Director, National Symphony Orchestra; and baritone Thomas Hampson. The transcript released by the Office of the Press Secretary also included the remarks of the First Lady.

Interview With Ellis Rubinstein of Science Magazine

December 6, 2000

Government and Science

Mr. Rubinstein. Our thinking is, you're finishing your second term at the millennium. We're in a new millennium, so you have a lot to look back on that would be interesting. We know you're a visionary, so we're interested in what you think about the future. I thought that we would start with a couple of philosophical things before getting into the practical things, because I think it would be interesting for our folks to hear you address the following issue.

Some of us would make the case that science is becoming such a core part of our individual human lives that something is actually transformed from the way it was some decades ago. That is to say, you almost can't turn around without needing to have information about science. I don't know if that's something that you feel, but I was hoping that you would address the notion about whether you feel that the impact that science can have now on society, individuals, or government is substantially greater in your mind than it was when you were younger and if that, in effect, has some sort of question——

The President. Well, first, let me say I think, at a minimum, we are much more aware of the impact of science on our daily lives than we were when I was young. I'll just give you just one example. You just take the space program, for example, where we—if you go back and look at the rhetoric of President Kennedy and the space program, we had to get out there, and we worried about—we didn't want the Russians to beat us into space, and could they do something negative back here?

And then you look at the rhetoric around what we're saying about the space station. We've got 16 nations working together. And we want it because it will give us some sense, looking back at Earth, about what's happening to the environment on Earth, how to handle climate change, what else should we do about global warming. It will help us in our studies in a gravity-free environment of all kinds of biological issues, how proteins form, what happens to tissues, all these kinds of things. It will help us in our efforts to resolve remaining questions in the material science area, which have been so pivotal to our growth of productivity and economic strength. So if you think about the range of subjects that are part of kind of the basic language of space research, as compared to where it was 35, 40 years ago, it's just one example of that.

And of course, most people didn't know there was any such thing as a human genome; most people still don't know what nanotechnology is. But if you combine the sequencing of the human gene and the capacity to identify genetic variations that lead to various kinds of cancers with the potential of nanotechnology, you get to the point where, in the imagination, you're identifying cancers when—assuming you have the screening technologies right—there are only a few cells coagulated together in this mutinous way, so that you raise the prospect of literally having 100 percent cure and prevention rate for every kind of cancer, which is something that would have been just unimaginable before.

Those are just two examples, and I could give you lots of others. And I think this whole—the inevitable increasing preoccupation of the world with climate change—yesterday I set aside 70 percent of the reefs that the United States has for protection in the northern Hawaiian Islands—I think that will lead inevitably—when people start thinking about the prospect that the sugarcane fields in Louisiana or the Florida Everglades could flood or agriculture could move north, people will get a lot more of the science.

And the other thing I would say is, I think that the globalization of society has made us all more vulnerable to each other's epidemics and viruses.

Mr. Rubinstein. More bioterrorism?

The President. Yes. And that's the final point I was going to make, that I think that

you've got—that science has become essential, indispensable to dealing with national security—bioterrorism, chemical warfare, cyberterrorism.

So for each of those reasons, I think the whole—the language of science and the necessity of understanding at least the basic concepts will make science a much more pervasive part of the average citizen's life in the next 20 to 30 years than it ever has been.

Mr. Rubinstein. So following on that—I thought you might feel that way—one of the things that one observes is that most international leaders are trained as lawyers, or they come up in the governments. We tend to have science not in the key place in the ministries, often. And so I thought maybe you could give our folks a sense of you, yourself—I think perhaps—or at least some people thought that in the first term you weren't that familiar with scientific issues, maybe uncomfortable with them, not sure that you understood them as well. But certainly since I've seen you, for example, at the millennium dinner that your wife did on informatics meets genomics, you were so obviously enthusiastically involved in the questioning and aware of the stuff. And you'd also given a very good talk at the AAAS on the genetic rights of Federal employees and so forth.

So I'd like to hear both on a personal level—has there been a rather marked change in yourself, in your own relationship to what you feel you need to know about science? And then in a general sense, what do you think that—do you think that governments have to be structured in a different way to deal with this world that you've just described?

The President. Well, let me answer the first question first. First, I've always been interested in science issues, but the nature of my life was such that I didn't have a lot of time to be consumed with them, except the one or two areas where my universities were doing important research in Arkansas when I was Governor. And one of the reasons that I asked Al Gore to be my Vice President is that he's devoted so much more of his life to studying scientific issues and understanding them. And one of the reasons I thought and still think he would be a good President is that he does understand those things, and he cares about them.

But what happened is, after I got here I began to try to imagine, just go through the categories you talked about: What are our responsibilities in basic research; how can I make a stronger case? Are we going to save the space program or not; if so, what are the arguments for it, and what are the real implications of what we'll be doing there? What are the national security issues of the 21st century, and how much will science play a role in that? And I think we were all shocked at that sarin gas attack in the Tokyo subway, just for example.

And then, of course, I had to deal with these global—the sweep of the age problems: the fact that one-quarter of all the people who die in the world today die from AIDS, TB, and malaria; what are the implications of the breakdown of public health systems all over the world—all of these things. So the more I learned, the more I saw these things related one to the other, and the more I began to study and read and try to learn so I could get myself comfortable with what I thought my responsibilities were at this moment in time.

Mr. Rubinstein. And do you think, from that experience, that you're confident that other countries have structures that are going to allow them to be able to react to these kinds of issues?

The President. I don't know that. But even in this country, what I did here was to establish this National Science and Technology Council, to get the Cabinet involved, to let my Science Adviser—first Jack Gibbons, then Dr. Neal Lane—kind of drive it for me.

Mr. Rubinstein. I think you only went to one PCAST meeting, though.

The President. I think, over 8 years, I think I met with them three times. I think I did.

Mr. Rubinstein. Does that say anything about your——

The President. But I thought about what they did a lot, and especially when—some of the members I knew quite well, and I also had talks with them. And then some of the specific scientific issues, particularly those relating to the national security—and one thing

we didn't mention, which was the safety of nuclear weapons in the former Soviet Union, I spent quite a bit of time on it. And of course, I spent an enormous amount of time on the climate change issue.

But what I would like to see—I would hope the next President would think of ways to even further elevate and institutionalize scientific concerns. Because I don't think you can sort of separate out science, except to say we've got to have a strong basic research budget. And I don't see that this is troubling for science. The stock values of dot-com companies or biotech companies go up and down. That's totally predictable and absolutely inevitable. But what it should remind us of is that venture capital cannot be expected or even the research budgets of big, established corporations cannot be expected to carry the whole research and development load for America. So, should we have a permanent R&D tax credit? Of course, we should. Will it ever be a substitute for basic research? Never—never, at least, in the timeframe I can imagine.

President's Accomplishments in Science

Mr. Rubinstein. So, going down that road, I think we would like to ask you what you feel are your big accomplishments. I assume that one of the areas that you feel proud of is the amount of funding in basic research, but maybe you could give a little more flesh to that idea, of what it is that you think it was important to have done, and also after that, what frustrations you might have had about it.

The President. Well, I think, first, I think we did do a great deal of good with basic research. There was enormous support in the Congress, and among the Republicans as well as the Democrats, for more funding for the National Institutes of Health and all related health research. And I think it was most—there were some politics in that, because it's easier to sell that to voters back home because we all want to live forever. But I think a lot of it was genuine. I think men like John Porter, a retiring Republican Congressman from Illinois, I think he—his commitment was deep and genuine. So I think there was that.

But we've kept fighting for overall increases. We got the biggest increase for the National Science Foundation in history this year. So I think we got research back on the national agenda, and big. And you know—and we had some unlikely allies. Newt Gingrich, even after he left the Congress, continued to speak out for it. So I think that was quite important.

And then, specifically, I think that research and the funding for the climate-change-related areas and the development of alternative energy sources and energy conservation technologies is profoundly important. In the end, that has got to be the answer. We have to be able to create wealth with smaller and smaller amounts of greenhouse gas emissions. We have to. And you're either going to have alternative energy or greater conservation. If India and China have to grow wealthy the same way we did, since they will not give up the right to become wealthy, we're not going to whip this climate change problem. So I think that's important.

The other new area that I think—I'm glad we continue to support the sequencing of the genome and all of the genome research. And we identified a couple of the genetic variants that lead to breast cancer and other conditions that I think are important. And I think the work we've done in nanotechnology in 10, 20 years from now will look very big, indeed. I just think that the potential of this is just breathtaking, and it will change even the way we think about things like calculation or what we're supposed to know how to do. It will—it's going to really, I think, have a huge and still underappreciated impact on our understanding of human processes and our capacity to do things.

Science Infrastructure

Mr. Rubinstein. I had heard you talk a little bit off-line with somebody at a meeting about how you had come to feel that it was one thing to support the disease-related research and the NIH and so forth, but it was crucial to support what I guess you call the infrastructure, if I remember correctly—I'm not sure—the computing, the physics that is now being used in bioinformatics, and so on. I'd rather you would tell it.

The President. You remember, we had that millennium meeting here——

Mr. Rubinstein. That's what I was thinking.

The President. ——where we had Eric Lander here, sort of talking about genomics research, and you had Vint Cerf, who sent the first E-mail to his then profoundly deaf wife 18 years ago, and how they both agreed that the sequencing of the genome would have been impossible without advances in information technology. And we now know, to make the point in even a more personal way, Vint Cerf's wife can now hear because she has a deeply embedded hearing device that would have been completely inconceivable without information technology, without the ability to have a computer chip with greater power on a smaller device.

So the thing that I kept arguing with the Congress on is that, "Look, it's fine. You can't give health research too much money to suit me. It's perfectly all right, but you've got to do this other, too." And this year, I think we've reached a happy accord.

Mr. Rubinstein. So, related to that, some people give you credit for pushing the NSF agenda. Some people wonder why it is, however, that DOD research has been cut by—the figure I've seen is 40 percent from the—which used to support a lot of infrastructure, math and Internet issues and so forth.

The President. First of all, I think a lot of the research is going to have dual benefits running back the other way. For many years, it was all this defense research which had a lot of nondefense implications. I think a lot of the civilian research is going to have a lot of defense implications now, because if you think about the kinds of restructuring that the Defense Department is going to have to do, an enormous amount of it will have to do with information technology and weapon systems and troop deployments and intelligence gathering. And I also think that a lot of what they will have to do in the fields of chemical and biological warfare will be driven in no small measure by nondefense research.

Now, I think the Defense Department, frankly, they had to make some very tough calls. In this last election, the Vice President said that he would put some more money back into the defense budget. And we began to turn the defense budget around a couple of years ago because we thought we basically reached the limits of the post-cold-war peace dividend.

So I think that's something that the next administration will have to look at, because we had limited dollars and we tried to put it into quality of life, into training, into the basic things that would make the force available to meet the challenges of the moment. And maybe, you know, maybe it does need some more money.

International Collaboration in Science

Mr. Rubinstein. I'm going to jump a little bit to international issues, because again, I was thinking about you—direction to some degree with things that you've done. And I noticed an interesting event, that you would never have known about, at Davos when you were there last year. I happened to be running some panels there. And before you ever got on stage, there was sort of a revolt in the audience of the Europeans and the Asians who didn't want to leave, because they had gotten seats 3 hours early because they were so excited to see you. And when folks wanted to sweep the room, they were afraid they were going to lose their seats, you know. And the thing about that was, they refused to move. And eventually your guys said okay and relented, and they stayed. But what I actually noticed about that was that for hours thereafter, people going, "Yes, finally America had to listen to us."

And I think that increasingly I've heard this sort of discussion as a sort of subtext, that we're such—we are the only superpower left. And if you talk to Europeans and Asians, some of them worry about this sort of power that we have and whether we are using it wisely all the time. They feel we moralize to them. I think this is not going to be news to you.

So what I thought would be interesting for you to talk about a little bit in the science context is, we've actually dropped some collaborations with Europeans and Asians on a number of their projects. It was hard for the Japanese to get us in their human frontiers program; I don't know if you recall that particular thing. We haven't supported some of

the big European initiatives. So in relation to this, what would you say, maybe either about your own experience or feelings or what you would advise your successor about how science might be used internationally for an effort to try to deal with the kinds of feelings that our European allies and Asian allies might——

The President. I think I would advise my successor to do as much to fund as much international collaboration as possible. If I could just take two examples where it has worked very well, the work that we did through the NIH with the human genome project involved several other countries. And when we announced the sequencing, we not only had Craig Venter here from TIGR from the private effort, we did it jointly with Tony Blair and with the Ambassadors of the other countries that were involved in the project with us. I don't think there is any question that even though there are all kinds of unresolved issues there, that the fact that we're doing this together has been a plus.

To give you another example which I think is profoundly important and somewhat controversial, the 16-nation collaboration with the international space station I think has been very, very important. I've spent a lot of time, as you know, on this space station, and to see what the Canadians have done, to see what the Japanese contribution is.

And the Russians got criticized for not being able to come up with the money, but the price of oil collapsed, and they were killed by this horrible financial crisis. It gripped Asia and also affected them. I think they're getting back on their feet, and I think they'll pay their way. But the contributions that they made, based on the *Mir* and based on the fact that they had certain capacities we didn't have, and what we learned by working together with them and the nine trips to the *Mir* we took together with them, and the fact that the corollary benefit of keeping—I don't know—hundreds and hundreds of their scientists and engineers working on a positive international project, instead of being picked off by rogue states to help them develop weapons and missile technology and things of that kind, I think, were enormous. So I think the more that we can make this an instrument of constructive interdependence, the better off we're going to do.

Also, there are a lot of smart folks out there. And I think we have to recognize that—when I took office, there weren't all that many people that resented us, because they thought our economy was a basket case and they were worried about us being too weak. Then, when we had a great deal of success, even though we bent over backwards not to lord it over anybody, and we did have—we had some inevitable conflicts—our desire to end the ethnic cleansing in Bosnia and Kosovo, things of that kind—that we were criticized when we did it, and then when we didn't go in quickly enough in Rwanda, we were criticized. Part of this is inevitable. But I think we do have to try to wear our power lightly and also with some humility, because there's always a chance we could be wrong, number one, and number two, nothing lasts forever.

Mr. Rubinstein. Are you aware, as President, of the brain drain that—the tremendous power we have to get the best young scientists coming over here and how few of our young people go over to work now——

The President. There might be a way for my successor to institutionalize a little offset there. For example, you know, I worry about that—if you just take in the information technology area, and you get out of it—you just forget about the labs, there are 700 companies today, in Silicon Valley alone, headed by Indians—700—and just in Silicon Valley. It was just stunning, you know? Now a lot of them are also active back home.

But I think there needs to be a way for us to try to share both the scientific and the economic benefits of our enormous infrastructure here. I'd like to see America used, in that sense, as sort of a global lab, but with the ability to send our folks back out, send their people who come here back out, finance educational and research exchanges, and even, as I said, even operational exchanges. I think that we need to—this is not a resource we should husband so much as share.

Mr. Rubinstein. Jiang Zemin—you remind me of Jiang Zemin, because he is very proud of his trip to Silicon Valley, where he noticed the incredible percentage of the folks

in one of the companies that he visited who were Chinese born and so forth. I know that—I was told by one of the vice presidents at Merc that 20 percent of their hires are born in China. But thinking about Jiang Zemin, he made the remark that, on a personal level, one of the things he was proud of was that he thought he brought some engineering expertise and discussions on the highest level. And I was wondering, is it really the case that when you guys get together at big events, that science is even discussed amongst Presidents?

The President. Oh, yes.

Mr. Rubinstein. Yes?

The President. Of course. I've worked with Jiang Zemin for 8 years now, and I have a very high regard for him. He's a highly intelligent man, and he also—he speaks Romanian, Russian, English. He lived in Romania for a while. I think he speaks a little German.

Mr. Rubinstein. He said very nice things about Hillary.

The President. He did?

Mr. Rubinstein. Yes, because he said he was sitting next to her——

The President. Yes, he likes her.

Mr. Rubinstein. He thinks she's great.

The President. He is quite proud of his training. And he tries to bring that perspective to a lot of what he does. So we've had a lot of discussions about it. We've also had some arguments about it. I've had some—I even had the Chinese Environmental Minister thank me, on my trip to China, for doing a climate change event because, he said, "We've got to convince people that you're not trying to slow our economic growth." This really is a whole different way of looking at the world.

Mr. Rubinstein. So with Blair and Chirac and so forth, occasionally science issues are actually discussed?

The President. Yes. I talk to Tony Blair about them a lot. And of course, we're dealing with them in more contentious areas, too. Within Europe, what do they do about mad cow disease, vis-a-vis the United States? What do they do about genetically modified organisms? How do you balance political pressures with scientific reality? How do you define scientific reality? Do they need a European Union-wide equivalent of the FDA?

Mr. Rubinstein. Genetically modified foods and whatnot?

The President. Yes, because all these things are really—these are hot issues now. I didn't even mention that earlier when we started, about all the things that will require a higher level of scientific knowledge, but that's another example. I mean, all this controversy over how we produce food and all that, that's going to be—that's not going away any time soon.

Science and Math Education

Mr. Rubinstein. Well, you sort of have gotten to some of the questions I was going to ask you about the future. I thought maybe I'd just ask you a couple of quick ones, and I don't know, I don't want to take too much of your time. But I would really like—I know you and Mrs. Clinton have been very interested in education. I don't know to what degree you're familiar with the state of science education, and I don't know if you have some feelings about—we just had the latest report come out about young kids in math and science being—I think we were 18th or something. I don't remember myself what the number is now. So I was wondering if you have some strong feelings about the situation. I know you do about education in general, but in science in particular?

The President. Well, I think there are basically two issues. One is, in a country as big and diverse as ours, how do you get more kids to take math and science courses at more advanced levels? And secondly, if you could do that, how would you have enough qualified teachers to do it? I think—the one thing I would say is that some States—I noticed California passed a really sweeping initiative this last year to try to give bonuses to people who will enroll—I think that what you're going to see inevitably in the future is that you will have to have more alternative certification mechanisms, and you'll have to pay people more.

I also think at the advanced levels of science and math, you may even see a lot of high school systems operating the way colleges do now and bringing people in to teach one course or something like that. I think that you're going to—since we are going to have a critical mass of people out there in

America who know the things that all of our kids now need to know, but virtually 100 percent of them are making a lot more money than they can make teaching school, you're either going to have to get people who make a lot of money and then can retire—I have a friend who's got a daughter who made, I don't know, $30, 40 million in her early thirties or late twenties in a software enterprise, who's now just cashed out and spends all of her time teaching inner-city schools.

But you're either going to have to find tons of people like that; or you're going to have to find ways to finance the education of young people to do this work for 4 or 5 years and just recognize you're only going to have them for 4 or 5 years; or you're going to have to have, like in junior and senior year at least, have people who have this knowledge come in and teach a course just like a—someone would come into a college and teach one course.

In other words, we're going to have to be, I think, flexible if we want to lift the level of performance in America above where it is now, because we have a lot of poor kids, a lot of poor school districts, very diverse student body, and a huge number of kids. I mean, most of these places that are doing very well have a much more—either a more homogenous or smaller, or both, student body and a system that's much more nationalized and much easier to control.

National Aeronautics and Space Administration

Mr. Rubinstein. Could you just tell me a couple things about—how do you feel about, right now, about why NASA, which you're very enthused about, continues to get a sort of flat budget? Is this a wise thing at this point?

The President. Well, first of all, I think that NASA, when I took office, needed to show that it knew how to economize and could be managed better. I think Dan Goldin has done that. I think they have proved that they can do more with less. I mean, they got the space station up 3 years ahead of time.

Mr. Rubinstein. But they've also had some disasters, which some people——

The President. They've also had some disasters, but look—I mean, they're out there fooling around with Mars. You're going to have some disasters. You know, if you want something with 100 percent success rate, you've got to be involved in something besides space exploration. You're never going to have that. I think the important thing is that, from our point of view, NASA responded in an honest, up-front way to their difficulties with the two Mars probes that didn't work so well, the lander mission and the other one. And they're going forward.

And I would like to see their budget increase now, because I think that they have proved, after years and years of flat budgets, that they have squeezed a lot of blood out of this turnip. They have really restructured themselves. They have gotten rid of a lot of their relatively inefficient costs. And I believe that now is the time at least to let them start growing with inflation again, if they're going to be able to handle their missions.

And I think that what we'll have to see over the next few years is where we go with Mars, because you've just got these new pictures, and it looks like there was water there closer to the surface more recently in time than we thought. So we need to keep taking pictures. We need to keep trying to—not withstanding what happened to the lander module, we need to find some way to put a vehicle down there that can actually physically get some stuff off the surface and bring it back to us.

We need to keep—and then I think the rest of the space budget may be in some measure determined by exactly what is going on at the space station, how much progress we'll be making in the whole—you know, there's seven, eight, nine areas of basic research that I think are likely to have enormous advances as a result of what's going on there. And I think that in these two things, more than anything else, will dictate how much money NASA needs and what they need it for.

President's Future Plans

Mr. Rubinstein. So, now that you've released your inner nerd, my last question is, do you think you'll do anything related to science in your next years?

The President. When I leave here?

Mr. Rubinstein. Yes.

The President. Oh, I certainly hope so. I'm very interested in continuing to work in the climate change area in particular and doing what I can to convince the political systems of countries that have to participate in this that there are economically beneficial ways to do the right thing for the global environment. And in order to do that, we have to continue the basic research into alternative fuels and alternative technologies. There is no way to solve this over the long run unless you can get more growth out of fewer greenhouse gases. There is no way to do it. And so, on that alone, I will continue to be very interested.

The other thing that I'm particularly personally interested in is the breakdown of public health systems in so many countries, and how it disables them from dealing with things like the AIDS epidemic and other problems, and what we can do to sort of put that back together again. So I expect those are two areas that I'll be involved in for a long time to come, if I have the opportunity to be.

Mr. Rubinstein. Thanks very much. I hope that we can ask you some questions about it later, when you're doing those things.

The President. Thanks.

NOTE: The interview was taped at 4:20 p.m. in the Oval Office at the White House for later broadcast, and the transcript was released by the Office of the Press Secretary on December 21. In his remarks, the President referred to Eric Lander, director, Whitehead/MIT Center for Genome Research; Vinton G. Cerf, senior vice president of Internet architecture and technology, MCI WorldCom, and his wife, Sigrid; J. Craig Venter, founder, The Institute for Genome Research, and president and chief scientific officer, Celera Genomics Corp.; Prime Minister Tony Blair of the United Kingdom; President Jiang Zemin of China; and President Jacques Chirac of France. A tape was not available for verification of the content of this interview.

Statement on Action To Reduce Diesel Emissions

December 21, 2000

A year ago today I announced the toughest air pollution standards for new cars and sport utility vehicles. Today we take another bold step to clean our air. We are adopting strong new measures to dramatically reduce unhealthy and unsightly emissions from trucks and buses powered by diesel fuel. Together, these actions represent the most sweeping effort ever to protect our air and our health from the pollution caused by the vehicles we drive. They ensure that by the end of the decade, every new car, truck, and SUV in America will be up to 95 percent cleaner than those on the road today.

Today's action by the Environmental Protection Agency mandates cleaner diesel fuel and extends the latest pollution control technology to all trucks and buses for the first time. These advances will prevent not only the thick plumes of diesel exhaust all too familiar to motorists but also thousands of cases of respiratory illness and premature deaths. We will spare thousands of children and elderly the agony of asthma and bronchitis and help to fulfill the promise of clean, healthy air for every American.

For the past 8 years, Vice President Gore and I have been guided by the conviction that a strong economy and a healthy environment go hand in hand. Indeed, our Nation entered the 21st century enjoying both unprecedented prosperity and the cleanest air and water in a generation. Our actions a year ago and today will help ensure an even safer and more prosperous future for generations yet to come.

Statement on Signing the Departments of Commerce, Justice, State, the Judiciary, and Related Agencies Appropriations Act, 2001

December 21, 2000

Today I am signing into law H.R. 4942, the Departments of Commerce, Justice, State, the Judiciary, and Related Agencies Appropriations Act, 2001. I commend the Congress for approving a bill that provides critical funding for enforcing our Nation's laws, protecting our precious natural resources, promoting international peace, and supporting our diplomatic operations.

Many portions of the Act are considerably improved compared to the previous House