



HOUSE OF LORDS

Science and Technology Committee

Corrected oral evidence: Financing and scaling UK science and technology: innovation, investment, industry

Tuesday 22 April 2025

10.15 am

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Members present: Lord Mair (The Chair); Lord Borwick; Lord Drayson; Lord Lucas; Baroness Neuberger; Baroness Neville-Jones; Baroness Northover; Lord Ranger of Northwood; Viscount Stansgate; Lord Stern of Brentford; Baroness Walmsley; Baroness Willis of Summertown.

Evidence Session No. 4

Heard in Public

Questions 29 – 40

Witness

I: Sir Paul Nurse, Chief Executive Officer and Director, The Francis Crick Institute.

USE OF THE TRANSCRIPT

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

Examination of witness

Sir Paul Nurse.

Q29 **The Chair:** Good morning. Welcome to the first evidence session of this Science and Technology Committee. We are very pleased to have Sir Paul Nurse as our witness. My name is Robert Mair. I am the Chair of this committee. The other members will be introduced when they ask questions.

Thank you very much for sparing the time for us, Sir Paul. Your *Independent Review of the UK's Research, Development and Innovation Organisational Landscape* reported back in March 2023, and the Government responded in November 2023. For the benefit of this inquiry, please could you outline what you learned from the review and what your main messages and recommendations were? With a couple of years' distance from that review—reflecting on the Government's response, and indeed the change of government since then—could you comment on what you think has changed?

Sir Paul Nurse: Yes, I am very happy to do that. Thank you for the invitation. I should declare conflicts of interest that may be relevant. I am the director of the Francis Crick Institute, which is funded by UKRI, MRC, CRUK and Wellcome Trust. I am also chancellor of the University of Bristol; a scientific trustee of Kew, so should the herbarium come up, maybe we should treat that as a conflict; and the incoming president of the Royal Society, where I am already engaged.

Thank you for the opportunity to speak to you. The review in 2023 was the second review I did, having done one some years before, which led to the formation of UKRI. It was not quite as I had originally thought it should work, but it is important in terms of governance, which I wanted to start with. We are now in a much stronger position in terms of governance than we have been previously because we now have a department—DSIT—that deals with science. That was a response in part to the argument that science needed to be at the centre of Government, and we need to keep other departments attending to science beyond DSIT; that is very important.

UKRI—as it was eventually called—sits next to DSIT and is really the opposite of it. One of the main things I proposed some years ago for UKRI was overall scientific policy, particularly from the practitioner's perspective, and to have a powerful voice there that interacted with another powerful voice in Government. We have the tools for governance there. Whether they are being fully employed is something that you might like to consider—I am not sure they are—but we should at least be pleased that we have the proper tools in place to do it.

My second review was rather lengthy, with 29 recommendations and 130 pages. I apologise for that, but it is very good if you are having trouble sleeping at night. I am certainly not going to summarise 29 recommendations for you, but I will give you a high-level account of the

particularly important aspects and am happy to pick up on anything the committee may have.

The first thing I really want to say is to do with money. I hate talking about money—I will be quite honest with you—because we scientists tend to whine all the time about money, but I do have to start with that, although there are lots of other things that we need to be doing in addition to money. It is sometimes said that we are very good at discovery research and less good at translation and application, which is true; therefore we need to pay attention to those. I will touch upon that, and you will have John Bell later, who will probably deal with it more.

There is a certain amount of complacency that our discovery arm of research is in good shape, but I do not think it is as good as people think. If I were to be straightforward about it, it is fragile. I want to start there because, although we are spending more money at this moment than in the past—one has to account for inflation, to be real and quite blunt with you—if we make comparisons with, for example, OECD nations, you will find that our funding is actually pretty pathetic. I will remind you that there are 35 OECD nations; it is not G7 or G10. It is absolutely not the funding you would expect in a science super-nation. It is, in fact, well down compared with OECD nations, probably by around 50% to even 60%; people just do not recognise that. There are reasons for that, which I will come to in a moment.

In particular—this was a surprise to me—UK government spend on research itself is very low, and I want that to be emphasised because often discovery research, which is mainly carried out with this money, is thought to be okay and that we do not have to think about it. We do need to think about it, and we need to think about it in terms of funding. Government spend has gone down to 30% or 40% of what it was post the time of Thatcher, who shifted much spend into the universities. That needs attention.

It is not all to do with money, but it needs attention. Now we are in difficult financial conditions—I am not naive about this—but what would absolutely help is to have a 10-year plan, maybe linked to GDP growth, that would spell out that science is central to this country and the Government's mission. If we had a 10-year plan in place, which I discuss in the review, then that would give a certain confidence to the community that things will get better, and attention would be paid to particular issues. Also in this case, 10-year planning would embed a stable government policy, which is really something that we have not seen because it wobbles around quite a lot. That is the first thing. I will not say much more about money, you will be pleased to hear. I just want attention paid to it.

What is needed in addition is to deliver the money in the most efficient and effective way, and this is being neglected in my view, partly because we do not look at it very carefully. Both my reviews looked into this because I have experience in carrying out research, and I tried to get back to the grass roots of what matters.

If I have to summarise, there are all sorts of reasons. We do not properly fund what I call end-to-end funding of research. We fund direct costs; that is the cost of individuals in a lab—paying their salaries, the immediate money that pays for chemicals, equipment and so on—but we do not surround that with the infrastructure that is needed for an effective scientific endeavour. That is expensive and is underlying significant problems across the whole landscape from universities, research institutes, PSREs; all the discovery and early translational research.

This means several things. That money has to be raised elsewhere. In the case of the universities—often with overseas students—it is very fragile, and in my view not applied very sensibly by the universities. They should be aware that it is fragile and think of different ways of presenting that money. In PSREs and so on, there is often no availability for it, so it is a real hole. How much of a hole? Well, I am not sure. I ran the Rockefeller University in the US—pre the present Administration—with 50% to 60% of direct costs. By the way, with these percentages, you need to know what you are doing. I am aware that it is a complicated matter. Our big charitable funders provide either no overhead or 15% overhead, and this is a major problem for medical research, which it is often aimed at.

I would like to look at end-to-end funding: providing high-quality technical cores and the administrative support that research needs. When I go to visit my university colleagues in particular, they are doing pathetically routine jobs all the time. I can tell you that doing research is very tough and difficult. You need time to think, and what they are doing is filling out endless pieces of paper.

First, many are not necessary, and that goes back to the bureaucracy issue; I cannot believe how bureaucratic this has all become over my lifetime, and I touched upon that too. Secondly, it has been stripped away over my lifetime and is damaging our discovery research activities. Thirdly is the diversity of our research-performing organisations. There has been a shift almost entirely into universities. I am a huge fan of universities; I am the chancellor of one and have spent half my life in universities, but it is only one way of delivering research. There are other ways, which have been neglected, particularly the so-called PSREs, which are a bit of a bucket that cover all sorts of things that I am sure you will be familiar with, and places such as the research institute I run, the Francis Crick Institute.

For very intense discovery research or research for a particular objective to solve a particular problem, universities are not the only way to deliver, and pushing it off to them does not take responsibility for the whole endeavour. Having said that, standalone research institutes and PSREs are expensive, and decisions to do them should not be made lightly. When decisions are made, they should be dealing fully with the costs.

If we look at some institutes that have been set up—such as the Alan Turing Institute and the Rosalind Franklin Institute—they have a building or labs in place but do not have the core funding to run properly. The

Turing is in trouble, partly because of that. The so-called hub-and-spoke model is a way of funding things without funding. You have spokes—often the universities—trying to drag money out of the centre. The hub is trying to survive.

It is a silly way to operate; there is no other word I can use. You need to properly fund these things. The Francis Crick Institute is properly funded because we inherited core funding from pre-existing institutes. The Crick works—you may ask me more about that—because we can make decisions on the ground that are important for research, and we are not constantly referring several layers up elsewhere. Let us look at the diversity of RPOs, research performing organisations, and not be naive about it. Make sure they are properly funded because, if they are not, we are just wasting money.

A final factor is to increase permeability between all these different RPOs. What we have is almost castles of the universities, PSREs and institutes. You go to an average university, and they do not even know what a PSRE is. That is ridiculous. Industry does not understand what we have in this country, and that brings me to a point I should have made. We need to have the knowledge of what we are doing, where we are spending and what we are spending. The ONS got the funding utterly wrong year after year after year. The policy wonks in universities or the different policy organisations did not know; they never looked into it. In my review, I got my civil servants to look into this, and it was the first time that some things were revealed, such as the overall spend. We need to have knowledge of what we have in place. We need to know how much it costs across the board, and that, I propose, should be part of what UKRI does.

I am talking a little too much. I will just end with one thing: bureaucracy. I mentioned it in the first report, and we now have the Tickell report. It is ridiculous. I will give you one example. My institute was reviewed by UKRI MRC three years ago, and I had to produce 6,000 pages, which I said was ridiculous but UKRI MRC insisted on it. I want you to imagine you are sitting in Harvard University and you get 6,000 pages through the post to review. What are you going to do? You are not going to do a proper review; it is absurd. I have been banging on about it for a decade or more.

It is a consequence of the fact that civil servants are terrified that you or the Commons are going to ask them a question about something they do not know the answer to. They feel they have to answer it in 24 or 48 hours, so we at the other end have to provide an immense amount of information that is never used. I said, "Just tell me when you want it. I will give it to you in 48 hours, but I am not going to provide a gigantic list". We are still being asked to provide lists to do it. That is just common sense.

Horizon Europe was one thing I emphasised. That has been done—well done, everybody.

I am going to stop there. I apologise for the length of time, and there are another 24 recommendations in there if you want to read them.

Q30 **The Chair:** I know Lord Lucas wants to come in. I just want to ask one thing, which I mentioned in my opening question. Since your review, do you think things have got worse? It has been some time now, and we have a new Government.

Sir Paul Nurse: Michelle Donelan was the Secretary of State who commissioned it. She wrote a letter thanking me for it, fully supported it, and gave it to the then new DSIT that had just been formed to look into it. I have had no formal contact with them, which is not a bad thing. When people write reviews, they should not be fiddling too much afterwards. I did write to them in anticipation of this hearing just to get an update because I knew the civil servants there and they are clearly trying.

What I like is that they are thinking of a 10-year plan or something like it, and looking at bureaucracy, I hope rigorously. They are looking at the way we deliver things, but perhaps not as radically as I would like, because the language I use in this review is a revolution. We need a revolution, but by evolution; by gradual changes and testing things. I mentioned direct costs and suggested, for example, that they could conduct a trial because I may be talking nonsense. They could fund a trial for a limited amount of activity in that way for a year or two and see what happens. That would not be expensive because you could identify a limited set of activities, but it is radical. I do not think they have done things of that sort.

So my view is that it is being taken seriously. We have a Minister and a Secretary of State who take science seriously, and the Ministers have huge experience. They are thinking about what to do. I am not aware of exactly what it is, but you can find that out for yourselves. They are taking it seriously. We need a 10-year plan, and we need to push it through as quickly as we can.

The Chair: Lord Lucas, do you want to come in?

Q31 **Lord Lucas:** A couple of things puzzle me when I look at science funding. One is the way in which funding seems to glow to a consensus, and being a physicist I particularly think of dark energy; you may think of others. The other is that universities do not look at the research they are doing as a source of future income down the road. They are not choosing what research they do according to its potential. Am I seeing things wrong? If not, what needs doing?

Sir Paul Nurse: Consensus is a problem if you mean by consensus that we go through committees of grey-haired people like myself and come up with obvious stuff: "Oh, yes, it is AI. We should be doing something with AI". I believe there is an issue with consensus thinking. If I may say, that is where institutes such as the Crick can help. We are much more anarchic and rely much more on youth—I should say "early career"—who will look at things in different ways. That is consensual.

You mentioned universities in terms of translation into commercial benefit, and that is an issue, but I am going to go further than that. It is back to the fact that insufficient attention is given to how you deliver the highest quality of research of any sort. That is actually where we have a problem because universities may always be scrapping around, looking for grants for money, and not thinking carefully enough about what they are trying to deliver. I am not suggesting that is top-down programmatic focus; that does have its needs, particularly when you are thinking of translation, as you probably were. Why are we not paying attention to how you deliver the most effective research activity? I do not see that in many places.

There are all sorts of things I mentioned in this report, a lot to do with technical cause and things of that sort. There are ways of doing things, and it is important to step back and look at them in a different way. I do not say that I know what the right way is, but what I do know is that there is no thought about this. It is much more, "Oh, what's the latest buzz word?" and, "How on earth can we get the most grants in to keep the whole machine working?" I think scientific endeavour is quite a lot more than that.

Q32 Lord Drayson: Sir Paul, you have already mentioned how the creation of DSIT was part of the Government's response to your review with the aim of putting science at the heart of government. How successful do you think DSIT has been? How effective is it now, particularly under the new Government? Does it have the authority and levers it needs to be effective?

Sir Paul Nurse: It has the beginnings, if I may put it that way; it is still a relatively new department. I was going to recommend something like DSIT in my report but I did not because I knew it was already happening. In my discussions, other departments were negative about DSIT because they do some science in their departments and saw it as something of a threat.

DSIT has a real opportunity now because it is the centre for thinking about science. If it works properly with UKRI, and UKRI takes that responsibility, we could produce something really effective. I have not spoken to the Minister or the Secretary of State about this in detail, so I do not know what they are thinking with respect to this, but we have an opportunity. I cannot tell you yet that it is going to be great; what I can tell you is that it is better than what we had before.

Science was fragmented across the Cabinet. Often, science and research got cut because research and looking to the future are always vulnerable if you are running a front-line department, and having a body that holds you to account at Cabinet level over those issues—or, to put it another way, should hold you to account at Cabinet level—is important. That is why I started by saying that the governance is in place if it is properly used. I am basically an optimist and am optimistic that things will get better, but I am also a realist and have not seen them get better in the last 10 years.

Lord Drayson: Are you seeing continuity in this new Government's science policymaking?

Sir Paul Nurse: I am hearing there is continuity in the sense that I know there are discussions about 10-year plans, but I am not seeing continuity, if I can put it that way. I know there is a lot of thought going into things. When I see the sums of money that are being allocated to certain initiatives, I would say they seem rather on the small side. So the jury is still out. I want to repeat though that there are things we can do—trials and so on—to work out what best practice is, which would not be expensive but would actually get the train going. Then, as I said, if we had a 10-year plan linked to GDP, people would feel that at least it is all being taken seriously. My bottom line is I am optimistic, but we do not have it yet.

The Chair: Baroness Neville-Jones, do you want to come in?

Q33 **Baroness Neville-Jones:** One problem about the British constitution is that money is allocated to the Secretary of State, who is the budget holder and is accountable, which militates against them being willing to share or spend moneys in ways which do not seem to be—in the departmental view—the highest priority.

In the early days of Cameron—on the defence and foreign policy front—they formed a pool of expenditure between the two departments and invented a method of accountability. I wondered whether you thought that was of interest in the science area and would be helpful, or would it just be too difficult to operate? It strikes me that DSIT is not actually powerful enough against some of the big battalions that want to spend their money their way, whereas what they are doing is actually extremely irrelevant to science research and translation.

Sir Paul Nurse: Yes, you are right. DSIT needs to get influence. The Secretary of State is a skilled politician and the Minister is a skilled scientist, so I am sure they have the respect of Cabinet. On pooling, we have some departments—such as the MoD—that spend a lot of money on research. Other departments—such as Education—should probably be spending more, the way it can flop or has flopped around with policy, for example. The Department of Health and Social Care would be another one that has to work very carefully with DSIT.

I am a trustee of Kew, so what I am about to say is conflicted. We have a herbarium at Kew, part of which was built in the 1840s and 1850s, which is hugely vulnerable. A proposal to put up a new herbarium—the responsibility of Defra—has been assessed as not being a high priority because it will naturally be thinking about farmers and so on. That is not right. The Minister does think it is; it is the Secretary of State who does not. What do we do? I have spoken to DSIT and asked if it could intervene. We will see whether it intervenes successfully.

Baroness Neville-Jones: Defra does not strike one as a department that thinks much about the rest of Whitehall. It is a characteristic of the

department.

Sir Paul Nurse: I am not a proper politician. We do need to have that sort of thinking. It may be that DSIT will prevail with Defra, and that would be a good example of success because we cannot let one of the greatest collections of the world catch fire or get flooded. It is utterly absurd. If your attention is on particular problems for farmers, this gets pushed off the agenda. DSIT could hold it to account—that is what I meant—but it needs to have the power to do that, which is probably best given from the top.

Baroness Neville-Jones: That involves inventing techniques.

Sir Paul Nurse: I would say the Prime Minister has a responsibility there.

Q34 **Baroness Willis of Summertown:** I need to declare a conflict of interest: I am professor of biodiversity at Oxford and the former director of science at Kew.

Sir Paul Nurse: You are aware of the herbarium.

Baroness Willis of Summertown: I am fully aware of the herbarium. I want to move on to the PSREs and the question in there. You were very clear at the beginning and in your review about the importance of them, which is shared by many, and your recommendation that we rebalance the system towards the PSREs. Yet, in the last three to four years, the PSREs I am aware of are the Medical Research Council institutes, which seem to be disappearing in front of our eyes or merging into universities. That may be a misconception on my part. Also, in my own area, the UK Centre for Ecology & Hydrology is privatised; therefore a lot of the data and information there understandably needs to be generating income, and it totally changes the landscape of freely available science. I am very interested to hear your view on whether or not you think the balance is working and that we are rebalancing, and if not, what one should be doing about it?

Sir Paul Nurse: It does need to be on the agenda, and the fact that we are even talking about it is a positive fact—not a very big one, but it is at least positive. I wrote a lot in this review about it. I tried not to be naive because these sorts of activities are expensive. You have to have real clarity of the mission and what you are trying to achieve combined with a certain ruthlessness about standards and what you expect from them. It is this word “complacency” again. Some MRC units have been around for 70 years. I happen to be in favour of units but am also a bit ruthless about them when making assessments.

The PSREs themselves have woken up. They are now getting together, and I am part of it, because sometimes what a PSRE is is difficult. Sometimes, the Crick is a PSRE and invites me along, and sometimes it is not. They are trying to engineer and organise themselves because they get ignored. Let us take UKRI. It will come up with a funding mechanism for something that reflects the need or way universities work for good

reason—most of the people involved in them are universities—which can often lead to situations where PSREs cannot get access to exactly the funding they need. It is not that people are being malicious; it is just they do not think about it.

For example, with the Crick, we had a complete emphasis on early career recruitment; we have recruited 45. UKRI invents a scheme for early career recruitment from around the world, and has a rule that does not allow us to apply for money because we do not give tenure after a 12-year period. I understand why they came up with the rule, but it precluded one of the biggest organisations that was doing this from actually applying for money. This is an example of the fact that PSREs—or their like—are not part of the way of thinking. Of course, 80% of the money is going into universities, therefore 80% of the government structure is linked to universities.

We need to be more open, and UKRI should be opening itself up, but—I repeat—putting up units, institutes and PSREs is expensive. In some respects, it is a privileged situation, although we have to look at salaries, which is part of the bureaucratic reading. It is not an entitlement; they have to earn it. That needs clarity of mission and on review.

Baroness Willis of Summertown: Could I just follow up very quickly on that? I was interested in the point you made earlier about the Government not understanding how all these things work together. It is also probably true of academics and businesses. I just wondered where the communication of how all this works should sit in your view.

Sir Paul Nurse: You are completely right. I apologise if I gave the impression it was politicians and Governments; I do not think academics do either. They think strategy is just choosing the next programmatic focus, not how you actually deliver it.

This is a reason I suggested UKRI, not as a super research council, which in my view is too much in that direction; it was actually to protect the research councils and make sure they worked well together. It was largely to deal with policy with government, policy with the charitable area, such as Cancer Research UK and the Wellcome Trust, and connections with PSREs and industry to go back to the commercial side. UKRI should be playing that role much more than fiddling around with what the research councils specifically are doing. They should be holding them to account and simplifying as much as possible, not making it even more bureaucratic, and playing a leading role with DSIT on the other side of the fence to deliver an effective scientific endeavour for the UK.

Baroness Neville-Jones: I sat on EPSRC and could not agree more with what you have just said about the relationship with UKRI. I hope the research council will get back more of its own authority than it appears to have at the moment.

You talked about the audit world and gave one of the explanations, which I am sure is real life, that civil servants feel they need to be able to

answer all questions immediately. In an ideal world structure, how would you audit so that it is adequate but not excessive and concentrates on the main issues rather than sometimes just fiddling with detail? What would your view be of a good audit system?

Sir Paul Nurse: Trust is the word. What you have to ensure is that you have a system and people in place that you trust—in other words, not just doing an overall level of audit on top of another level of audit that has already happened. What you do is ensure that adequate processes are in place that will do the job, and that people are in place who know how to do it and will deliver it. If they cannot, you get rid of them.

In other words, you focus on having a system that works without having all the second-guessing going all the way up—from a laboratory to a department, to an institute, to a funding agency—all the time asking similar or increasingly expanding questions. I know nothing about audit; it bores me to tears, but I know it is important, so I have somebody who does it and I trust them. Of course, we have a board that makes sure it all works, but you have to trust that you have a system in place, and the focus should be on delivering processes that allow you to actually have that trust. That is how I would deal with it.

Q35 **Lord Stern:** Thank you very much for coming, Paul. It is very good to see you. I wanted to pick up on three or four points that you made and suggest that they point in a particular direction. You emphasised R&D at the heart of government, the low funding from Government for basic research, and proper funding in terms of an end-to-end, 10-year strategic programme. You also mentioned the ability to take risks, which is obviously relevant to what you said about audit. Surely all that points to one place: the Treasury, because it has the money and is the heart of government alongside No. 10 and the Cabinet Office.

You will remember a dozen or so years ago, when you were the president of the Royal Society and I was president of the British Academy. Where did we go? We went to see George Osborne in the Treasury. Do you follow the logic as to where that power is? What do you ask for? How do you marshal the arguments? As you are marshalling the arguments, how would you be persuasive and correct in assessing and defining the benefits from R&D?

Sir Paul Nurse: The first thing to say is the Treasury—in my experience—is usually rather sympathetic to research, and in some cases, has been incredibly useful and powerful in supporting research in quite difficult circumstances. It also has rules that go with its operation, some of which are just plain silly. Salaries in research organisations are an example of the silliness. Salaries are probably related to the Prime Minister's salary or something of that sort, so it is restricted by a civil servant not realising what Prime Ministers can make in a year by giving speeches after they have left office. Goodness knows what sums of money are involved. Putting that aside, I thought we had got rid of it under David Willetts, but it was somehow forgotten, so we are still under this Treasury restriction.

If you are in a university, you have no restrictions. If you are in a PSRE or laboratory such as the MRC Laboratory of Molecular Biology at Cambridge—one of our great institutions—it is pathetic what salaries they can pay. It is absolutely absurd and not in the least bit competitive. In fact, they have just lost one of their great scientists to the person about to give evidence after me, who is setting up a new institute that will be paying a far greater salary.

We have to be reasonable about salaries. I worked in the US and could get paid four or five times more. We should not be restricting the MRC Laboratory of Molecular Biology to offering a salary for a highly distinguished scientist of less than £100,000 a year, which is what we are doing.

In the Francis Crick Institute, we are not restricted to that. Although we are funded by the MRC, which would have normally restrained us, it is only a particular fraction—less than 50%—so we escape it. This is a Treasury rule and is a rule that could just be changed. ARIA has changed it.

This is another lunacy; let me ask this. If it is thought to be right that ARIA can remove these restraints to attract people, then why is it not for the rest of the entire research system? Please identify it as lunacy because it is lunacy. What do we do? Sorry, I have ranted a bit here. The relationship with the Treasury is important. It goes back a bit to your question; it will obviously be very interested in the application of discovery into useful applications so it tends to come at it from that direction. I go back to what I emphasised: there has to be a balance of discovery, translation and application.

Having good contact with the Treasury is something DSIT and academics like me have to do. You are right that we did have an open door; George Osborne would certainly listen to us.

The present Chancellor has visited the Crick and we have had conversations. They are sympathetic. They are in a difficult place, and that is why I go back to the 10-year plan to give us confidence that something will happen. In these present circumstances, that would not be sufficient but is enough to actually give us hope and faith that something will happen, and the Treasury is important in that.

Lord Stern: Apologies, Chair. I should have said that, as a professor at LSE and chair of a couple of institutes there, I have an interest here.

You pointed out very clearly how low we are in direct government funding. If we are asking for substantial increases in resources and for a 10-year commitment, we have to marshal our arguments in a very clear and strong way. How would you help the Treasury understand how to assess the overall returns from this kind of endeavour, taking into account risk and the long run? By saying it is risky and a long run, that does not excuse you from having an argument. You have to set out what the returns can really be. How would you do that? How would you ask the

Treasury to do that? This is going to be critical to making the case.

Sir Paul Nurse: I am going to say something that is not very useful because the sort of argument Treasury likes is this calculation. If we build a railway line from Oxford to Cambridge, for every £1 of investment, it will deliver £7.33 by the year 2054. You are an economist and know there is enormous accuracy in that calculation. It is, of course, something in the sky, but they love that sort of thing, and they apply ways of working that might work for railway lines, the development of houses and so on, but do not work for most of the activities that we do.

Some colleagues think up this sort of stuff: "For every £1 in liver research, it will produce £4 something or other in 33 years". It may impress the Treasury, and we may have to do it, but I would go more philosophical and cultural. I would say it is obvious that understanding the world better is going to produce things that are of advantage to the world and the people who live in it. We cannot produce calculations that the Treasury likes, but have faith that this does work, look back over 250 years of our economy and elsewhere and see if that has happened.

The present economic strength of the US, which is being attacked on all sides at the present time, was without a doubt built on the revolution that science applied. We only have to look at history. Our own wealth—the Industrial Revolution and so on—is obviously closely connected. There is a need here for a transition of thinking that is not simply mercantile and a bit artificial, but a faith that this is going to actually work because of what has happened in history. That is why I said I am not sure it is that useful, because I am not sure anybody in government should have faith.

Lord Stern: There is a strategic and evidential base; it is just not channelled through the narrow route of microscopic cost-benefit analysis.

Sir Paul Nurse: Exactly. You said it so much better.

Q36 **Viscount Stansgate:** First, I have to declare an interest. I have no financial interests at all, but I am the president of the Parliamentary and Scientific Committee. I am a trustee of the Foundation for Science and Technology and the unpronounceable Parliamentary Science and Technology Information Foundation.

Listening to you now, I remember being in a room on this very corridor—at the other end—in a Commons committee. It was either being chaired by Andrew Miller or Ian Gibson, so it was quite a long time ago, and you were talking to me about the Crick Institute. My question asked you to explain how the Francis Crick Institute works. I remember very clearly you saying words to this effect: "Well, you just get a lot of brilliant people, put them in one building and see what happens".

In commenting on how the Crick model works, I wondered if that was the way you approached it. Is that how it has turned out? Can you say something about its focus on budgeting and pay, which we would like to know about? In your view, is the Crick a model that could be extended to other areas of the research landscape?

Sir Paul Nurse: The way the Crick works is useful in part, but in no way would I say it is the only model that one needs to think about. I am a great believer in diversity of approaches, but certain places like the Crick are essential.

What did we do? The first thing is that it has nothing to do with lots of money. Some people say we just got lots of money; it is simply untrue. We merged three institutes, and I got 20% less money than was in the three existing institutes. It only existed because the funders thought they would solve a real-estate problem; it had nothing to do with vision or anything of the sort. It was a real-estate issue, which I was happy to exploit, so we can just put it in perspective.

What did we do that was different? We did several things that were different and cannot be applied everywhere. The first thing we did was abolish departments and divisions. My experience in universities—Oxford was a good learning lesson for this—was that departments and divisions fight with each other all the time for resources, and so on. For example, if you have cell biology, immunology and genetics or whatever, the geneticists will fight for genetics. So we abolished it. We did not have anarchy completely, but we had some anarchy. We had research directors, but they did not just look after their discipline; they looked after a range of individuals. That has had a fantastic difference because now they fight for the institute and not for their department and division. It sounds trivial, but it is incredibly important.

Secondly, I took away some direct money that supported individual groups, quite a lot in fact, and said they had to get grants for it as well, which is more difficult for an institute because it cannot apply to the MRC for programme funding, nor to Cancer Research UK and so on. So it is tough. We had and welcomed the ERC to some extent, but we are more restricted.

So what did we do with the extra money? The extra money was used to set up the high-quality technical cores, which supported everybody. We have 120 research groups there, and they support everybody. These exist in a primitive way in universities too, but nothing like what we have. What it means is that when we hire an early career group leader—I will come on to that in a moment—they instantly have access to 18 specialised technical cores. This transforms what they do. The first papers they produce are twice as fast as in a university setting because they have access to technical cores, and we give them a limited amount of core funding.

Thirdly, we had an emphasis on early career group leaders, but we combined it with lack of tenure because institutes and units often ossify and it is very difficult to move people on. We have a much more fluid and weaker tenure system than would be the case in an American university, for example.

The early career group leaders come for a period of 12 years: two six-year periods. We give them a limited core funding; then they have to

leave. It does not matter how brilliant they are; they have to leave. Why do we say that? Because we see ourselves as a source of recruits that can go elsewhere into the system. That is one reason. Another is that they learn how to deliver research, and we are exporting trained people elsewhere—sometimes across the world—but that produces networks that are useful in the future, quite often within the UK.

We have shifted from being one in five early careers to 50% now, but they cannot stay. Old people like me—if I am allowed to use the word old—were reviewed really seriously every five, now every seven years, because the MRC proposed that and we do it very seriously. Out of the 80 to 90 we inherited from the founding institutions, I had to turn over 26. They were very good researchers, but not quite of the standard that we wanted. That needed a certain ruthlessness, to be perfectly honest, but what we did is we treated them decently, and this is something that does not happen after a negative review. We helped them go somewhere else. My funders said I should not do it, and we ignored them because I could not have the blood on the carpet of 25 individuals. They went willingly in the end, and all who wanted them got Russell group professorships.

So the problems have been technical cores, weak tenure, very strong reviewing, lack of departments and divisions and setting agendas because we are a discovery institute, bottom up rather than top down. That is something that is unusual too: instead of saying, "I am going back to AI. I do not think I am negative to AI. We do a lot of it", what people do is they will have a recruitment call in a particular area that is trendy at the moment. In my experience, new areas are best discovered by letting early career people loose. We just make that exactly how we work. This could not work in a traditional university. With no departments and divisions, how does that work? Lack of tenure, how does that work? Having a few hothouses like this and demanding high standards of activity is useful.

There is an opportunity in Scotland to do one. MRC and CRUK have big institutes and units. They could merge them in Edinburgh and make the Crick of the north. What has happened is all the universities in Scotland want a bit of the action, they want a hub-and-spoke thing, and it will be a disaster. It will not work. If they had boldness, they could produce exactly that. We do not need many of these things.

Viscount Stansgate: In your experience, did the Crick turn out to be the creative powerhouse that you wanted it to be?

Sir Paul Nurse: Completely. It is unbelievable. We have four Nobel Prizes in there. Two are not so active any more, but two are active. Of our 50 senior group leaders, nearly 30 are fellows of the Royal Society. There is no concentration like this anywhere that I know of in the UK. It is endless because it is a focus on quality of the highest level.

Academics are snobs and like going to places where there are very smart people. Once you get this reputation of being smart and effective, it is easy to attract. I will give you a statistic. We cannot actually do any

recruitment at the moment—although we had a very good outcome—because we were given 1.6% inflation. I am now 20% down on our budget. I have had to stop recruitment over the last two years; we just do not have the money to do it. It is a way of working that has attracted the highest-quality people; the last time we did an open search for somebody two years ago, we had 450 applications from around the world.

By the way, this is a way to shift gender balance. I was told that because we did not give tenure to people, we would never get females to apply. It is complete nonsense. We had 170 women apply for the job. We have completely shifted to a 50:50 male/female ratio based on the fact that we can attract so many applicants. There are so many pluses to all this, some that we predicted and some that we did not. I am the director, so you should not believe me.

Viscount Stansgate: Thank you very much for that. My colleague has a follow-up.

The Chair: We have many more questions to ask you. So, I am going to ask all our members—

Sir Paul Nurse: Do you want me to be quite short?

The Chair: No; I am going to ask our members to be as brief as possible. I know that Lord Ranger wants to come in; Lord Drayson first, and then Lord Ranger. We have quite a number of questions, so thank you for answering them all so well.

Sir Paul Nurse: I will be shorter.

Lord Drayson: You have already mentioned the importance of diversity in research institutes. We have a new model that has recently been launched in the UK, in the Ellison Institute. What do you think of that model?

Sir Paul Nurse: I do not know very much about it, but it would depend on how well it is run; that is the bottom line. You have to run these things very efficiently and effectively. It is not enough just to have money. But I do not know enough about it; ask John when he comes in.

Baroness Walmsley: He is already in.

Sir Paul Nurse: Oh, is he?

Baroness Walmsley: He is behind you.

Sir Paul Nurse: There you go. I did not say anything rude, especially since I did not know you were there.

Q37 **Lord Ranger of Northwood:** Thank you for your evidence, I found it very interesting. I have a couple of brief questions. You mentioned at the start that you would not talk too much about money, but as I find with scientists and people in this area, it has been a constant theme. I am not

a scientist, I am not from the research world; I am from industry so I talk in outcomes about what we are going to deliver. Scientists seem to talk about what they might do and have faith that they will deliver something. It does not work that way in industry, so sometimes that is the challenge in working with academia. I have found that anyway.

I have a brief question on your 10-year plan. Who would own that plan, and do you see a risk in potentially linking it with GDP? If you are looking for certainty, we are in an era where economic growth may not be what we all dream it might be. Secondly, what do you feel would be the type of outcomes that would give people confidence in a 10-year plan?

Sir Paul Nurse: "Outcomes" is a big word. You are thinking of commercial and societal outcomes which are important, but we also have to focus on major understandings of how the world works which will lead to the things you want as well. I want to create some clarity here. Often you get an assessment of research, which is, "Is it of high quality?" The answer may well be yes, but that research may not lead to scholarly outcomes at a high level. Often, you have to decide about that at a later point because discoveries can be made.

What I am trying to say is that the normal review process will ask if something is being carried out to a high standard, but that does not mean that there is a high scholarly outcome. We should always be thinking about outcomes, whether they are commercial applications or scholarly outcomes, so I am just adding that to the equation.

The closer you get to application, the more top-down it goes. I described this in my first review if you are interested. At the discovery end, it tends to be bottom up, it is a bit anarchic, and you have to live with that. At the other end, it is more top down because you are dealing with a particular objective. One important aspect of this is to recognise that, although across the spectrum, there are many similarities—the pursuit of truth, relying on evidence and the like—the way they operate is different and you just have to accept that.

Then there is the fact that—I used the word "faith", but you threw it back at me—the discovery side, which is bottom up, produces discoveries that then can be turned, if properly employed, into real-world applications. John will be able to talk more about that, but it is a very strong system and I would say it is what has traditionally happened in the US.

Now, although I was pushing discovery research a lot we have been complacent, assuming that it is all going to be fine and we do not have to do much, and that needs correction. We also need to pay attention to your point; how can we make sure that discoveries, when appropriate, are used for societal good, whether that might be improving health or improving commercial opportunities? You often need different sorts of people to do that because it is difficult working from the bottom up compared to top down. At the Crick we recognise that we may not always have the people who will do it top down but we have put processes in place to capture things we think will be useful and which we will then try

to push out. We have been quite successful, even early on; we have a lot of start-ups and so on.

What I find though is that if you put too much pressure on that system to apply, you get nonsense applied and you waste money as well. You have to be ruthless in the decision-making about how you develop things further because people think, "I have to have something which has impact", and they are thinking of commercial societal impact, so you get rubbish being shoved there. Somebody will put money into it, but it is just a waste. Now, obviously this process has a risk because so little actually succeeds, but more will succeed if you are ruthless at decision-making.

How does all this improve? I have one word: permeability—massive permeability which is lacking in the system; that is to say, permeability between the discoverers, the translators and the applied or commercial sector. If a company has a problem, it will usually look to other companies to get the information. It does not go looking at the academic side because it is not in the same community. I did suggest—I think it was in this review—that one role for universities would be a place where local industries could come and find out where in the academic sector there might be something relevant to what they do. Normally, tech transfer in a particular city will only be interested in the university in that city. I was suggesting that universities should have a much greater UK influence. That may or may not be a good idea, I am not sure, but thinking of greater permeability and how to mix these communities is very important. I even thought that, maybe, we should have parties at the Crick and invite young entrepreneurs. I have held breakfasts, but not cocktail parties yet.

Lord Ranger of Northwood: Who has ownership of the 10-year plan?

Sir Paul Nurse: Sorry, I did not answer that; I was waxing lyrical. I see the 10-year plan as being driven by DSIT working with UKRI, with UKRI taking a wider perspective than it has done up until now. Ownership should be in the Cabinet as a whole, with the leadership role coming from DSIT. That is how I would put it. But DSIT needs greater power and influence. Somebody hinted that it may not have it yet, and I agree.

The Chair: Baroness Neuberger wants to come in; we are running fairly short of time now so can we all be as brief as possible?

Q38 **Baroness Neuberger:** Paul, it is lovely to see you. I declare an interest as chair of University College London Hospitals NHS Foundation Trust.

I just wanted to ask you more about money. We have talked about money quite a lot; we are clear that Government cannot pay the same as the private sector or indeed as many international competitors, such as the United States. You have described a culture and a method of organisation at the Crick. What else could Government do to compete for researchers and research funding, in your view?

Sir Paul Nurse: If they put science at the centre of their agenda and shout about it from the rooftops, that will help, particularly now as we watch the collapse of sanity in the United States, which for extraordinary reasons, seems to be particularly aimed at science and research. We will be enormously attractive. I would say it needs to become a strategic priority for Government and they need to shout about it.

Baroness Neuberger: Should the model that the Crick uses be replicated in small numbers?

Sir Paul Nurse: This will sound strange since it is obviously something I care a great deal about, but it only has a partial role. We have to look at the way our universities are funded and supported; they are in deep trouble for various reasons, but having a few Cricks around, or things like them, can be enormously attractive in getting people to come here at an early age. I sometimes say that if we choose the right age, they might fall in love with somebody and settle down as a consequence. That is not a bad strategy.

Baroness Neuberger: I agree. Thank you.

Q39 **Baroness Northover:** Can I bring you back to international comparisons? You mentioned at the beginning, without figures, where we stand in terms of comparisons with OECD countries. We are very interested in what we can learn from other countries—you mentioned the United States—in terms of the UK science and technology ecosystem, and anything else that we can draw upon. Where in particular would you point us?

Sir Paul Nurse: I will be quite honest with you; I have never understood why Britain is as good at science as it is. When I am asked that question—which I am sometimes because it has been effective—all I can come up with is the weather and that is obviously not a particularly good answer.

We have the foundations but what we are lacking in my view, and I will make some comparisons, is a long-term plan, decent funding, not ludicrous funding, and—connecting back to this permeability issues that we were just talking about—a better ecosystem as a whole.

We can learn things from different countries. When we set up the Crick I sent people round to 20 different research institutions around the world. If I were DSIT, I would do the same: I would send intelligent people around. I would look at Germany, at Japan, and at China. I would look at bits of the US which are still working. I would capture and steal everything that works. We can sit here and talk about what happens in Max Planck and so on, I would send someone out there to look and see what happens on the ground because sometimes what is happening on the ground is not the same as what is actually being projected. We could learn a lot and it would not be that expensive. It would increase our knowledge base so that is what I would do.

I am not answering the question as you probably hoped I would by saying we should follow Max Planck in Germany and the Chinese Academy of Sciences in China; I would send some people around with the objective of trying to capture what is working most effectively and then see what we can do to our system.

Q40 Baroness Walmsley: In view of your earlier comments I should mention that for 10 years I was the chair of Botanic Gardens Conservation International, and I absolutely agree with your points about the herbarium at Kew.

You mentioned in your opening remarks, and have alluded to it since, some difficulties about movement opportunities for people, ideas and technologies between academia and industry and the PSREs. Can you tell us any specific measures that you believe would work to break down these barriers?

Sir Paul Nurse: First, as I have already mentioned, we could contemplate and try through a pilot scheme giving universities the responsibility of being a source of information about research around the UK—not just in York, Bristol, Oxford or wherever. They can become a hub for information for local industry. This would be particularly useful for small and medium-sized companies; it may be less useful for larger ones. It might be an interesting experiment because, at the moment, the universities only try to see what they can do for themselves economically. I am saying this is part of the public good for the UK. So, that is something I would do.

Secondly, it may sound trivial but there is something to be said about mixing up these societies, these different communities. They do not mix enough. I did that to some extent in New York which was a bit easier, I have to say. I have talked about connecting different communities in London: scientists—who tend to be nerdy people—lawyers, entrepreneurs, financiers and so on. London should be great for that but we are not open to it, certainly not as open as people were in New York. So, I would do something socially. It is barely something this committee should be thinking about, but it is important.

Thirdly is political leadership that recognises the entire spectrum. Politicians tend to talk more about the translational or the application parts because that is close to their business of producing impact in the sense you have said. But to cover the entire system and to speak in favour of the entire system will be one way of breaking down barriers.

I am going to refer you to John who can talk more about industry because he has had a lot more engagement than I have.

The Chair: Sir Paul, you have been wonderful in answering all these many questions so comprehensively. Thank you very much for coming to speak to us. We are going to pause for a few moments now while we bring Sir John into our next session.