European Science Foundation Policy Briefing

The Future of European Science and Technology Policy

Key-note speech by Dr. José Mariano Gago
Special session of the ESF Executive Council, Strasbourg, 23 September 1999

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The European Science Foundation acts as a catalyst for the development of science by bringing together leading scientists and funding agencies to debate, plan and implement pan-European initiatives.

Foreword

The European Science Foundation celebrated its 25 years of existence in 1999, and in order to mark this anniversary, a number of scientific events were organised throughout the year. One of the most notable occasions was the address given to the Executive Council by the Portuguese Minister for Science and Technology, Dr. José Mariano Gago, at its September meeting.

The speech by Dr. Gago, who was asked to address the topic "The Future of European Science and Technology Policy", turned out to be not only an extremely realistic and critical account of the recent past but also a stimulating challenge for the future. As a consequence of his challenge a most spirited and enthusiastic debate took place after Dr. Gago's speech. Past ESF Presidents and Secretaries General, members of the Executive Council and a number of distinguished invitees exposed their ideas as triggered by the Minister's presentation.

Minister Gago, who Chairs the European Union Research Council in the first semester of the year 2000, is certainly not an outsider to the fact that the Portuguese Presidency is putting knowledge, research and technological development at the front of the political agenda. This is an example of actions needed as expressed by him during his address to the ESF Executive Council.

Minister Gago did not refrain from asking ESF to play an important role within the Science and Technology scenario in the future where he could foresee a number of actions for which ESF was not only well placed but unique.

I believe that the transcription of the speech and consequent debate, including the lack of formality in the discussion, constitutes a science policy briefing on its own. For that reason ESF is proud to publish the text that follows as a contribution to a larger scale debate that European Science and Technology needs.

Enric Banda
ESF Secretary General

Sir Dai Rees:

This is a special session of the European Science Foundation's Executive Council marking our 25th anniversary.

Scientifically speaking, the ESF has always been a very broad church spanning the physical sciences to the humanities. We have also always tried to be a forward-looking organisation so it is really quite appropriate that we should be celebrating our first 25 years in the surroundings of Strasbourg's brand new Museum for Modern and Contemporary Art and that we are here not to relive past glories but rather to look to the future, and in particular the future of European science and technology policy.

While our actual birthday – which is not quite yet – will be appropriately marked in the presence of representatives of all our member organisations at the 25th Annual Assembly at the end of November, we nevertheless felt that it was important that the Executive Council, which in many senses has been the real driving force behind the ESF's quarter of a century of progress, should be involved and indeed celebrated in our festivities.

I am delighted that so many distinguished experts, friends and supporters of the ESF have been able to join the Executive Council for this afternoon's special session.

I would like to give a very warm welcome to two past ESF Presidents, Eugen Seibold and Hubert Curien, who is also representing the *Academia Europaea* this afternoon, and also two past Secretaries General, Michael Posner and Peter Fricker.

In addition, we are delighted to have been joined by their Excellencies Guillermo Kirkpatrick and Paulo Castilho, the Spanish and Portuguese Ambassadors to the Council of Europe, and by José Manuel País Morera, the Portuguese Consul, Luis Magalhaes, President of the Portuguese Science and Technology Foundation, and Ana Cristina Neves of the Portuguese Ministry of Science and Technology. Representing the Mayor of Strasbourg, who will be our host later this evening, it is a pleasure to welcome Paul Schmitt.

From our neighbours at the Council of Europe we welcome Martti Tiuri, Vice-Chairman of the Parliamentary Assembly's Committee on Science and Technology and the Secretary of that committee, Halvor Lervik.

From the European Commission we are joined, alongside our ESF regular Achilleas Mitsos, by Richard Escritt of *DG XII*, and from the COST Programme, Gösta Diehl. In addition we welcome David Gould from *INTAS*, David Williams from *CERN*, Fotis Kafatos from the *EMBL*, Inge Knudsen from the Confederation of European Union Rectors' Conference, Wilhelm Krull from the *Volkswagen-Stiftung*, Claude Kordon from *EUROSCIENCE* and François Becker from the *International Space University*.

The Chairmen of three of the ESF Standing Committees have also joined us this afternoon and we welcome Robert Erikson, Juan Rojo and Lars Walløe. We are always pleased to see our friend from the press, Philip Campbell, Editor of *NATURE*.

In anyone's book this is an impressive cross-section of the representatives of European science, as Lord Flowers, our founding President, comments in the 25th Anniversary brochure that you have all received, "the ESF has never had a pot of gold but the advantage of this is that it has forced us to focus on scientific excellence".

That, I believe, is precisely what we are doing this afternoon, putting the

emphasis where it should be, on quality debate and not on fancy fireworks.

In that vein, it is my great honour to be able to introduce and welcome to the ESF our key-note speaker, José Mariano Gago, the Portuguese Minister for Science and Technology. Minister Gago has been deeply involved in science policy at both national and European level, and is also a scientist of repute. He is a Professor of Physics at *the Instituto Superior Tecnico* in Lisbon and has in the past worked for *CERN* for several years, subsequently sitting on its Governing Council.

Since being appointed Minister for Science and Technology in 1995, Professor Gago has overseen a considerable strengthening of Portuguese science, securing year-on-year budget increases and paying particular attention to the development of the next generation of scientists. He has also become a figure of considerable presence on the European stage, both in Brussels and here in Strasbourg, and has in recent years put a great deal of energy and effort into pushing forward plans for a European marine agency.

There are few people better qualified to start off this afternoon's discussion on the future of European science and technology policy, so it is with great pleasure that I hand over to Minister Gago.

José Mariano Gago:

Thank you very much, Mr President, Mr Secretary General, ladies and gentlemen, members of the Executive Council of the European Science Foundation and guests.

I would like first of all to thank you for the invitation and for the opportunity not only to speak but to listen to you later on. I hope this will initiate a debate. In science, we are used to debating our views and our doubts and

F. Streicher

José Mariano Gago, the Portuguese Minister for Science and Technology

I will try to express a certain number of doubts rather than a number of certitudes.

First of all, you have asked me to debate the question of the future of European science. Coming from a scientific organisation and being a scientist myself, it is a very curious request. The future is not an object of science. I tried to find an appropriate quotation to start my speech. Unfortunately, I only found the French translation of *The Considerations on Universal History* by Jacob Burckhardt. I don't have the English translation nor the German original. It is just a few lines, so if you allow me, I will read it in French and then I will continue in English. Burckhardt says:

« Nous croyons qu'il est aussi peu désirable pour l'existence de l'humanité que pour celle de l'individu de connaître l'avenir. Et c'est une folle impatience qui nous pousse à le vouloir lire dans les astres.

Si nous pouvions nous représenter en individu qui sût le jour et les circonstances de sa mort, ou un peuple qui connût d'avance le siècle de sa perte, nous verrions certainement une confusion de toute volonté et de toute ambition, car celles-ci ne se développent complètement que si elles agissent "à

l'aveuglette", c'est-à-dire en suivant leur propre impulsion. C'est la condition même de l'avenir, et, s'il n'en était pas ainsi, le développement et la fin d'un homme ou d'une nation revêtiraient un tout autre aspect. Un avenir révélé est, en soi, un non-sens. Le prévoir n'est pas seulement une chose indésirable en soi, mais encore une réalisation assez improbable.

Tout d'abord nos désirs, nos espérances et nos craintes provoqueraient des erreurs dans cette connaissance de l'avenir ; en outre, nous sommes entièrement ignorants de ce que l'on appelle les forces latentes, matérielles ou morales du monde et nous ne pouvons pressentir les imprévisibles contagions spirituelles qui soudain peuvent le transformer. Il faut tenir compte également de la grande illusion d'acoustique dans laquelle nous vivons, car depuis quatre cents ans la raison et le raisonnement, doués par la presse d'une complète ubiquité, dominent tout de leur voix et, semble-t-il, tiennent également dans leur dépendance l'ensemble des forces matérielles ; mais il se peut que celles-ci soient à la veille de s'étendre triomphalement d'une toute autre façon, à moins qu'un mouvement spirituel ne prépare au contraire une réaction dans le sens inverse ».

Cet extrait de Burckhardt a été ecrit en 1870.

This short reflection about the future, its limits and its pitfalls is, in my view, important because it places us in a position of facing a very difficult choice – trying to forecast like Wells and predict the shape of things to come – or of staging our fears and anxieties and describing science policy as a kind of brave new world. Or, which is frequently the case in the scientific community, to speak about the future in the mood of a "save European science" manifesto.

I think that is the problem you have asked me to deal with. Under these conditions, I cannot deal with this problem. I will try to do what is common in science, that is to deal with another problem which is nearly the same, namely, the main problems which we are facing now in European science policy, which eventually will lead, will shape, will dominate, will condition the future of European science policy.

I will describe my view of these problems in six points and after that I hope we will have a lively debate where I will be contradicted on all six points and on any other matters I have missed.

The first point is related to the European Union and the political evolution of Europe. I am referring to the institutional problem of European Union science policy. The European Science Foundation was somehow a response to that problem. The EUROHORCS is another response to that problem. The Framework Programme in Brussels is one of the responses to that problem. But in fact all these answers to the problem came before the new generation of European Union treaties. What is now in the front line of political debate - which is, as you know, the debate around the question of federalism/non-federalism, and the relationships between the nation-states and the federal states that will emerge in Europe in the next decades - is the problem of what will be the future scenario for European institutions. Which new institutions must be created as European institutions? In which areas? Responding to which problems? And how will these institutions diminish or amplify the role or the functions of national institutions in the same field?

There is just one answer to that question. In the economic and monetary field, the governments reached

agreement on the subject, although we still do not know beyond the letter of the treaties what will really happen if the next economic crisis will force the conflict between governments, national banks and the European Bank.

Apart from that very limited, although decisive, question of the European and monetary policy, we still do not even have a debate on the question of the new European institutions, and in particular of European institutions in the area of science policy.

It would be easy for me, but not very fair, to compare Europe with the United States and to say that we certainly do not have anything in view compared to the National Institutes of Health or the National Science Foundation, although the names seem to coincide. That is a very difficult problem because, on the other hand, there is a political machinery in Europe – the European Parliament, the European Council – with a certain number of duties and rights which the European citizen is expected to believe in and to believe that they will decide to some extent what the science policy or other European policies will be. But that is not true. The European Council of Ministers for Research does not decide anything relevant for European science policy. It decides unimportant matters about a particular instrument which is called the research framework programme.

On the other hand, beyond the European Council of Ministers there is no other political body in which members of governments responsible for and in charge of science policy meet, debate and decide on questions of science policy. That simply does not exist. So there is clearly an institutional problem. You will probably correct me and say that, since the Second World War, a certain number of international, intergovernmental organisations, or research and development organisations like CERN and EMBL, ESO etc., were created. These are intergovernmental bodies and from time to time they even held meetings of Councils of Ministers. That is right, but not one of these organisations has stemmed from the new political scenario which is the root of the new Europe. They come from old politics, from intergovernmental agreements.

My second point is the question of the new political frontiers in science policy. I discovered that in politics the future is normally seen in terms of political frontiers. How can you decide that a certain issue is or will be a political frontier? There is no rule for that. But in fact, as a rule of thumb, I would say that a political frontier is what a large majority of people in a democratic society believe is a tautology, believe is a political frontier. If one particular government or party is against or does not recognise its frontier, that government or that party will be no more. We are not in science, we are in politics.

What are the new political frontiers in Europe in recent years? What political frontiers have been recognised by the population, by political parties, by the press, by the media? These have changed remarkably in accordance with the economic situation. I would say that over the last ten years in the evolution of the European Union the questions of employment, of economic reforms and of new factors of competitiveness in Europe as compared with other parts of the world, have been constantly in the front line of political debate.

Any issue, any new venture, any new initiative connected with that main trend of politics will be given priority

and all the other issues, which are seen as outside that main trend of politics, will be given low priority. So one question that we must ask ourselves very frankly is the following: is science policy nowadays within or outside the boundaries of the mainstream of these new political frontiers?

There is certainly one element which does not come directly from science but from technology, which has unexpectedly come to light and entered the political arena: in fact it came from the United States and entered Europe and European politics a few years ago, and in my view it has tended to stay on - and this in Europe is called "the information society issue". Several politicians and scientists have expressed the view that the European way of looking into the super-aware evolution or the international evolution (or whatever you call it on the other side of the Atlantic) was the information and knowledge society. However, there is no clear set of ideas around that question. The sociology of the information society has been mainly developed in the United States but in fact by Europeans, such as Manuel Castells.

One could imagine that the idea of the information society could be a very good link between the scientific and technological development in Europe and society at large, as well as political concerns. Why? On the one hand it is because of the debate on the question of citizenship and democracy, which is very strong in Europe and will certainly become stronger in the future. How can citizenship be linked with the appropriation of information and information sources, of the power of interactivity by institutions and people in the new generation. On the other hand, it is because of the obvious links between information technologies and the future of employment, as Japan, Malaysia and Singapore have certainly taught us.

However, this view is not very common in our societies. Even if the major political parties in Europe and the European Parliament tend to devote a fraction of their time and give low priority to this view, they receive – if I might be a little rude here – very little help from the scientists and from science policy bodies. In fact they need intellectual help from these bodies but up to now they have not received such help.

Following up this debate around the so-called information society, one could imagine or envisage the emergence of a kind of biotech society, fuelled by the debate around safety, health, food, a kind of bio-safety for all. That would certainly trigger the debate on the question of personal versus institutional responsibility, scientific responsibility, technical responsibility, industrial versus scientific responsibility. This is certainly one of the fiercest debates which we have now and will have in the near future in Europe. But in fact, up to now, this question - in my view - is also not in the front line of the debate on science policy.

One of the reasons for that - but this is just a guess – is the almost non-existent interaction between the social sciences and humanities and the physical and biological sciences in science policy in Europe. But we will certainly come back to that later in the debate.

My third point is very American. I will now consider more and more that a useful way of looking at Europe is from the American view point.

My third point is the following: what will be the new European science adventures in terms of political relevance? We are speaking about science policy, so with political relevance, what have science policy bodies in Europe proposed up to now?

What proposals to governments do they have on their agenda in terms of the future? How do they want to shape the future? Traditionally, there are three major objects coming out of regional, national, international science policy bodies when they speak about this problem in terms of political relevance. One of them, the modern one, is products. I don't know if they are right but some scientists and technologists think that it is better to shape the future, and to organise the future in terms of science policy, in terms of new products because they feel that will lead to an alliance between industrialists, governments and scientists, which will eventually trigger high priority for science elsewhere.

However, at the political level, there is no such agenda awaiting a decision. There is nothing in Europe comparable to the problem for simulation to the United States. There is nothing in Europe compared to the technology programmes in the United States. Of course, again, we have the European research organisations that have long-term strategies, which are supported by governments and propose something not in terms of products but more in terms of explorations. They explore microphysics, they explore space and the universe, they deliberate worldwide on the human genome programme. We do not have a programme for mapping or studying the oceans worldwide such as the Americans have recently launched.

Apparently, science policy bodies in European countries have not come together to suggest and put on the political agenda new science problems or paradigms, whether the very old-fashioned ones like the origin of life, or the process of ageing, or European efforts to understand the immune system, or to understand the problem of consciousness in the brain, etc. All this has been around for several years but not one these problems is considered to be a sufficiently important new adventure to be taken seriously, for instance, at the European Summit by European member states. Comparable decisions have been made several times in the last 20 years by Presidents of the United States.

Of course, some of those who, like me, were engineers before becoming physicists, think that the new leading science ventures must be, and require, a large variety of stake holders and a combination of new technologies and new markets. Science and big science – after all science is always big even if it is a compound of small-scale science – generates public markets so scientists can be in alliance with industrialists. But it is not clear in the European present structure – and probably that is due to the absence of institutions which would debate that question – the strong suggestion by the scientific and technological establishment to governments as a combination of development of new technologies, new products, and new paradigms in science.

I have looked very briefly into the debates of the last ten years of European Summits. I have asked some of my colleagues who have been debating in politics for several years but they do not recall one single important decision on science in the last decade in Europe, not one single report or decision. The main decisions have been taken at national level.

The title of **my fourth point** comes from a novel by Patricia Highsmith called *The American Friend*. Some of you may have read the novel. *The American Friend* is a kind of modern myth of America. He is a friend and you tend to

follow him but finally you will lose your life and he will continue. That is the moral of Patricia Highsmith's novel. But there is an American problem as seen from Europe. Young Chinese, young Japanese, young people from Malaysia, young people from Africa, from eastern Europe, all want to go to America if they want to study science. If they are not good enough they will accept to stay in Europe. But if they are *very* good they will not accept to stay in Europe. If they were not good enough to get a job in America they would not dare to tell their families at home. Europe has been a closed society for the outside world for quite a long time. More than that, we do not like to be depicted in this way. We have been a very closed society compared to the openness of the scientific establishment in the United States. Our universities have not had the impact of the American revolution as some of our research laboratories had after the Second World War. Our universities are old-fashioned and closed; they still value mediocrity, even the best ones.

It is very difficult for someone coming from the outside world to make his or her life on our continent without the right friends. This is so true even Europeans themselves, our own students, some of our best students, want to go to America. Some even lead laboratories in America. In political terms – and I must be brief – I will just concentrate on two points. One is the question of opening up the so-called European innovation system. How to attract capital from America, energy and organisation, to bring new scientific and technological ideas to the market. It is clear now that the same input of organisation which in fact has helped develop and modernise European laboratories after the war is now needed to modernise the innovation system in most European countries. Obviously, America is a place of contrasts and there are places in America which are desperately behind Europe. I am not speaking of America as a uniform country but there are places, companies and laboratories there which have no parallel in Europe and they must simply be copied. The only way to copy them is to import people, to attract capital and to attract these laboratories and these companies to Europe. In recent years European leaders have seriously objected to this. A simple view more akin to our own way of thinking is just to make Europe a promised land for young scientists of the world. It seems simple on paper. Some of you will recall the debate last year at the end of the approval of the fifth framework programme of the European Union. You probably know that there is a fellowship fund, the Marie Curie Fellowships. Unfortunately the meetings of the Council of Ministers for Research are not televised and one cannot listen to what is said there. But a large part of the debate was centered on the problem of how we could allow young men and women from countries outside the European Union, even with the authorisation of European Union governments, to be given these fellowships. That should certainly be forbidden by regulation.

I recall that in fact under certain conditions, and after two sessions of the Council, they were finally considered eligible for these fellowships after the Swedish Minister at the time reminded the Council that Marie Curie did indeed come from Poland. If the decision was to exclude them from the fellowship scheme then it should be named differently.

That small episode illustrates how distant the scientific community and scientific community debate is from science policy debate in Europe. How is it possible to reach this state? We do not

have a common policy at European level to systematically attract the major international conferences to Europe and to stimulate student participation in these conferences. In Europe we lack a common policy to sell European Union higher education world-wide and, whenever possible, in the students' own languages because that is part of the richness of Europe which other parts of the world do not have. In Europe we do not make extensive use of United States' referees in our national systems as a way to open up our systems to co-operation with countries outside Europe. Our politicians are not instructed to ask the United States to give similar treatment to Europeans in their federal bodies.

My fifth point is therefore the question of scientists and science policy-making. I cannot avoid a certain sense of mission and certain idea of manifesto in that area in contrast to what I said at the beginning. But I certainly feel that we need to create a new form of participation by scientists in science policy. We need a renewed social responsibility for scientists in societal controversies, in science education and in the promotion of scientific culture in our member states in the media. We certainly need to break university rules and laboratory walls in Europe. They are still almost entirely national. More important, I think, is how to plan ahead and forge the new generation of scientists. All reports tell us that scientists in many European countries are approaching retirement age, and that in certain areas we will lack a science work-force in Europe. If this is true, then there is a tremendous opportunity to forge a new generation of people who will be active in 20 years' time. The opportunity is to launch a movement of reforming science education, including the popularisation of science, the relation of science to the public, the organisation of scientific controversies, the introduction of the culture of evaluation in society which is entirely ours, and which comes entirely from the practice of science and forging a new generation of scientists.

To be successful, that strategy must come from the scientists themselves; it must be prepared by science policy organisations and presented both to the general public and to politicians, and it must finally be adopted as a new area of politics for the years ahead and a new area of consensus of European states for the years ahead.

My sixth and final point is about freedom of research. I do not think that freedom of research is guaranteed forever. It will go up and down several times. But in the long run, freedom of research, as freedom in general, is a political problem, not a scientific problem. And freedom of research can certainly only be based on its ability to generate the unexpected, to invent totally new ideas – not simply products but ideas – which permeate society and are seen by society as something completely new in order to prove that freedom itself is one of the best bets, one of the best and most productive resources. But this has to be proven constantly and repeatedly and we cannot take for granted that having proved it several times, freedom of research will be granted to us forever. I know that the European Science Foundation is a body devoted to freedom of research and on its 25th birthday it comes to an age in which reflection on the question of the conditions of freedom are in order.

Enric Banda:

Thank you very much for your speech. The President, Sir Dai Rees, has asked me to lead the debate. I want to start by thanking you because you have gone through a number of items and we certainly cannot accuse you of triumphalism.

You have spoken with realism. You have reminded us that there is a lack of new-generation institutions in Europe. You have told us about the lack of European initiatives in terms of paradigms and of decision-makers at the highest political level. You have reminded us of something that the ESF can be proud of, at least of the intention. We keep repeating that we need a better environment to attract young people – not only young people but the best scientists from all over the world. You have reminded us of the involvement of scientists in science policy-making and ended up with the freedom of research which could probably generate several hours of debate. We don't have several hours but we do have plenty of time.

It is now my pleasure to give the floor to Professor Seibold and Professor Curien if you would like to give your first impressions of what you have heard from Minister Gago. I will then ask the two past Secretaries General for their comments, and then we will open it for general debate.

Hubert Curien:

I am not so pessimistic. I am optimistic in my heart, but why be pessimistic? We have so many things to do and so much to try and improve the situation in the world, that scientists have certainly a brilliant future.

But as you said, we are European and we have to look at the possibilities to really develop a Europe not exactly in competition but in co-operation with other parts of the world and, namely, of course, America. One very important question, a major question now is - there is a brain-drain certainly - the difficulty of how to get back our pupils who go to America. It is said that it is not a question of salary. It is more complex and they sometimes have the impression that their future would be more brilliant if they remain in America. We must show that it is possible in Europe to carry out very important and very rapid work in science and technology. We have to demonstrate it but this is not so easy. As you said it is very important to attract big meetings, international conferences in Europe. I think that, for example, in ICSU, Europeans have rather neglected the possibilities and we must certainly be more active in those international bodies in order to make Europe a real centre of interest. That is a very important point.

We have already done much towards better co-ordination in our actions in Europe. The ESF has done a good deal in the past 25 years but it is not yet sufficient. As Mr Gago said, we have of course in Brussels an important programme for science and technology but the politics which are discussed in Brussels are essentially the politics with the Brussels money and not general policy which is much more important. The money which is spent for Brussels is about 5% of that spent in Europe from private and public sources. So we must go much further in common discussions and current programmes in Europe. That is certainly a point on which bodies like the ESF may play an important role. We did it already, for example discussions on the big instruments. We have done a lot at the ESF. Remember that ESRF is really the child of ESF which was not easy. But more and more we have to think about it. If I really had to retain only one point from Mr Gago's speech it is that

we must be attractive for the young people, not only in terms of salaries – we are honest when it comes to salaries – but in terms of the possibility of being brilliant in the context of Europe.

Eugen Seibold:

Many thanks for your six points. It is impossible to go through all the six points. I would like to have only two points from you.

First of all you said that freedom is the basis for unexpected things. And of course we all know in science that unexpected results are the best modes for the future. But even in politics some things happen and I suppose that freedom for the eastern and middle European scientist is such a fantastic thing, a historical thing. That would be my first point, that we should use the enthusiasm of these young and elderly scientists from eastern Europe as they can really tell us what freedom is or what freedom can do. We are in a parallel situation here in western Europe and I think we should use the impetus of all this enthusiasm coming from the eastern countries. That was the first point.

The second point is about young scientists. I repeat and repeat that one especially important point for ESF would be to develop the system of Euro-conferences. It is not expensive but the young scientists are the future of ESF and the future of Europe. Of course we can say now there are a lot of new media networks, new communications systems - that is not a problem at all. The problem is that you should have closer contact and then you can use all the other things. Closer contact with young scientists, together with some elderly colleagues, would, in my opinion, be an excellent way to bring together the optimism – usually the young are more optimistic than I am, and maybe than you are – and therefore we can use the optimism of young scientists coming together after two years. Coming together after two years is one point of the system. I think it is very important. Then you have the first contacts and you see that there are some lousy colleagues; they are idle and are happy to go over there for two weeks and to stay around. But they know and they learn, and they are excellent people – men and women, that is important too, sometimes. And you have a wonderful chance for contact and I think that our system of Euro-conferences urgently needs more input, and it is not very expensive. These are the points I would like to address to you. I am not pessimistic, I am an optimist, but you should give the young people the chance to come together and make contacts.

But my good friend Curien told us about the chances in America. At least in Germany what I see is that we have excellent young scientists. In chemistry, history or theology they have no chance of a permanent or semi-permanent job in Germany. So they say to themselves "In America I will get a chance" and they will get a chance. And hopefully when they have children after 10 years and come back to Europe because in Europe the culture is better for the children, after 10 years when they are brilliant, we can really use them.

Michael Posner:

I admit, Sir, that at that point and indeed in several points in the Minister's most excellent and thoughtful address, I did turn to my former colleague and present friend, John Smith, and say "Is this man a social scientist?" And he told me, no, he's a distinguished engineer!

There are of course, in history, several rather good ministers of science in

Europe, at least one of whom is present in this room and who has already spoken today. But I would say that in my reasonably long life in British science policy it was not normal to meet a science minister who was able to address such a provocative set of remarks and such an interesting set of remarks. I didn't like a lot of what he said but that is what lectures are for. They are not to tell people what they want to hear; they are to tell people what is sometimes useful to hear. I was trying to find some positive things to say, and extremely glad that Professor Seibold mentioned one positive set of things which the ESF has done, is doing in research – in conferences - and I am sure there are many more.

In the same radical tone of voice as the Minister was using, and thinking of the future – not of an economic crisis but of the sorts of changes in the framework of economic institutions that some of my more radical professional colleagues now envisage – I suggest that it might be instructive to consider a world in which some of today's key features of the "Furniture of the Universe" for science policy might disappear. Continents shift, as I learned when I was with the ESF, and some of this continental drift can happen relatively fast. I have been looking at science policy over the last six years from the outside, and from that standpoint, the "science budget" is just one of those bits of customary government expenditure to which the beneficiaries have become habituated. And it could be that, within a relatively few years, the Research Councils, which have been around since the beginning of time as far as most of us in this room are concerned – I can hardly remember a time when there were no agencies for spending taxpayers' money on science – may disappear. The Great Scientist up there in Heaven has not written on stone tablets that Councils must be with us for the next five hundred years. It may be that quite a lot of science will continue without explicit government decision or direct government funding.

After all, some economists are now speculating about further tectonic shifts in the institutional framework of economic policy. Against many expectations, the Commission in Brussels has not given birth to some super economics ministry; but Governments in Paris, Lisbon or London have to a great extent abdicated from their role as managers of their respective national economies. The central banks, and the new European Central Bank have to some extent taken over that job. And economists are now arguing that, within the lifetime of many of us, electronic banking will make the crucial controlling function of central banks neither necessary nor possible. No national "ministries of the economy"; no national central banks; no central bank for Europe itself (nor, for that matter, for the USA).

If such a transformation is possible in economic affairs, the abdication of a "science funding role" by governments or Commission is relatively easy to imagine. The pharmaceutical companies will finance bio-medical research; Microsoft will finance number theory and the rest of higher mathematics; Monsanto will finance agricultural science; polar science will attract the patronage of companies with a long term interest in the natural resources of the polar region; and the many companies who support the New York Opera or art museums are, most of them, multi-nationals who could support the arts and humanities in Europe as well. (The funding of economic research has already fallen into the hands of financial institutions).

So, in this dream (or nightmare, if you like – I am old enough now to see myself as a traditionalist), research councils may fade away, and with them "science policy".

But there will still be a necessity to bring scientists together, and an opportunity for those organisations who perform such a function, quietly, effectively, with skill and sensitivity. This will still be a good way of thrusting forward science by combining elements that already exist in relative isolation. And such organisations, like the ESF, which operate by accelerating the circulation of ideas, of thought and of innovations may play in the future a more important role than that of today's institutions which merely pay for the production of scientific activity.

You will see that I have been tempted by Minister Gago to play a forecasting game. I know, as does the Minister, very well the traps that lie in wait for those who play that game. But you have to do your job properly, Ladies and Gentlemen, to look a little further into the future than the tip of your nose!

Peter Fricker:

First of all I was delighted to hear Minister Gago's talk. He knows the Foundation very well indeed, also from an earlier very good visit where we had an excellent discussion.

I have only two points I would like to mention. The first one concerns the questions of a coherent European science policy. It is true that at a national level, I think mainly due to financial constraints, the national science policies have been tightened. I think we have many more directives nowadays. On the European level, however, I wonder whether it is not a matter of scale. I don't think that we should expect to have a very detailed coherent European science policy but rather some general guidelines. A framework would be most useful because if you look at the United States science policy it is not coherent either, that is quite clear. That is my first point.

My second point is that over the past years, in the few science policy discussions I have had, there was one element which came forward, namely the fear that fundamental scientific research suffers already to some extent, and if you look into the future it may suffer some more. This is your last, your sixth point, where you mention the freedom of research. I think that Professor Seibold has already touched upon this point. I think that at the European level, of course one has a tendency to formulate sometimes – may I say – opportunistic research themes. All the evils of the world today come from the climate change. I am exaggerating now. This is one of the themes and I think that one of the very important tasks which has been managed I think fairly well by the European Science Foundation so far was to have here a counterpoint, namely to see to it that fundamental research within a framework, where you also need to consider mission-oriented research, should play a very important part. I think that this would be a very noble function. It is a difficult task nowadays, unfortunately. But I think that for me this would be a most important element in the future that the ESF can, through its weight – it is the only encompassing European organisation, besides of course the European Commission – which comprises all scientific fields which would have the weight and possibility to certainly underline this aspect of the fundamental innovative research. I think that this would be my main point at this stage. Thank you very much.

Enric Banda:

Thank you. I would now like to open the debate to our distinguished invited guests, members of the Executive Council and the staff of the ESF.

We are lucky to have Minister Gago with us. We don't have him every day, so if anybody has a question?

Pieter Drenth:

Thank you very much. My name is Pieter Drenth. I am from Amsterdam in the Netherlands. I would like to ask a question but not without, however, congratulating the Board and the Secretary General on the 25th anniversary of the ESF.

I do that on behalf of ALLEA, which I have the pleasure to represent. *ALLEA* is the Association of Academies of Arts and Sciences in Europe.

I have listened to the speech of Professor Gago with great interest, in spite of the fact that it was a rather sombre mirror that he showed us. In fact it was so sombre that you are forced to find weak spots in the reasoning or in the mirror so that the picture is a bit less gloomy than it was given.

I have two comments: one is in respect of America. I think that the education system, particularly the higher education system in America, is such that you find much more differentiation than in Europe. In America, as you know, you find hundreds and hundreds of very low-level higher education institutions. You have a few where you can get a very good education and a very few where it is very difficult to avoid it, as in MIT and Harvard, etc.

In Europe we have more the policy of not focussing everything – certainly not private money – into individual institutions and making them really top institutions, but to divide that better over a large number of institutions which are then not mediocre but are high mountains without having really great peaks. So that is the different philosophy between Europe and the United States. So if you look at the United States it is very difficult to avoid looking at MIT, Harvard or Carnegie, but you have to keep in mind that there are a great many very low-level, higher education institutions in the United States.

This leads me to a second observation. Three or four years ago the European Commission issued a Green Paper and within ESTA, that is the European Science and Technology Assembly, of which Dai Rees and I have been members for a number of years - as many people in this audience - analyses have also been made of the strengths and weaknesses of European science, *vis-à-vis* Japan and the United States. Both of these analyses showed that both the level of education in general and the level of scientific output in Europe is not lower than Japan or the United States. If you look at output, if you look at citation in that way, if you look at prizes, even Nobel Prizes, on the average the performance is not lower than the average in the two other countries. What is lower, however, is the translation into industrial applications and in innovations in industry and in the technology sphere. That is where Europe is weak. Due to legal, organisational or financial constraints or whatever, we do not find it possible to translate our findings into industrial application and that of course has an impact on the output.

In fact, to summarise, I thought maybe the gloomy picture was given more from the perspective of your former ego as an engineer than as a scientist. Thank you.

Daniel Cadet:

My name is Daniel Cadet. I work for the CNRS in France. I would like to come to two points which have been raised by Minister Gago.

The first one has been mentioned by two other persons concerning the United States. What I heard seems to me that people are thinking about science as something which is closed. I think it is seeing the United States in a different light. There is an environment. When we are talking about science, saying that we are dreaming about the US attracting young scientists, our scientists, there is the other side of the coin which is a bad side. We know that. As scientists we are part of the dream of society, so we are winners, and winners in the US. We are not losers in that sense.

In the same vein, in the US science is not immune and this is part of the environment in the US, what we call, and are calling now, the ultra-liberalism, with the other side of the coin. We could be being a little pessimistic about the future in Europe. But I am quite optimistic because in fact we are moving in the same direction because of the globalisation of the system. Obviously, we are going to have this openness of the system in Europe. I have the feeling that thanks to the funding at the level of the Commission now and in the last one or two decades, there is something which has happened in the scientific community among the young scientists. There has been considerable exchange between the different countries, changing the situation in the different countries quite a lot. What we have to do for the future, and it has been mentioned, is to open the frontiers of Europe to attract the people from the other continents. That is what we have not been able to do but what the US has been able to do. This is part of the total situation, culture, in the US. Again, I am saying that I am quite optimistic because we are going in the same direction. Liberalism is entering Europe. We see that in the economy everywhere, in the money and the market etc., so it is also going to go the same way in science.

The second point is that Minister Gago was quite pessimistic about the future of science because he mentioned a few organisations that have been set up really before the beginning of integration within Europe. He mentioned ESA, ESO, and CERN. In fact the question is, are all the niches filled so there is nothing to do? I would say no. So the other part of the question is what is preventing us – I would say the different countries and Europe – to take a decision in science? What is preventing that? Have we put too much democracy in the system so that now it is impossible to take a decision? Was it easier at the time when it was decided to start CERN and so on? Was it easier to take a decision? So there is something which is locking the system. I don't know what exactly but we have to find a way to unlock the system so that decisions are taken. Thank you.

Vincent Courtillot:

I am Director of Research at the French Ministry of Education, Research and Technology. I am here on behalf of Claude Allègre and my first mission is, as was done by a previous speaker, to congratulate you and to bring you Claude Allègre's very good wishes on the occasion of this birthday.

I would also like to congratulate José Gago, as everyone has done so far, for his speech. It was very rich and it generated so many questions that I have seen all of us scribbling things and we have only to select the subset of our remarks for this discussion.

He started with a quotation from Buchart. I was thinking of two other quotations, one from Goya but I cannot quote it in Spanish which is something like "A slumber of reason generates monsters". The other one, which is more a general French saying is when you see a bottle which is half full you can say it is half empty, but you can also say it is half full. I think that the bottle of research is more half full than half empty. I do think that I would share about 95% of José Gago's analyses and then use them as a base to see where we can go forward. I think he has given us indications as to where we can go and that some of these indications have an importance for us in our respective positions and jobs as administrator, researcher or scientist etc. I also think that he has given us leads for what the ESF could be doing and the relationships between EC and ESF which I think are one of the more important points.

I would just like to go quickly through four points which are related to these issues. The first one, which was also stressed by Eugen Seibold, which I think is *the* number one question, is the young people. They will be there when we have gone and all of our attention should go to them. Indeed, we have a very conservative system. When I say "we" I should say France. Most of the time I do think that it is France, maybe southern Europe and in some cases also northern Europe. We are conservative in our attitude towards the young. We are not open enough. We are not giving them autonomy early enough. I share someone else's views in saying that it is not so much money that takes some of our brighter people to the United States or for the French side to the UK which has a lot of potential attraction. I think that it is the fact that they get autonomy quicker. Very early on they have their PhD; they are ready to have a technician, start a team, write a proposal, get money for the proposal, have freedom. In the French system, despite significant changes over the last two or three decades, we still have a rather mandarinal system in which you have a lab structure which has its very good aspects because you need a lab structure in some cases, but in some cases it has prevented the young from being autonomous early enough.

So I will say that we are currently spending – I think that it is a national problem first and then a European problem – a lot of effort trying to provide answers to these questions. I could go on, if there's a discussion on that.

The second point is evaluation. Again, I agree with the glum observation that, apart from probably northern Europe, I would say that southern Europe – and France is at the border and in that sense unfortunately it is more southern than northern, France is a country that does not like evaluation. We have to bring in the culture of evaluation and the scale of a nation is too small. France works as regions and we have plans every seven years where regions discuss with their universities and research labs saying "What are we going to help you with? What is your next piece of equipment?". I think that ideas should start from the bottom up. But evaluation should never be at that scale. It should be at a national and in many cases for France, over the national scale. The national scale is too small for a country the size of France and this is where I am sure we have a lot to do at the European level. I think ESF and I would have proposals. Enric, I have already discussed this with you over the last two years. I would have proposals for ESF to engage more in things related to evaluation.

As a suggestion to my colleagues who are in administrative or ministerial positions, and the speaker would be the first, I would say that we are trying to involve evaluation at the highest levels. One thing among several that we did in the last two years, which I think would be useful to others and which we are finding tremendously stimulating, is now our highest-ranking science advisory committee of 30 people, advising directly the minister and government freely on all issues of science, meeting twice a year with total freedom. It is composed of one-third non-French, mostly Europeans, one-third industrial and one-third academic research organisation people. It will meet for the third time next week, every six months. It is new but it is a tremendous experience. I could share that with you, and suggest that some others try it.

The third point is how to attract people from outside and how to make our system more readable. We have tried, with your help, and with many others, to start that, and this is giving us ideas as to how we can function within Europe. I am thinking about what Daniel Cadet said on have we gone too far with democracy in science. I would translate that in the following way: we do not always need to be Cartesian in the bad sense of the word, as there is a bad sense of the word Cartesian. We do not have to require absolute unanimous, uniform reactions from everyone at the same time. If some people want to do something together, if they can go a bit faster, let them do it. Certainly that generates heterogeneity and probably in Europe we don't want to reach the degree of heterogeneity which has been reached in the US. That was your *American Friend* paragraph. A great attraction, probably too large a variance, but we need more variance. We need a wider spectrum and probably we need to have better attractions for the young people. The way we have been trying to do it in that case, with the help of most European ministers now, was to say let's try with a few countries. That was the problem of harmonisation of European diplomas, that was one of the many translations which is difficult to transit. But could we have something which, seen from the US, seen from Japan and China, India or South Africa, seen from within Europe, is readable. I think it takes any one of us at least an hour to explain to our students how our own system works. In France we have at least 60 different levels, diplomas and the like. We should not have much more than three. I think that the fact that we have agreed on the system of what we call in French *la licence, la maitrise, le doctorat*, or undergraduate, graduate, or PhD or their translation into our language. If we can go forward and have a readable system which does not force everyone into the same diplomas but has the translation allowing our people to understand and move from one place to another, I think we can really move ahead. How did we do it? We started with four countries; we now have 35 ministers including you, who have signed this agreement, done in a very non-democratic manner and certainly not through Brussels in the usual way, because after two years we would still be half or a third of the way. That we have accomplished by not being politically correct in that case.

The fourth point, very much European Community versus ESF, is subsidiarity. This was your point 3. I am not going in your order but what new ventures? We have ideas and I think that in science ideas are unpredictable and they always have to go bottom up. But we need feedback top down, so how do we do that? I think we should let all our respective research organisations, science centres, stay at the European

level, rather than as we often do from Brussels, generate programmes which are competing with already existing national programmes. That does not promote European co-operation.

I think ESF could be instrumental more than now in helping to analyse, identify, co-ordinate and identify gaps where EC or ESF or other agencies could push forward new programmes and ventures that were called for by José Gago.

Finally, a lot of what I said – participation in evaluation, subsidiarity – can be done by ESF in pro-active ways that would alleviate a lot of what the EC does and shouldn't be doing. It does some things well; it does several other things not so well. It could do much better, including management of programmes, by giving this management to other bodies and actually trying them out. We have already discussed with Enric the idea which was probably abandoned because things have been happening in the EC and Commission for a few months - maybe they are restarting now – but I think that some of the EC programmes, and one prominent programme, could be delegated to ESF for probably better, wiser management and better use of its capabilities.

I will briefly end by saying that probably, even though 20 years ago I would have disagreed strongly with what I am going to say, I think that it is not a bad idea to have scientists accepting to go into the arena and becoming ministers. Thank you.

Michel Cuenod:

I am Secretary General of the Human Frontier Science Programme whose Secretariat is in Strasbourg. I would like to bring congratulations from my organisation to the ESF for this nice birthday.

My basis was Zurich University. I would like to make a few comments too and bring in facts which in part contradict the pessimism of Minister Gago. The Human Frontier Science Program distributes fellowships throughout the world. We have figures of how many young fellows want to go to the United States or want to go to European countries. In fact it is not exactly balanced but around 55% of them want to go to the United States and 45% to European countries which shows that we are not so far off a balanced situation, at least in that context.

José Mariano Gago:

Do you have exactly the same balance in the United States, so that you have an overall flux across the Atlantic?

Michel Cuenod:

No, that flux is very low. The flux from the US young students to Europe has been decreasing.

We have observed that in our universities it has been decreasing over the last decades drastically, very unfortunately. I have discussed this with people from the ESF and they are concerned about it. I think that one problem is that at present the job situation in the States has been tighter and tighter and people are afraid not to be on the spot to get a job. But we should also not forget that, since World War II, many generations of European scientists have been trained in the United States and have brought back to Europe the best aspect of the spirit of

research in the US. So I think that we have done something in that direction and we should not be so pessimistic.

There is one problem which we cannot neglect and that is the fact that – and I would like to give just one example – in neuro-science there is a European meeting and an American meeting. The European meeting gathers approximately 2,000 people; the American one 25,000 and there are usually more Europeans at the American meeting than at the European meeting. That has been the problem for the Europeans. There are many factors playing a role here but probably one of the important factors is that in Europe there are meetings of national societies in addition to the European meeting. People tend to go the national meeting for the job and the position and go to the American meeting for the science. I think that we should be aware of this.

My final point is that we should also look at what the Japanese Government is doing. They have made a very clear decision about the future of research. For instance, in neuro-science they have decided to invest an enormous budget in that field. Thank you.

Robert Erikson:

Thank you very much. I am partly responsible for social sciences in the ESF. I had a similar reaction to Michael Posner to the start of your speech.

I must say that in my view it seems that you are pessimistic about science. I am optimistic about science in Portugal.

I would like to mention two points. One was when you talked about science taking our responsibility towards political frontiers. I would say – and it is an interesting point here – that technological advances make industrial production more effective. That is really producing more of an unemployment problem than creating employment. Medical science may find new drugs to keep people alive which will make the ageing problem even worse. In the end it is obvious that we need social science answers to many of these problems which I think is a very important issue.

The second point which I would like to mention refers to when you talked about science policy, that science must take responsibility for the public observance of science. I think that the freedom of science is essentially based on the public having trust in science. Here, you talked about the American press. I think we have a very bad American press. We saw a few weeks ago, in the verdict in Kentucky, where the creationists come up and say "The Creation story in the Bible is as good a story as the Darwinian view of development in biology of the species". An important task for the ESF – which perhaps we could call the enlightenment problem, that is to say, one way or another, all scientists, regardless of direction or discipline – have a responsibility to come out with and spread to the general public the understanding of the scientific way of viewing and understanding the world. If we cannot convince them, and we get more creationists and New Age of various kinds, science will be out. There will be no political support for us. I think that this is a major task for all scientists, and Europe is the task for the ESF. Thank you.

Inge Knudsen:

Thank you very much. I congratulate the ESF on their 25 years. We tried celebrating 25 years of our existence last year and it was a very pleasant experience. I hope that it will be as pleasant for the ESF this year.

I would also like to thank Minister Gago very much for his speech. I had the good fortune to meet him last week in Lisbon. After the discussions there and also your speech today, I don't think that the dividing line in your speech is between optimism or pessimism. It is between what I think everyone who has grown up will know, that there is a distinction between illusion and ideals. You are quite clearly looking for the ideals in trying to show us the illusions of this whole scan, or play, or whatever you want to call it.

I think that the important thing is also the underlining of bringing young people in to see these ideals, to work for themselves by bringing them together, exactly working towards the ideals, not only towards products. I think that is one of the things that is perhaps the problem about *The American Friend*, that we have been blinded by the illusion of the market and see research only as a force in production. The whole innovation chain leads towards products. I think that the distinction between illusions and ideals would be used as well between products and processes. What the young people need in their training is to see the value of processes, of learning of knowledge and of ideals, and not just of products. I am happy to say that the Confederation of European Union Rectors' Conferences has the training of young researchers on its agenda. Thank you very much.

Philip Campbell:

I will keep this very short. This is talking about the information society and also about the involvement of scientists in social debate.

The information society, at the sharp end of social debate, is particularly what I would like to focus on, simply to say two things and to speculate in a third way.

The first thing to say is that whenever you come to debates about BSE or GM crops there is a crucial lack of information available to the public in a form that it can understand and with a promptness to which it can have access to participate and understand the public debate. The media has a role in providing certain sorts of information but it will never provide the information that I believe is required. Only governments or European institutions can provide that, and I don't necessarily mean the governments themselves - you could be talking about independent government agencies, including the select committees that look into a specific question such as BSE. That is one point.

Another point I would like to mention is that when you get into that sort of debate, the question of scientific uncertainty and how that affects public attitudes towards a technology becomes very important. There are several things to say about that, but the only thing I will say here is that consensus conferences are increasing in frequency. That approach is a very healthy one, in trying to explain to key representative members of the public what the scientific answer is. Talking about evaluation, however, I do think that the process of participation by the public in regulatory matters in consensus conferences needs evaluation and exploration. That is maybe something that the ESF itself can do.

My final point is just a speculation. I am very struck in London and indeed in Britain that if you drive around you are under surveillance all the time to an extent that would have been completely shocking to people, including myself probably, 20 years ago. It seems to be more and more accepted as you see criminals being caught thanks to these cameras. It becomes more acceptable. I just wonder whether there is a parallel there in terms of private genetic and biological information that will become more and more available to certain people - maybe just the individual, but to insurance companies etc. At the political level there may be pressure all the time to make that information more and more accessible to agencies of the state or indeed to the public. Thank you.

Fotis Kafatos:

Thank you very much. I would first like to congratulate Minister Gago for his talk, which personally I did not find pessimistic, but refreshing, provocative and incisive.

We needed to have debates like this and the fact that it led to so many interesting interventions really justifies the talk.

I also want to congratulate on behalf of EMBL the ESF, which is a transition of the same generation as ours and I want to orient my comments in that direction as really we all came up from a time of a burst of activity in the European ideal. We were born out of the initiatives to unify Europe. We have to say, sadly, that currently we do have a deficit of ambition and initiative in this direction.

I believe that we must strengthen and enhance the European scientific community in education in a science-driven manner. That must be emphasised. I think that it is trailing, not leading the economic and political unification, unlike the situation when we were students.

The responsibility of our organisations, our political leaders but also our scientists is to push this process forward.

In this respect, starting with our own responsibility, I think we must organise and project our views clearly and we must also be willing to spend time for social debate, for service and political organisations, and even in politics. That does have a cost but it must be necessary for our cause.

It is very encouraging to see that Professor Gago and also the French Minister who is represented here among the political leaders have looked at the European level. Having spent a great deal of time in Brussels, as many of you have, I see the opposite going on there. Many of us have had the experience of being dismissed as members of ESTA by the former Commissioner, when she was criticised by the ministers. Frankly, what has to be said is that the science advisory structure has been Balkanised in Brussels. There is paradox that international organisations are seen as not eligible to participate in FP5 except in exceptional circumstances. Large infrastructures have not been supported as they were in the previous one, at a time when scientific needs increase.

I just used this as an example to say that there is a process going on, that we have to counteract. We do see the vitality of the education system in Europe. We have to dedicate ourselves.

José Mariano Gago:

Thank you very much indeed for your reactions. I am really grateful for your remarks and most of all from Inge Knudsen the remark that it was not a debate between pessimistic and optimistic but between illusions and ideals.

I fully share this view and that was my purpose.

I was really very struck with the general reaction that in my speech I was very pessimistic. I think that it is part of our scientific training to know that to face the truth is the first element to be able to act effectively. I am personally very optimistic about science and about science in Europe. But that was not the subject of my talk. The subject of my talk was about European science policy which is a different matter.

I am certainly very optimistic for a variety of reasons. I was trained first as an engineer, then as a particle physicist in two different countries. I was exiled in France for several years and I experienced myself, in my personal life, what Europe was about when the European Union was not there at the time. I worked in the *Ecole Polytechnique* as a young student and then received my PhD in Paris, and then I went to *CERN*. Being a Portuguese national, when at that time Portugal not being a member of *CERN*, I was included by the French in the French quota for *CERN* to enable me to be admitted to *CERN*. I made all my scientific career in that very good organisation, certainly one of the best international organisations in the world. In fact, *CERN* is an organisation which proves exactly the opposite of the rule in Europe. Americans come to *CERN* and *CERN* is one of the biggest American laboratories nowadays.

In my own country I have been lucky enough that in the last four years I have had no problems with the budget, although the public budget has been decreasing. As all of you know, all public budgets have to meet strict Maastricht criteria. My own budget was increased 15% per year in the last four years. Our scientific community is increasing at about 10% per year. By law we managed to prove that all evaluation panels at every level must have a majority of non-Portuguese members from other countries. In fact whatever evaluation of institutions the totality of the members is non-national.

I must be optimistic. On the other hand the question of science policy in my view must be taken very seriously. The question of any branch of policy – be it science, education or health – is about politics. We are not speaking any more about science alone. We are speaking about politics which means the ways of creating consensus and generating priorities in society at large through the appropriate political bodies of society. In my view that is the European problem nowadays. We don't have the right institutions at European level. We lack these institutions. We are not guilty - it is not a question of guilt. It is a question of history and it is something that we must face in order to solve the problem. But if someone has to solve it, first of all the scientists must help to solve it and thus science bodies and science policy bodies must think about it, they must go into the political arena and debate that problem which is *the* problem of Europe nowadays in terms of science policy. If we want to achieve what we want to achieve in terms of the future of science in Europe, with this new Europe which elsewhere in the fields of monetary union, in the abolishment of frontiers, etc., is being built up, we must do something in our area. We cannot just stay in our laboratories, in our old-fashioned organisations and wait. What for? We are not in the fifties now. We cannot expect

the Americans to come and help Europeans to create *CERN* or to create other institutions as they did. We cannot expect that. We must do that ourselves. We cannot expect political parties out of the blue to invent the new science policy institutions of Europe. That is not possible. That is a critical question in terms of institutions but it is also critical as seen from the grassroots, from young people. Ideals come from ideas, from people, but also from institutions which in fact are the nerve centre of all that.

When Philip Campbell speaks about the question of information and the importance of scientific and other information being available to the public, when the public is eager to learn that information in terms of political or social controversies – those are the best educational moments in society nowadays. That is certainly the new time-scale of education at large in society and we must learn this new time-scale of education in society. Someone has to do it and it cannot only be done at national level any more. If we don't do it, other countries outside Europe will do it and are doing it. Other institutions are doing it, but I am not against that. I am just saying that we must participate in that work.

I will give you two examples of something that politicians could decide. We could decide – as at a certain level the Americans tried to decide and in effect they decided several times (I don't know the success rate; their success is debatable on the eve of the sputnik) - that science education at the European level should be considered a top priority of the political agenda. We could benchmark that priority in some areas. For instance, if we feel that experimental work for young children is lacking, we can benchmark the percentage of time devoted to experimental work by the children themselves in schools at European level. Why is it about 50% in the United Kingdom, 25% in Germany and less than 10% in almost all the other countries? Is that normal, is that acceptable? Is that an acceptable variety or should something be done to give equal opportunities for the new generation of people, those who will become scientists and those who will not become scientists but will pay the science that we want to do. That is something that must be debated. But where are the institutions to debate that problem? The European Council of Ministers for Research? The European Council of Ministers for Education? If you have ever been there, you know very well that that is not possible.

There is still one element and one new point where decisions can be taken and that is at the European Summit. At the European Summit decisions can be taken if they are prepared. Those are political decisions, if they are prepared. And some decisions across borders have been taken at that top level, which is the level we are aiming at for science policy. If we could debate, for instance, whether internationalising the training of the new PhDs in Europe is a good or bad idea. Personally, I feel that it is a good idea. I feel that it is a shame that less than 10% – I think that the figure is about 6% or 7% – of all PhDs in Europe nowadays are awarded in the country of origin of the student. Just 6% are given outside their country of origin, a figure which shows that the basic level of internationalisation of the scientific community in Europe, at the PhD level, is very low and should be increased. And political action can be taken on that point and we can aim at having about 20% or 25% as a good level for that in 10 or 20 years' time, but that is a decision that cannot be taken by one government alone.

It must be taken by all governments. It will have societal consequences. That is the age of marriage. That will increase international and cross-border marriages in the scientific community. But it is the realm of politics that should decide that. Decisions at national level have been taken in the past but never at European level. That is my point, that action must be taken. For action to be taken the players in the field must themselves be prepared for the debate and for preparation for action.

My last point is an insistence! I am sorry that I cannot comment on all the other very important issues that have been raised but I will finish with my last point. I think the relation at the heart of the problem is to link in better ways how science policy is done in Europe – debated and discussed – and how this can be linked to the scientific community itself. And up to now this type of linkage has not been very productive. It stems from career not from enthusiasm. It does not help young scientists to help new ideas to come into the field of science policy. Science policy nowadays in Europe is and must be the realm of experience. But you must add something new to that. You must add the contribution of those coming into the field, of those liking science but not being scientists and of society at large.

If science policy is kept closed - and in my view it will not be kept closed, that will not happen because society will not allow it to happen, and because we will not allow something so wrong to happen - it will continue at the present level of institutions, then I would not believe in its future in the next generation in Europe. I strongly believe in the future of science policy but I also strongly believe that something must change to build up that future.

Sir Dai Rees:

Thank you very much indeed, Minister Gago, for giving us so much to think about and for stimulating such a lively debate, and especially for your rallying call to action at the end.

Thank you also to everybody who participated in the debate.

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