technology, but you would think very carefully about the application.

Katherine Fletcher: Regulate the outcomes, effectively?

Sir Patrick Vallance: Yes.

- Q49 **Katherine Fletcher:** There was some speculation that we actually need to set a framework up to allow these things to have some clear input parameters to help guide the thinking. Do you have any views on that?

Sir Patrick Vallance: Well, I know that many people are looking at watermarking—a technology that would allow you to know which data had been ingested, and where those data came from. I think that that may turn out to be quite important. The technology is not there yet—it can't be done in that way yet—but I think that that is one thing that lots of people are looking at that may turn out to be quite an important way of working out input. However, over-regulating input at the moment would probably just stifle innovation.

- Q50 **Graham Stringer:** Just one question: is the natural conclusion of what you are saying that the people who are arguing for a pause in the development of AI are wrong, because, even if we pause AI, China and other countries won't, so we have to carry on if we are to be competitive as a country and to ensure that we do not fall behind?

Sir Patrick Vallance: Well, unilaterally falling behind does not seem to me to be a very sensible approach.

Graham Stringer: Nor to me.

- Q51 **Tracey Crouch:** Some of the reporting on AI has been "end of days" stuff. Without wishing to evoke some sort of PTSD, if you were back in that press room again, trying to explain AI to an uninformed, worried public, what would you be saying to reassure ordinary people about AI?

Sir Patrick Vallance: Well, I think that AI brings a lot of benefits, and we shouldn't view this as all risk. It is already doing amazing things in terms of being able to do medical imaging better. It will make life easier in all sorts of aspects of everyday work—in the legal profession and in all sorts



of other areas as well. It is going to be incredibly important and beneficial. That is the starting point: it is helpful.

On the other side of it—where it can cause harms—I mentioned the three areas, and I think that the most immediate one of those is truth. How do you ensure that the output of AI does not distort the perception of truth? That seems to me to be something that can be looked at. There would be ways of thinking about marking something as an output of AI, where it is appropriate to do so, so that you did not end up with people inadvertently thinking that something was something that it wasn't.

On the jobs aspect, again, during the industrial revolution, the initial effect was a decrease in economic output—as people realigned in terms of what the jobs were—and then a benefit. I think that we need to get ahead of that. Which are the jobs and sectors that will be most affected, and what are the plans to retrain, or give people their time back to do a job differently?

There will be jobs that can be done by AI, which can either mean that lots of people do not have a job or that, actually, lots of people have a job that only humans can do. In the area that I know most about on this—medicine—it could be that you actually get more time with your doctor, rather than that being pressured, so that could be a good outcome.

- Q52 **Tracey Crouch:** One of our witnesses said we have to make sure that we are “the most intelligent form of intelligence”, which goes back to your original point about the teaching of sciences, relevance and trying to create a better understanding of these things, so that we remain the most intelligent form of intelligence.

In your emerging technologies review, you talked about a multi-regulator sandbox. The Government have accepted that recommendation, but are you happy with their proposed six to 12-month timetable for establishing that sandbox, given how quickly everything is evolving?

Sir Patrick Vallance: One of the points we made in the short review on regulation was that you have to move at the pace of the technology, so the quicker you do these things, the better. There is already an embryonic sandbox between some of the regulators, which they got off the ground themselves, and it looks like a pretty good starting point. The sooner they get on with this, the better, but they will obviously want to do it properly.

- Q53 **Tracey Crouch:** Do you think the creative industries will be able to reach an agreement on a code of practice on AI, or will there have to be some kind of intervention?

Sir Patrick Vallance: What we have argued for is absolute clarification on IP and copyright. I have alluded to future technologies such as watermarking, which could be quite important in that. In the meantime, to draw a rather obvious comparison, when you see pictures or hear music, it inevitably influences what you then think about if you paint a picture or create some music. That does not mean you have copied something; you have been influenced by it. The challenge on AI is, what is appropriate



influence equivalent to human influence, and what is copying? That is where being able to track data inputs eventually would be useful.

- Q54 **Aaron Bell:** I have a couple of brief questions on space. Are we at risk of falling behind in space? Obviously, we were very disappointed with the failed launch, but this Committee heard evidence after the launch from some of the commercial partners involved, who felt that our regulations were getting in the way. In your report, you recommend a variable liability approach. Are we at risk of losing our position in the space race with Europe and other countries of our size?

Sir Patrick Vallance: We have to make sure that we keep pushing that, and, again, Europe links are important in that. Variable liability is important. The Space Industry Act 2018 introduced an unlimited liability for people putting things in space that carried a lot of risk, and the aim of variable liability is that the CAA could determine, depending on what the purpose and the activity were, different thresholds of liability. I think that that will help to free up some of the investment and security of the companies, because if they know that they have unlimited liability for something, it is quite a risk for investors.

- Q55 **Aaron Bell:** You recommended making that change by June this year. The Government are now saying early 2024, which is at least 10 to 12 months later. Again, is this an example of the Government not moving quickly enough in a fast-developing industry?

Sir Patrick Vallance: Obviously, it is much easier to write a review than to implement the solution. We were impatient, and we wanted to put pressure to get that as soon as possible. I recognise that these things take time to get through, but the quicker we move, the better.

- Q56 **Aaron Bell:** In their response to your report, techUK said that space debris and sustainability was a critical issue for Government to address but was not covered by the report's recommendations. What actions do you think we should take?

Sir Patrick Vallance: That is a very important international question. Interestingly, space debris is one of the things I picked up on in my first year in post and wanted to do something on, and then I got distracted by other things.

- Q57 **Aaron Bell:** There have been a lot of other things! Are you aware of progress being made internationally?

Sir Patrick Vallance: There are several international groups looking at this, and it is a huge issue of who owns it, who feels responsible for it and how you can do this in a safe way.

- Q58 **Chair:** I have a quick question on AI. Even at this stage of development, it seems clear that the major players are large global and non-UK-owned companies, and for all the vibrancy of our tech sector, it seems likely that it will be dependent on them. Does that concern you, and is there a case for considering whether there can be a UK sovereign capability in this area?



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Sir Patrick Vallance: We have obviously got a lot going on in this country. Take something like DeepMind, based in London; that is one of the world's greatest AI companies. We have got a lot going on here and based here. I addressed the sovereign capability issue earlier. I think we need a sovereign capability in our ability to use, probe and work with those things.

I do not think the idea that we are going to invent something that rivals what the big companies have already made sounds very sensible. That sounds like attempts to invent a new internet, which people did try. But why? I do not think it seems to be a good use of money to say, "You know what we are going to do? We are going to make a better large language model than anyone else has already made." But I may be wrong.

Q59 **Katherine Fletcher:** Are you going to check that other people's are kosher?

Sir Patrick Vallance: Yes—and work out where the vulnerabilities are, how to use these things, improve them and input into them. That is great, but I do not think we are going to invent a new one. DeepMind might, but ultimately they are US owned, as you said. I do not think that a national, public activity is likely to do that.

Q60 **Chair:** We have a fascinating ongoing inquiry into this, and that is one of the recommendations we have heard from witnesses already, so that is helpful.

Sir Patrick Vallance: They might be right—I am just giving you my view. It does not sound to me like we are likely to be able to do that in the right way.

Chair: Thank you. Graham has some questions on other areas.

Q61 **Graham Stringer:** Going right back to the very beginning of your answers, you said that one of the things you got right was the Vaccine Taskforce, and Kate Bingham did a fantastic job chairing it. She made a pretty devastating attack on the civil service and what had been learned by Government from the taskforce. She said we were in danger of losing our position as a superpower in the biological industries. Would you care to comment on whether you think Kate was right with her analysis?

Sir Patrick Vallance: I have talked to this Committee previously about the seven lessons of the Vaccine Taskforce, which I circulated widely across Government and made public. I think those are the seven lessons and we should focus on them. It is worth remembering that the Vaccine Taskforce was first set up in March, and we got a lot of people involved at that point, including Kate, who then took over in May. The taskforce involved civil servants; it was not just people from industry. The civil servants in the Vaccine Taskforce were crucially important to it.

I think Kate's comments echo some of the things I have talked about today: lack of skills, lack of capability right the way across the civil service, lack of structures for careers, and interaction with industry. Those



are all things that, if we want to be a properly science and technology-enabled Government, we need to work on.

- Q62 **Graham Stringer:** She went rather further than that, didn't she? She talked about the stifling of that initiative and the lack of understanding of both what had happened on the taskforce and of the commercial sector. It was a bit more devastating that just saying that we haven't got the skills.

Sir Patrick Vallance: Kate expresses it in her way. I think she drew a lot of the facts from the science capability review. I think there is a lot that needs to be done. I will say one thing: we set up the Vaccine Taskforce. That tells you that we can do this. Are there other areas that look like that, where you can take a similar model? I happen to think that some of the other areas that the Government face could be dealt with in the same way—I would love to see more of that happening.

Yes, I do not underestimate the scale of change that needs to take place. But, to go back to an earlier answer, there is pull for it now—it is not all push.

- Q63 **Graham Stringer:** I have one final comment on that. Surely her point was that, in an emergency, like a war, people break the rules, take big risks and do things they wouldn't otherwise do, but the civil service and big Government are not able to incorporate that experience into their everyday activities. I think that is the point that Kate was making.

Sir Patrick Vallance: That is true in any organisation. I reflect from my time in big industry that whenever we had a crisis, the conversation immediately afterwards was, "How can we make sure we bottle the way everyone behaved during that and do it in normal times?" I think that is normal, but I go back to the principles on which the Vaccine Taskforce was set up. It was actually drawn from a paper that we wrote in, I think, 2018 or 2019 on how to run a mission. It argued that the model is one that could be used in Government much more widely. I think that is true and that it does not require an emergency to do it, but it does require a change of approach because it cuts across departmental boundaries.

- Q64 **Graham Stringer:** You said one of your priorities when you took on the job was climate change. There is a huge number of green initiatives. Do you feel, as I do, that if you have 20 priorities in green issues, you have no priorities and that the Government need to focus down more on key priorities, which would both focus Government and make many of these projects that require private investment more investable?

Sir Patrick Vallance: I do believe in focus and that is, again, part of the 10-point framework I referred to. If I come back to net zero, the Council for Science and Technology wrote a letter in 2019, I think, or maybe early 2020, where we pointed out that the net zero problem is fundamentally a big systems engineering problem and there needs to be a dedicated group of expert engineers in Government who can help drive that forward. I still believe that. I think we need to have enough experts to be able to deal properly with industry and to set very clear objectives, which would



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include procurement pull through from industry. That probably comes down to a smaller number of things. I do think that maybe 20 recommendations is okay, but 120 recommendations is not.

Q65 Graham Stringer: Do you have a view on what those priorities should be?

Sir Patrick Vallance: One of the advantages of viewing this as a systems problem is that, actually, you can look at it properly and model which ones are going to make the biggest impacts and what your trade-offs are. One of the great trade-offs that needs to be taken into account is land. Unless you do something like a proper systems map, you can end up doing all sorts of things that sound terribly sensible, but you realise you can only use land once; you cannot use it five times, and you end up with a mess. A systems map at the centre is important, and then there are some obvious things that can be done, such as decarbonising the electricity supply completely and making incentives for things like electric vehicles to get those out faster.

There are some big, difficult problems, such as domestic heating, that need to be gone after, and there are some issues around things like industrial energy supply and heat, which needs to be looked at. You can actually boil this down to a smaller number of things. I think I have said to the Committee before that, if you take 2050 as your target, you should not be dreaming that you will invent a brand-new technology before 2050; you have to go with what we can currently see and scale it. That is not to say you should not keep investing in things that might be useful beyond 2050, but that is what I think you need to do for 2050.

Chair: We have a few final questions from colleagues, starting with Carol.

Q66 Carol Monaghan: The Committee has been interested in diversity in STEM. We carried out an inquiry last year and have recently produced a report. I have already talked about diversity in the civil service, but diversity in STEM is really important.

One of the witnesses in our inquiry was a lady called Katharine Birbalsingh, who talked about girls not liking hard maths. It was an interesting comment because, while we might scoff at that, it actually encouraged a lot of debate around the subject, which was possibly useful. Today and tomorrow, young people in Scotland are sitting their maths exams. I am sure that lots of the girls will be enjoying the hard maths, and will hopefully be very successful. In our inquiry, one of our recommendations was that DSIT set about improving diversity. We called on the Department to share how it would do that. Have you any thoughts on that?

Sir Patrick Vallance: I have alluded to this a bit. I think it is an incredibly important area. I will go back to the three areas that I think will be worth focusing on. The first is relevance of subjects. In other words, how do you bring subjects alive for pupils? There are those who love the purity of pure maths, or something. That is not going to be for everybody, for sure, but the more you can bring subjects into relevance using things that society,



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individuals and children care about—climate, biodiversity, health and all those things—the more you can make them acceptable. That means that industry, Government and others probably need to be helpful in making those subjects relevant to people. The second area, as I said, is role models.

We have to concentrate on who the role models are and put in effort to get them in the right place, including teachers. The third area, as I have said, is resources. That includes not only the need to get more people into teaching but the sorts of tools you can use to teach, which are important. Those three things are crucial. If DSIT is taking them on, I really welcome it.

Q67 Carol Monaghan: Do we have the issue that Katharine Birbalsingh is not an outlier, and that people actually believe that some subjects are more appropriate for one gender than another, or for certain groups of people from particular backgrounds?

Sir Patrick Vallance: I have no idea. I think it is unlikely that that splits down a gender line completely, or any other line, but in society there are definitely people who have different learning needs and different approaches. The Council for Science and Technology wrote a letter, probably three years ago, on technologies for learning. We pointed out that there are many advances in technology and science that can ensure that teaching and learning is appropriate for people with specific skills.

There has been a lot of interest in dyslexia over many years, but there is much less interest in dyscalculia—people who actively cannot do the mathematics—and there are ways you can help those people. Beginning to understand those breakdowns of specific learning needs will be an important part of this, rather than assuming that everybody can do things, and do them in the same way.

Q68 Carol Monaghan: Going back to diversity on gender grounds, girls are more likely to go with biological sciences, and boys are more likely to go for engineering and physical sciences. That shouldn't be because of different capabilities. How do we sort that? How do we break down those barriers?

Sir Patrick Vallance: If I knew the answer to that, I would be getting on with it. I point to the Royal Academy of Engineering, which has put a very big effort into girls and women in engineering over the past few years, and that has made a measurable difference. That tells us that you can make a difference here. I can't remember the exact numbers, but the website got an enormous number of hits of people wanting to learn, because the academy had made it appropriately accessible and appropriately relevant. It comes back to a version of the role model thing. How do you make this relevant to people who might not think it is for them? With my new hat on, I will say that museums are quite important in that regard as well.

Chair: In fairness to our witness, Katharine Birbalsingh, I don't think she said that maths and physics were appropriate for only one gender. But there was quite an interesting exchange on diversity, which is reflected in

the report of this Committee.

Carol Monaghan: She did say that girls didn't like hard maths.

Q69 **Chair:** She observed that they were not choosing to study it. She didn't say it wasn't appropriate.

Let's move on to a couple of final areas. Antimicrobial resistance has been a long-standing interest of this Committee and its predecessors, and for you and your predecessors. Could you give us a brief thumbnail on how you think we are doing on guarding against resistance to antimicrobials?

Sir Patrick Vallance: It is a long-standing global problem that remains a global problem. I will take the opportunity, though, to have one little reflection on my past time in GSK, when we did actually keep on researching on antibiotics.

One of the great advantages of the fact that it takes so long to make a medicine is that you get deferred gratification. There is an antibiotic that I worked on, and kept going hard on, when I was at GSK, gepotidacin. I was rather pleased to see that last year, clinical trials on it were stopped, because it was so effective. That is a brand-new class of antibiotic—probably the first class for 30 years. You can make new antibiotics; that is important.

There are many other ways to go after this. We need to carry on with that. We need to make sure that appropriate use of antibiotics is looked after. Over-use remains a problem. We need good surveillance systems to pick up what the changes are. In terms of approaches, vaccines are really important, rather than our just relying on treatments.

Chair: Thank you. Carol has a question on the subject of one of our inquiries: bacteriophages.

Q70 **Carol Monaghan:** You are probably perfectly placed to comment. We are carrying out an inquiry on the use of phages. Have you any thoughts on this? With AMR increasing, do you see them being of use?

Sir Patrick Vallance: Well, they have been around for a long time and a lot of people have looked at this. There was a lot of bacteriophage development in the Soviet Union; it was a big topic that they pursued. Lots of companies have looked at it. It definitely has a place, and there are some effective examples. It is not straightforward.

I don't know exactly what the number is, but there's something like 10^{30} different bacteriophages—it's a pretty large number of things to go after. You often end up with a soup of bacteriophages to try to get an effect, and the effect may not be killing the bacteria, so there is a regulatory issue. What is your end point in a clinical trial? There are lots of reasons why this gets a bit complicated, and manufacturing is complicated because of that soup issue. Yes, it's worth looking at. Yes, they have a place. I doubt they are going to be the magic-bullet solution.

Q71 **Carol Monaghan:** Do you see them possibly having a place alongside



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antibiotics?

Sir Patrick Vallance: Yes, they have a place alongside antibiotics and vaccines, in certain situations.

Chair: Thank you very much. Finally, Katherine Fletcher.

Q72 **Katherine Fletcher:** Thank you, Chair—a wonderful Chair. We would be entirely remiss, Sir Patrick, if we had your expertise in front of this Committee and did not ask you for advice for the future. First, what advice would you give your successor about dealing with Government? If you sit them down and take them for a coffee or maybe a glass of sparkling water, what are you going to say to them?

Sir Patrick Vallance: Well, I'm rather pleased that Angela McClean is absolutely superb, very clever, and does not need my advice.

Q73 **Katherine Fletcher:** However, if she were to press you—

Sir Patrick Vallance: She will press me on the questions she wants to press me on, but Angela knows how to work in Government and she's got very broad connectivity across academia. She is learning about interactions with industry. That area is one that I think is important for a Government Chief Scientific Adviser to know about—the industrial side of things.

Q74 **Katherine Fletcher:** Well, perhaps we can benefit from your expertise. What should we be doing now and next year—with the kind permission of the Chair? What are the things that we need to bring this Committee's focus to?

Sir Patrick Vallance: We have touched on some of them. AI is clearly going to be an enormous issue. It is important to look at the 10-point framework and say, "Are those 10 things actually being done?" The concept was that there would be a Secretary of State leading for Government as a whole on each of those 10 areas. It will be quite interesting to see how that works out and whether it gets implemented.

Life sciences had become, within Government, a term to mean human health sciences, or pharmaceutical sciences. I am very keen that we don't forget that life sciences is agri-tech and the use of bioengineering to solve manufacturing problems, and covers all sorts of other areas. That is a rather undeveloped area in the UK that will be important for the future.

I have already alluded to this, but it would be interesting to ask, "What science being done in the public and private sector is relevant to the national risk register?" That is quite an important thing to do for the future of the country, and may be something you want to probe.

Q75 **Katherine Fletcher:** Is there a moonshot thing that, just for your own personal interest, you would love to see investigated?

Sir Patrick Vallance: Would I like to see you investigate it? I am a bit loth to go down this route, but maybe I will; I will just say what I think will be important, and what the Committee has to be careful not to interfere



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with. I am very excited by the establishment of ARIA, which is looking at some very interesting areas that it might choose to do work in. Those areas will be challenging, high-tech and potentially big-return, so they may inform things that you think you want to look at. Having said that, I absolutely do not think you should bring the CEO of ARIA in front of this Committee ever.

Q76 **Katherine Fletcher:** Okay, I get where you are going with that. Do you want to elaborate?

Sir Patrick Vallance: If you look at all the iterations and past directors of ARPA, DARPA and so on in the US, their message is very clear. Why do these models fail? They are kept on too short a leash and they are interfered with. Leave ARIA alone and let them get on with it. By all means, if you want to pull the chair here, they could answer questions, but leave the CEO alone. Let him get on with it, let him be ambitious, and let him fail on some things.

Chair: That is a controversial note on which to end for this scrutiny Committee, but we will reflect on your recommendation. We are very interested in ARIA and its work; we published a report welcoming its creation.

However, we really want to thank you, Sir Patrick, for your evidence today and over the past five years, and for your leadership of science in Government, which, as my colleagues have said, was very much in public. You have drawn great attention to the distinction of science in the UK, and your clear communication has helped the nation through some very difficult times. For that and for all your assistance to this Committee, thank you very much.