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SCIENCE IN RUSSIA: PROVIDING THE FOUNDATIONS FOR INNOVATION

Building Russia's Creative Capital

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In recent years, Russia has strived to maintain its leadership in scientific research in such areas as physics, space and aeronautics, and policymakers are working with educational institutions and businesses to not only strengthen R&D in areas of traditional expertise, but also spur further research in geosciences, chemistry, computing and others areas.

Moderator:

Oleg Kharkhordin, Rector, The European University at St. Petersburg

Panelists:

Harley Balzer, Member of the Governing Council of the Basic Research and Higher Education Programme

John J. DeGioia, President, Georgetown University

Andrei Fursenko, Minister of Education and Science of the Russian Federation

Henry Rosovsky, Geyser University Professor Emeritus, Harvard University

Konstantin Severinov, Head of the laboratory, Institute of Gene Biology (RAS); Professor, Rutgers University Department of Molecular Biology and Biochemistry (US)

Stanislav Smirnov, Professor, Geneva University; Director of the Chebyshev Laboratory, St. Petersburg State University

Konstantin Sonin, Acting Provost, New Economic School

James Wolfensohn, Chairman, Wolfensohn and Company L.L.C.

O. Kharkhordin:

The discussion will be in English. I apologize to the Russian participants on this panel, who will have to wear headphones. However, the purpose of this meeting is a dialogue, and so we will speak in English, which is the 'lingua franca' of modern science, whether we like it or not.

So, I will be speaking English in order to ensure the best communication between the panellists. The idea behind this session is pretty simple. We had a conference of Russian diaspora scientists, meaning scientists of Russian origins who right now work in US and European universities. We had this conference a year ago, and it was linked to a new initiative of the Russian government to invest millions of dollars into a so called mega-grant scheme, which would allow us to re-establish laboratories of experimental science, which were left penniless for the first 20 years of Russian independence.

When we assembled those people, we understood that there are some potential growth points which Russia can offer to global developers. We know about the traditional strengths of Russian science, but there might be new points associated with the problems of getting Russian science involved in novel areas to do with global development.

We might run another scientific diaspora conference a year from now, and this panel serves as a kind of testing ground to develop some of the discussions there. One of the issues which surfaced during our discussions a year ago was the difference between the capital-intensive science in Russia, and non-capital-intensive science in Russia. What I mean is, science which requires only a pencil and a computer to produce results, like mathematics, theoretical physics, etc., and science which requires huge laboratories. The trajectories of the two types of science are very different. So I would like you to reflect on that, and consider what will happen in the future for Russian science.

We have now 8 people on the panel, I will be moderating, we have 5–7 minutes each, and then a discussion at the end. First we will have a row of Russian

participants presenting, then we will have a series of illustrious experts on scientific and economic development, also talking on how science matters to us. And at the end of the panel, Andrei Fursenko, the Minister of Education and Science of the Russian Federation will wrap up with some remarks. Then we will have 15 minutes where we will take questions from the floor. And there is one participant here whose contribution is very important, this is Igor Agamirzyan, the head of the Russian Venture Company, who was a mathematician in his former life. So without further ado, I will start, and I would like to give the floor first to the obvious starting point, at least for the year 2010 when he was awarded the Fields Medal in mathematics, that is Stanislav Smirnov, who after that started working simultaneously in St. Petersburg and Geneva, where he is trying to contribute to reviving Russian mathematics.

S. Smirnov:

Thank you Oleg. So first I want to point out that somehow mathematics is a rather specific example, because traditionally it was at the top level in the Soviet Union. I would emphasize three things, that there was continuous education from school to university, which worked very well, and science was at the top level. Also, it was very well connected to industry, so most mathematicians I know also did some consulting for industry, doing different things, from shoe factories to nuclear ice breakers. And also in more technologically advanced projects, like the nuclear project for the space programme, where mathematicians really participated at a very high level.

Now if we speak about the situation with science today, I would say that perhaps the two main problems with Russian science were chronic underfunding, which is starting to change for the better now, and also the data handling procedures, for example to do one thing in Russia now takes much more administrative effort than in other countries, and as a result most young active people here choose to

either quit science or emigrate, because it is just too hard on such an administrative level do work in science.

So if we look at the outlook for the future of Russian science, especially mathematics, I think it could be quite bright, because the school system, as far as talented students are concerned, functions fairly well. And this is one thing that other countries try to replicate. So, there is a system of special schools here for talented kids, and it is a rather good sieve for selecting students who are interested in something specific like mathematics, or biology, or dance, and so there are flexible ways to teach these students. So this system works very well, and incoming students into universities are prepared. Therefore it is more of a question of how to reform Russian universities, so that the Russian sciences can function well and be competitive with world science, and also contribute to it.

So there are two main things, one is to really support young scientists at the beginning of their careers. It should be some sort of a long term programme, so that a person who is graduating from university can be sure that if he performs well for ten years, he will be well supported, and he will have adequate working conditions. And another thing, Russian science should be well integrated with international science. Because with mathematics, I think it is one of the biggest problems, that somehow apparently even during the Iron Curtain years, there was somehow more of an exchange of ideas than there is now. And since science has become even more complicated in recent decades, one country cannot survive alone, even the United States, or China. No country can survive alone. Science should be international.

So even if these two things are addressed, I think Russian science could take its place in the world, and be very useful for the Russian economy. I am now part of a fundamental science, mathematics, which for some reason, people often joke that we do it only for curiosity. That might be the main motivation for many mathematicians, but I think it can be useful in many ways for the state. Certainly, it is very expensive for the state to support fundamental science, but on the other

hand, it is very profitable – only you do not see it immediately. One thing is that it contributes very much to the educational process. So, in most countries, people who do fundamental science teach in university. So, this improves the quality of how mathematics is taught. And if we speak about high-level engineers, if you really want some innovation, say in computer science and space programmes, you need people who know mathematics very well.

So, this is one sort of educational bonus. The other thing of course is that even being a fundamental science, it has some applications even in areas where you do not expect them.

So if you take anything, like, say a mobile phone, you would be surprised how much of modern mathematics, which were developed purely for statistical reasons about 10 or 20 years ago, goes into making an iPhone or Android phone, and even most mathematicians would not know that.

So there are these bonuses; another thing which is good is that fundamental science, being supported by the state if it develops some technology, is usually free for all to use, so somehow it promotes the usage of it. So perhaps one of the best examples comes from Geneva, CERN there, the largest nuclear science institute. It developed a system to find scientists for seminars which are held at the institute.

And it became the HTML standard, Hypertext Mark-up Language, which we all use to encode worldwide web pages. Now, there are other standards which are used in the worldwide web which are proprietary standards, but they are not as widespread, because they were not developed by fundamental scientists, but rather by private companies. So, this is in a sense because of fundamental science, that we had this rapid development of the internet. So, this is just one example.

O. Kharkhordin:

Thank you Stanislav. Right, now we go from the traditional strengths of Russian science, which is maths, which is non-capital intensive, to capital-intensive science, which is experimental and medical biology. And this is Konstantin Severinov who, for me, represents the model of a new scientist because he works in Rutgers and Moscow, and very often one can meet him on the plane carrying the probes and the assays from one country and one level to another. So, Konstantin, please.

K. Severinov:

Thanks Oleg. So in the beginning we had this little powwow where Oleg said what we are supposed to say to all of you, and one of the things was that I am supposed to summarize one of the achievements of Russian science, in my case, biology, that happened during the past three years.

And so, I am happy to report that there was such an achievement, and that is to say that Ruslan Medzhitov, who is at the faculty of Yale and also a Howard Hughes Investigator there, received the Shaw Prize, which amounts to a Nobel Prize, but sort of for the Asian region.

So, let us sort of like step back and look who Ruslan is. So, he is a graduate of Tashkent University. He did his PhD in the Cancer Centre in Moscow. He graduated from that graduate school with no prospects in life, no apartment, no anything, and he moved to the US where he went on to a stellar career that now resulted in all these accolades and things.

And I think the problem that is to be solved with Russian science is for future or current Ruslan Medzhitovs who have not yet showed themselves for what they are, to be identified, and for opportunities to be presented to them, so that they can actually professionally grow and realize their potential in this country.

And assuming that these people are there somewhere in the expanses of Russia, the question becomes how to make conditions right for them to realize their dreams, and of course to capitalize on that then.

For those who did not hear, I presented to you the abridged version of the career of Ruslan Medzhitov, who is probably the most well-known scientist of Russian extraction, who happens to be from Uzbekistan, in the modern day life sciences.

And now I can relate to you my personal stories since I have been here, running a lab, two labs in fact in Russia for six years now. And so during the last three years, I am happy to report that 12 of my PhD students have defended their PhD theses, but all of them left for places such as Yale, Harvard, Imperial College in London and others.

And the question then becomes why is this so? These are presumably future Ruslan Medzhitovs in 10 years from now. And what can be done to help them to grow and realize their potential in this country? Some of the problems are so well known that I do not even want to really mention them.

Biology is an experimental science and you have to have biological samples, you have to have reagents, you have to have equipment, and without that you cannot do it. And unless the conditions are right, such that you can compete on an equal footing with your friends or competitors in the west, you would not be able to do it here. And for anyone who wants to do competitive science—and science is competitive—the conclusion is very clear, and that is 'go west, young man'.

Fortunately, the government and the Ministry of Education is doing certain things to solve this situation, but until the situation is solved, for the most part the young scientists say, "Well you know what, you solve the problems that you have to solve and we will sympathize with you, but until these problems are solved, we will just do whatever we have to do, and that is compete on the outside from, you know, here".

Another problem is mobility, and science is not done in a single lab anymore, especially biological science, it is all about collaboration and things. And here unfortunately, the Russian passport is a detriment rather than an asset, because it is much more difficult for you if you are a Russian passport holder, and that is

the only thing you have, to be able to participate in all of the exciting things that happen throughout the world: conferences, teaching courses, and all that stuff.

Note that I never mentioned money. The money is here. There is more money here now than there is money for example in life science in the US, comparatively speaking. But it is hard to make this capital work so to speak. And unless these problems are solved, I am afraid that the Ruslan Medzhitovs of this world will be going outside.

And people who are less than that person will also be going outside, because unless Russian businesses, Russian pharmas start to siphon people into their R&D Centres, again, the situation would be rather bleak. And that is pretty much it. Again I just want to say for the last 15 seconds that this is not about the money. It is not about the conditions, per se. It is about this atmosphere that does not allow professional development of young people, and them seeing a future that they can capitalize on. Thank you.

O. Kharkhordin:

Okay thank you, Konstantin. Now, we will go to another Konstantin who is on the opposite side to biology and maths, he represents a new science for Russia, this is the science of economics, which hardly existed in this guise 20 years ago.

So, Konstantin is the most modernized among all of us. He is the only one who has a PowerPoint presentation, maybe this is a sign of his trade.

K. Sonin:

Perhaps I am just the most serious of us. I was asked to provide another view of the state of affairs, and of economic science in Russia. And I took this task very seriously. So in my 11 slides, I am going to basically tell you about all the work in economic science that was done during the last 10 years.

Fortunately, or unfortunately, it is not that much. Of course, there is a big difference between mathematics and economics, and one big difference is that a

mathematician is a clearly defined concept, but an economist is an extremely vague concept.

So to define economic science, in preparing for this presentation, I just took the 250 most important academic journals in economics, and looked at all the Russian economists who published papers in these journals.

Basically, the quality level of the bottom part of these journals is quite low, but if you look at the most important, most prominent Russian journals, they are typically ranked around 500th or 600th in terms of world journals. So, we do not distinguish between publications in Russian journals and English language journals, but the 250 most important journals do not include Russian journals.

So, if you look at the publications during the last decade in big Russian academic institutes, then the picture looks extremely dismal, especially because, if you look at the three top rows, Central Economics and Mathematics Institute, the Vychislitelny Centre, and the St. Petersburg Economics and Mathematics Institute, most of these publications, are just mathematicians working in areas which are borderline between economics and mathematics.

So basically, these are decade-old publications. But, if you look at the top universities in Russia, then the picture is different. Basically, we have many more publications than in the previous decade and the decade that preceded this decade.

So judging by this, by publications in top Russian economic departments, this was an extremely successful decade. If we want to have an international comparison, then the best economics department in Russia, the New Economic School, is about number 50 in Europe, the Higher School of Economics, the Economics Department, and the International College of Economics and Finance, is about 150th.

But, if you looked at Eastern Europe, then you would see that basically, they are the first and the fourth in this ranking. And if you look at the Central European University and CERGE-EI in Prague, then back 10 years ago these universities,

they were like a generation ahead of us. We were lagging behind. But somehow, we can now compete with them.

If you look for the immediate reason why the economics departments of universities were so successful, you will find it is because they hired people based on their research prospects. They hired people on the international job market, and this is extremely important.

Actually, the most important thing over the last three or five years is that several state universities started to hire economics professors on the international job market as hundreds of other economics departments around the world do. So now, we had this trend, and perhaps next time we speak about this there will be more state universities on this list.

If you look at the younger generation, I chose people who are under 33 years of age, who have at least a single publication. This is the whole list in our country of people who are under 33 years old and have had at least a single scientific publication in economics. It seems that it is extremely small for such a big country as Russia, but if you go back a decade, then this list would include only a single person. So, there has actually been huge progress during this decade.

As I said, there is a big difference between mathematics and economics. One thing is that the dynamic was completely different. There was no downfall in the 1990s, basically because there have never been big achievements in economic science in Russia. Russian economists—and we have Nobel Prize winners among Russian economists—but this work was done basically in the 30s and early 40s. So, this has nothing to do with the legacy that we have now. And also, what is completely different from mathematics and physics departments is that economic departments are experiencing a huge inflow of very strong students.

So, those students who in Soviet times would go to mathematics and political physics, now they go to economic science, so that is why this is so successful. So, I think we had a great decade, and the next decade is also going to be great basically because we are lagging so far behind.

O. Kharkhordin:

Thank you Konstantin for fitting your rich presentation into the seven minutes we have each. And, I can tell you that what I understood is that the new social sciences were flourishing, right?

K. Sonin:

Yes. This decade for economic science was extremely successful. We now have research departments in economics.

O. Kharkhordin:

Okay. So right now, we will go to a scientist who is trying to develop a technology company in entrepreneurship and he is the head of the Russian Venture Company, formerly a Doctor of Science and Mathematics – Igor Agamirzyan.

I. Agamirzyan:

Thank you, very much. I am actually in a pretty interesting position between science and business and a venture company, which is the Development Institute for the Russian Economy. Definitely, for us, the existence of a strong science base in Russia is very important. However, science is definitely not the only one source of innovation, though it is a very, very important source. And I truly believe that without a good scientific background, without strong schools in the basic research areas, there will be no human capital for developing an innovative economy.

I would just try to say a few words emphasizing the importance of, not to say formal education for scientists, but the importance of the existence and a force for the creation of scientific schools. And just recently, maybe somebody here had a chance to read Perfect Rigor, the book about Grigori Perelman, which was

published in the US a couple of months ago, and translated back into Russian and published in Russia.

Actually, I referred to that because I knew that Stanislav Smirnov is actually a former student of the same teacher who taught Grigori Perelman, Sergei Rukshin, right?

In the Center for Mathematical Education of Children, I referred to this book, because it really shows the history and the importance of scientific schools using the example of mathematics. And I completely agree that mathematics today is one of the areas in which Russia is completely integrated in global science, and we are at a world-class level of achievements.

Unfortunately, in many other areas such as schools of—informal sometimes—scientific schools, because they include all the levels of education, starting from groups for school children, and up to the informal mentoring and tutoring for post-doc students. That is a pretty informal network of those who are working in this area of science. In a way, it is pretty unique, if we think about creating the conditions for such scientific schools to be growing up and emerging in our country.

And another point is that, definitely, in the modern global world, it is impossible to do in isolation, it is impossible to do it isolated from global science, from the global economy, from the global communications of this new world we are living in. Thank you.

O. Kharkhordin:

Thank you, Igor. Right now we will go to our international contributors, and hopefully they will put the Russian experience through a global perspective. Or a US perspective; we mostly have our American friends.

We will start with Harley Balzer, who is a professor at Georgetown and simultaneously is one of the biggest experts on the history and sociology of Russian science.

H. Balzer:

OK. Thank you very much. I thought I would try to talk about innovation, and since I spent two years of my life working with archives here in St. Petersburg, I also thought I would talk a little about history.

And since this is the 50th anniversary of Yuri Gagarin's space flight, it seemed that the history of the Soviet space programme might be a worthwhile topic because it is full of myths. It was full of myths for the Americans, and the American response was to spend a lot of money on education and science. That was not such a bad use of myth.

In the Soviet Union, it produced a myth that it was a state programme, that the government sponsored, and that the Communist party led diligently. And that myth has been really damaging, both to Soviet science and to Russian science.

The lag in America was not a problem. The sense that state programmes really produce innovation is a problem. The myth of Big Science is still something that people invoke when I talk to them, and it is disturbing.

I would say the space programme and the Soviet Union happened not because of the party but despite the party. And for this, I am using some archive work from some younger historians. To save time, I am going to overestimate personality and focus on two people very quickly: Konstantin Tsiolkovsky and Sergei Korolyov.

Tsiolkovsky is famous, of course, as the father of cosmonautics. In 1903 he mathematically proved that liquid space propellant could actually get a rocket into space. He was also slightly insane. He focused on eugenics. He was a mystic.

But he was a figure who inspired an enormous number of people in the Soviet Union, and in Imperial Russia, to focus on space—amateurs and then professionals—and had an enormous influence. His influence came up in Alexei Tolstoy's novel, which became the film *Aelita*. It came up in popular science writings of other people.

Korolyov, Glushko and others paid a lot of attention to Tsiolkovsky, and he really inspired them to work on rocketry, even though it was not a state programme. The government did not support them. A voluntary association was created. They worked in a church, in apartments, in a converted wine cellar. They melted down silver to do their soldering because they could not get it any other way. They brought it from home. And they did not have state support until Tukhachevsky came along. We know what happened to him. There was a downside to having a patron like Tukhachevsky.

Korolyov, of course, ended up being sentenced. So was Glushko. They all ended up in Tupolev Sharashka, another kind of informal community, if you want. After the war, they ended up in Germany together, trying to bring back to the Soviet Union the knowledge they could find in Germany. They got utterly contradictory orders.

As a result, the success that the Soviet Union enjoyed in Germany came from informal networks, not from any state coordination. There was no official state programme for space in the Soviet Union until 1954. Stalin did not care about space. He cared about rockets and ICBMs.

Yet these folks kept working on it, and they finally got their chance. Ironically, once it became a state programme, it never did as well. Sputnik, Gagarin; and then the Soviet Union really lost the moon race.

Evidence that it was not a state programme: when Sputnik was launched, Pravda the next day ran the story on the bottom half of the front page. The lead story that day was preparation for winter. Edward Keller in America talked about this being a greater defeat for the United States than Pearl Harbor. A week later, Pravda came out and said, "We are winning the race in the cosmos".

What I take from this, is that I do not deny the achievement. To this day, the only way we get to the international space station is on Russian rockets. It is not as if this was something that was not a major contribution to world science.

But it came not from a major state programme. It came from a lot of innovative individuals who persisted in working, sometimes under conditions that were nearly impossible.

That is how you get innovation. That is how you get those young people to want to work here and stay here. And that is what is going to be needed here in the future.

O. Kharkhordin:

Thank you, Harley. And right now we pass the floor to Henry Rosovsky. Henry is an economist at Harvard. And apart from being tenured, he is famous for the fact that in 1974, after he assumed the position of Head of the Faculty of Arts and Sciences at Harvard, he reformed it completely. What I adore, of course, is the core curriculum, which generations of Harvard students then not only witnessed but lived through.

And Henry, of course, wrote the best manual for a university administrator ever made, which is called The University: An Owner's Manual. But without further ado, right now we will listen to Henry and his comments.

H. Rosovsky:

I am not a scientist. I am not a Russia specialist. But I have lived with a great many famous and very difficult scientists. So I am going to make a few remarks from the American perspective.

We are supposed to focus, I think, on science and innovation. It was the title. And I think one of the questions that comes up is, what incentive is there to innovate, for the individual and the institution?

And as I think it would be a very good thing, I do not know what the situation in Russia is. But if there are innovations generated within institutions, it would be very helpful if the innovator and the institution both benefit.

I do not think anybody questions the human capacity of Russian scientists. In any case, there is no such thing as 'Russian science'. We are talking about science. The issue is whether the system here can be improved to make world science flourish more.

I have to say that I have worked in universities for a great many years, and today was the first time that I have ever heard a biologist say, "Money is no problem". I would have loved to have heard that from a single biologist at Harvard. But I never heard that.

I think I will make a few suggestions on the basis of the American experience, and other people have touched on it already. I think we believe very strongly that keeping science in the university, that the interplay between students and working scientists has worked very well for the United States, and sort of the institute type of development of science, we have used much less.

A big problem for us, I think, is that the young take too much time to be independent, because we do have money problems. So it takes years of grant writing to work as post docs and so forth before you can really set up an independent laboratory. I think that, for us, is a big problem. It certainly would be a problem to avoid here, if possible.

Another thing, of course, is that from the point of view of senior scientists, we are too bureaucratized. And senior scientists spend more time writing grant applications than at the bench. I think that is not good for science.

I would make only two other points; one is, in a sense, almost philosophical in nature.

I had a colleague for many years, James Watson, who was of Watson-Crick. Watson was an idealist, and firmly believed that the great innovations come from the individual working more or less by himself, pursuing whatever intellectual curiosity took his interest.

In fact, of course, Big Science has in many ways taken over. I think that from the point of view of the development of science, the balance between the Watson

vision and the Big Science vision is one of the most difficult to obtain. And for those who run programmes, I think it is a very important issue.

Finally, I am an economist, but I would generally not call myself an economic scientist. I am probably too old to do that. But the point is that, in a way, Russian social science has been absent. And I think that the world is waiting, the learned world, not just for the entry now of the important contributions that Russian economists are making but also Russian sociologists and Russian political scientists.

There is a need to develop this part, I think, of the scientific armament. And this is one reason why some of us are here at the European University, one of the leaders in that area. Thank you.

O. Kharkhordin:

Well, thank you, Henry, for your comments, particularly for the lovely remarks on this institution which I represent and the discipline about which I cannot speak as a moderator. But I am a political scientist and sociologist, of course.

Now, we will move on to the person who for me has the most, how should I put it? Who has the most unbelievably interesting career, because John DeGioia is by training a philosopher, but he chose to become a philosopher king, meaning the President of Georgetown University. Now he will offer his comments.

J.J. DeGioia:

Thank you very much Oleg. What I would like to do is actually pick up on one of the last points that Henry made. There are three points I would like to make, and the first one really builds on the last point that he made, and I would just describe it a little bit differently and that is, the importance of recognizing a defining characteristic of particularly university science, which is seeking a balance between competition and cooperation.

I think we, we recognize that the importance of competition, probably captured in Professor Watson's perspective of the importance of the individual engaged in the practice of science, but perhaps a word of emphasis on the balance between competition and cooperation. I think the goal always is to create a context to bring out the very best in our scientific communities.

And the way we do that is by rewarding the very best in science, and I think we have found over time that such conditions include a focus on peer review, on funding based on merit, on conditions characterized by academic freedom.

Increasingly though this work does require cooperation. I love the way Henry put it. There is no 'Russian science', there is no 'American science', there is global science or world science, and increasingly we need to find the ways in which we can support and sustain the networks of cooperation and collaboration that are going to enable to us to bring out the very best in our scientific communities.

A second point I would like to make also refers to a point that has been made by a couple of folks, and that is regarding funding. About five years ago in the United States, we had a very distinguished panel of experts come together and produced the report called The Gathering Storm.

And it was created out of a sense of crisis in the United States, in which there was a recognition that we simply were not creating the conditions to bring out the very best in science in our universities and in our national laboratories. There was chronic underfunding, an ageing workforce, and a lack of public respect for science. It is important to know that in our context, only 15% of our students are pursuing studies in physical science and engineering.

I think funding is characterized by mismatches, and it was good to hear today that it is not about the funding right now, here, but I think over the years of experience that we might be able to represent, it is hard to overestimate the importance of consistent and enduring government funding and support of research in ways that enable us to sustain this balance between the individual and the group.

I just mentioned this point about a lack of public respect, that was identified by our colleagues who worked on The Gathering Storm report. So the last comment I would like to make is about the imagination. I was born in 1957, and I tell you this to place my boyhood in perspective, because it was in large part shaped by the experience that my colleague, Harley Balzer was describing; I cannot wait to read his next study, his latest work because it will be fascinating to understand what really drove the success of space science in the 1960s.

But for me I grew up at a time of great public respect for science, and I can remember being in grade school and classes stopping, and then the television going on and everybody riveted to the next lift off of one of our rockets taking off, one of the Gemini capsules going up into the sky.

We need to capture the imagination of our young people again. We need to be able to establish the kind of vision that was present in many different contexts at a different point in time in the lives of our countries. We need more young people engaged in science. We need more science. And one of the challenges we recognize back in our context is the need to capture the imagination of our young people, so that more of them are pursuing a vision of what life can be like dedicated and committed to science. Thank you.

O. Kharkhordin:

Well thank you Jack, you have captured our imagination for sure. We are all just preparing for the flight. The next speaker is James Wolfensohn, and I should stress that he is the only person on this panel who chose his seating intentionally, meaning, he is the most modest speaker, but I can that actually Jim is with us not only because he is the former President of the World Bank between 1995 and 2005 and the other part of his identity which is very relevant for our panel is not development, but the fact that for 23 years, he was the Chairman of the Board of Trustees of Princeton Institute of Advance Study, which is one of the key institutions of science in the world.

Jim also supports the Center for Global Development at the Brookings Institution, so he was known to have many talents, not only music, but science as well so he will offer his remarks right now in the science way. Thank you. Please Jim.

J. Wolfensohn:

Well thank you very much and I should underline that that in my 23 years at the Institute of Advanced Study, I do not think I understood more than one dinner conversation with my colleagues, because they were operating at a level way beyond anything that I could aspire to. But I would like to make just a few comments on three subjects.

The first is how America has a great advantage in being able to draw on the talent of the world, including Russian talent. And the ability of the United States, first for financial resources and for history, and to be able to benefit, really remarkably, in attracting the talent of the world—both by opportunity and resources—in a way that allows people to contribute to the United States, to a degree which is quite different than what they recontribute to their country.

And I think that one of the things about United States in terms of what I have observed in in my activities at the institute, just to give you a few names, we started with Einstein and Van Neumann and with Panofsky, and people who came to the United States, they were running away from tyranny in Europe, but they were given freedom in the United States. And they came together and started an institute which has kept that tradition, which is not just a place for people who are running from politics, but people that are running to have an environment, not only of free thought, but also the resources mentioned earlier to allow them to carry out their work.

And I think that this has been a remarkable thing; today we have Vladimir Voevodsky as a mathematics professor there, and we always have a series of Russians who are on permanent assignment. And I think that as we look forward

and the Minister of Education is here, the opportunity of setting up both partnerships, and providing the opportunities are really quite substantial.

The second thing I would say is that we do not just do it at that level. Just to give you some numbers, the United States has something of the order of 300,000 students studying abroad (within the US) from India or China at the moment. There are more than 300,000 students from each country studying at universities abroad. More than 100,000 of them are studying in the United States. To give you an example of how little the United States is preparing itself for an Asian period, the United States has 13,000 students in China and 3,100 in India.

So the way that the world is going in terms of its direction, is that we are seeing a new dimension in China or India, which is coming. Many of them are staying in the United States, but we are seeing more and more now fortunately going back to their own country.

And the third thing I would like to say is that we are very impressed in our country but what Rusnano is doing. You have a company here which in practical terms has USD 10 billion so far invested in going abroad and contracting with the best scientists overseas and contracting for the application of science. And Anatoly Chubais, who is heading that institute, really understands that what he has to do is to reach out so that he can offer those companies in the United States and elsewhere. It is an opportunity of access to this part of the world in a way that I think is enormously constructive.

And I have to say when I looked at their demonstrations today in terms of what they are doing in forms of electronics, you have to say that this is an extremely positive element that we are now seeing being applied in Russia, and I think is highly commendable.

O. Kharkhordin:

Well thank you, Jim. And we will now pass the floor to the Minister of Education and Science of the Russian Federation, Andrei Fursenko, who apart from being

of course a high-level official, also represents the shining glory of Russian science, which was physics throughout the 20th century.

A. Fursenko:

Thank you. I saw the signs that say ‘three minutes’ and ‘one minute’, and am thinking about just how difficult it is going to be to present everything I think about science in such a short time, even within the context of today's agenda.

Looking at history, I want to say right away that Soviet science, Russian science, has never been rational. That is the source of both its merit and its deficiencies. Harley Balzer was talking about that. Our successes are not based on rational approaches, and certainly not on economic ones. Our science has in general been very interesting, both in the defence and civilian sectors. I remember Harley's words, that the best place for a scientist in those years was the position of Chief Research Officer of the USSR Academy of Sciences. We were fully able to satisfy our scientific curiosity at government expense by saying that we were doing something to solve this or that national problem. There was very great scope for independence. The country has changed, but Russian science is perhaps the most conservative and most slowly changing institution of what remains from the Soviet Union. On the one hand that is a good thing, because the previous achievements in some sense are continuing. However, from a different perspective it is not very good, because new questions are continually arising. We are losing our heritage, and, unfortunately, we are very slow at creating something to replace it. However, I want to say that it is precisely this systemic character and complexity of change that cause the greatest aggravation. This is the case both in our old institutions, where it is understood that if they do not disappear altogether, they will be thoroughly reorganized, as well as in the new ones. On the one hand, scientists are not satisfied with the slowness of change, but they also do not want to give up their very positive situation, even lack of responsibility (in a good sense of the word), which means

that since they are not responsible for the result, they can do things that they personally find very interesting. Yet the bureaucracy, which exists in the scientific sector throughout the world, is perceived in Russia as much more unhealthy. If we honestly compare the Russian bureaucracy and the bureaucracy of the European Commission, the European community, all of us—including myself, as a person who has worked within the European Union—can say that the European bureaucracy is more dreadful than ours. But it does not evoke the same aggravation as the Russian bureaucracy does. After all, we have expected and are right to expect that all problems—both those we had at the beginning—lack of funding, and those we have today—for example, different administrative pressures—should be compensated by the ease of working with this additional money. But this is not occurring. A transition to new ways of doing things always causes problems.

In answer to questions and comments that were raised here, I want to say that the most important thing for science is that it be in demand. Demand for science in general by the economy, by society, and, consequently, demand for scientists. Demand for science has currently fallen for two reasons. There is less demand from society, because the prestige which, 20-30 years ago, was still associated with the country's achievements in science, has now fallen by the wayside. Also demand from the economic point of view is not very strong, because our economy does not connect its outstanding achievements with our Russian science. This is because the gap between the scientific ideas that are emerging and their embodiment in economic decisions, unfortunately, has not yet been fully closed. Consequently, scientists are not fully in demand, or if they are, then the demand is coming from other countries. A scientist knows that he is in demand around the world. There is nothing wrong with that; migration of scientists occurs everywhere. We are talking about the problem of emigration from Russia, but the same thing exists in Europe, and even in the United States. Yet here it is perceived as extremely unhealthy. It is seen as somehow shameful,

a defect in the country. However, absurdly enough, it is seen as a defect both that we let our scientists go, and that we invite foreign scientists to come. I must say that there is a certain lack of logic there. In fact, both are normal; it is a worldwide phenomenon. At the beginning of this year, I was at the Argonne Lab in Chicago, and I recall one of the top people there saying that he had a huge problem in such an important area as electrochemistry, which involves almost all the new tools for the conservation of energy. It turns out that there is not a single American there—but Chinese, Koreans, one of our people. The problem exists anywhere and everywhere.

In conclusion, I would like to say the following: Russian science cannot be viewed as if it existed in isolation. It is a part of world science, part of the global economy, and the problems, questions and challenges that are put before the scientific community have to be viewed precisely alongside the challenges, questions and proposals that are being considered worldwide. The analysis should be done for the world as a whole. Of course, we want our science to be the best in all respects, and not to have the problems that it does. However, it is not the case. Science is part of society, it is part of the economy. Thus all the measures we are taking in education, in science, will be effective only if we consider them as part of worldwide science, as part of worldwide education, because science and education—at all levels—should not be separated from each other. This is a global trend in the development of universal human potential, which is now very much lagging behind the development of the world economy. The problems must be solved comprehensively and simultaneously for the whole world, not just for any given country.

O. Kharkhordin:

I am switching back to English, so we are ready to take some questions from the floor as the organizers required, and we have got some time. I see a hand in the first row here. Could you pass the microphone?

A. Seryi:

Instead of a question can I have a three-minute speech?

O. Kharkhordin:

A speech?

A. Seryi:

A three-minute speech.

O. Kharkhordin:

A three-minute speech.

A. Seryi:

And that would be a question also.

O. Kharkhordin:

Then present yourself.

A. Seryi:

I will present myself. So I am Andrei Seryi, Professor at Oxford University. I am Director of the John Adams Institute for Accelerator Science. So my points. So I would like to connect several questions which you have already raised here, and also try to make a kind of an executive summary which a minister could put in his to-do-list because I heard a lot of speeches, but I would like to summarize what exactly needs to be done.

So, coming to this atmosphere of science, which Konstantin mentioned, it is really very important to have this real atmosphere which supports science.

So I have just been at a business lunch where Leonid Parfyonov talked to these business people, and we were discussing the price of oil. So the price of oil needs to be discussed—I raised the point—in comparison with the fraction of GDP which is spent on science. And all countries discuss that. So for example, when the crisis came in the US, the spending for science was increased. There were these additional funds, stimulus funds.

O. Kharkhordin:

Yeah, we will discuss it.

A. Seryi:

But still you need to discuss—indeed try to raise—this spending for science overall. So again, talking about Russian science being a global part of science. So for example, one of the questions which was in this list of that website, what are the challenges to maintain leadership in R&D in Russia?

So one of the challenges is you need leaders. So you need leaders, you take the best leaders from around the world and again, just to stress, I am not talking about myself. There could be some other leaders. There could be leaders who are Americans, or other nationalities coming here. For example, Kirai Physics Laboratory is now looking for a director, and the Japanese say they do not care about what nationality he or she is going to be.

So these kinds of things also need to happen in Russia and then again, fundamental science was another question. Is fundamental science important? Yes, it is crucial for innovation. So fundamental science is connected to education, and without that, it is really hard to have educated people to create this atmosphere of the value of knowledge. So again, what should our country look like in 20 years?

It should aim to value not the price of oil, but to value the price of knowledge, and that is where it should all come to.

O. Kharkhordin:

OK, thank you. Do you want to respond right away?

A. Fursenko:

Yes, I can answer very briefly. You see, the situation is much more complicated, even in financing. In the United States, they really increased some financial support for the sciences but not for all. You know they decreased support for their basic research. They increased support for the very concrete topics: for the green economy. I know it because I talked with Holdren and I got the whole picture from John Holdren, who is the Advisor to the President of the United States for Science and Technology. I know about it, you see.

There is just the same problem in Europe; it is also much more complicated. Believe me, in the UK you also know it decreased expenses on science.

So the structures have to be changed. The structures have to be changed. The problem is that the crisis demands a new approach for the sciences. It dictates that not all things are supported, as it was; it demands changes to the structure of science.

But the problem is that many requests from scientists are to save our scientists, to save our pre-crisis science. "Give us more money for our science, because it is a very good topic". This is a big problem, it is a social problem because it is really the best and brightest, but these best and brightest do not change themselves. They want to change everyone else. I am sorry but it is impossible. We work in a new world.

O. Kharkhordin:

We will have to have more dialogue in the break. There are other people who want to ask questions. Sorry. Dialogue afterwards. I will take two questions, and

then members of the panel will answer. Hopefully, the questions are not only to the minister.

M. Shmatov:

Thank you, Oleg. I am from the European Technical Institute, and I would like to switch into the Russian language because we are in Russia, OK?

M. Shmatov:

I would like to put a question on the agenda, because the people here are engaged mainly in the general sciences. In the last two years, one of the problems we have encountered is that of engineering and technical personnel. At first, we were working to train and retrain engineers and technical staff. Now we realize that the main issue is actually a different one: who will train these engineers and technical staff in Russia, five or ten years from now? Now the question is how to train our existing teaching staff, to retrain them, while adapting to the needs of industry. Therefore we need to create working groups with business people, to learn the needs of business and to train teachers on the basis of what we still have. That would be a good compromise. Thank you.

O. Kharkhordin:

There was a question here.

Y. Kuznetsov:

Yes I am Yevgeny Kuznetsov from the World Bank, and my area of expertise is making science relevant for business in countries like Argentina, India, South Africa, Morocco, and in similar countries.

And you know, this perspective actually allows me to shift the discussion a little bit towards 'the glass is half full' outlook, rather than half empty, which I think with all due respect to the previous speakers, might be useful because science and

universities, one should be aware, are of course the only two remaining medieval institutions.

But, they are also extremely heterogeneous. And what I would like to ask, is that I know quite a number of examples of great dynamic segments in Russian science universities, which are already doing very well, which are already part of world science and world universities.

The question is, what can we learn from those and how can we expand? Would it be a relevant question to ask? Thank you.

O. Kharkhordin:

Can we answer those questions?

K. Severinov:

Yes, can I suggest an answer? I think you do not need to learn, you just need to multiply that. So, if you think that something is working, well darn, what you need to do is just to put more money in there and to make it develop further.

Conversely, if you think that something is not working for you, then you need, as a manager, to stop putting money in there and make some hard decisions, and perhaps close a certain direction completely, and that is pretty much it.

O. Kharkhordin:

Does somebody want to answer the question about engineers?

K. Sonin:

May I answer in Russian, Oleg? You hear these conversations all the time, about how business needs engineers, but I know that there are some other professions that are very much needed, such as architects. And what do we see in these professions? Wages are very high and there is enormous competition at the universities. The Moscow Architecture Institute (MARCHI) has become the most

prestigious university. When people say that we do not have enough trained engineers, yet there is no intense competition at any of the engineering universities, this poses a rather strange paradox. It is not quite clear what they mean. Do they need good engineers whom they can pay very little?

O. Kharkhordin:

Yes, thank you, Mr Fursenko, please go ahead.

A. Fursenko:

I will address the issue very briefly. As you know, people are conservative, but I want to say that certain changes are definitely occurring. Thus it became clear that construction is the sector where you can earn a lot, and the competition is growing very strongly at universities offering that specialization. For example, engineers who graduate from the Moscow Institute of Physics and Technology are in great demand, because they are first-class planners, not just operatives, but first-class planners. And of all the universities in Russia, the Moscow Institute of Physics and Technology has the stiffest competition, the highest marks, because everyone knows that its graduates are in demand. In fact, people go where the demand is.

But some of our colleagues from, shall we say, the state-sector economy, say, “We really need engineers, but they have to come to us for their assignments.” I think that some in the audience do not know what ‘assignment’ means. I can explain. Assignment is when university graduates are obliged, as if under serfdom, to work for the feudal lord for a certain time. Of course, no one will go to a university like that.

The situation is changing, and changing in a good way, because there are places where companies today are asking for engineers, attracting engineers who were trained in other countries and are paying them very well. In these areas, such as the oil and gas sector, salaries are definitely increasing. But this is a process that

takes years, not months, but years. And, in fact, changes are occurring, but you cannot think that simply because today this sector is in demand, good engineers will be available tomorrow. Even a baby needs nine months for gestation, whereas for engineers it takes five years, not less.

O. Kharkhordin:

There was another question. Please introduce yourself.

V. Boiko-Veliky:

Thank you. Vasily Boiko-Veliky, President of Russkoye Moloko, an agro holding company. I would like to draw everyone's attention to the fact, as has already been pointed out here, that innovation in Russia and worldwide requires development not only of the technical sciences, but also the humanities, and also the development of education. Unfortunately, it has been 20 years since the fall of the atheistic, socialist government in Russia, but labour productivity is less in Russia than in comparable enterprises in the United States, Britain, France, and the countries of the socialist camp. Less, not because technicians know less or are less intelligent, but because the overall system of values inculcated in the population is still based on the premise that the state owes a person everything, and that a person can count on the state for everything, without working for it. And, unfortunately, so far the system—I am not addressing the other former socialist countries, but in Russia, the same practices that were used under the Soviet Union are deemed sufficient in humanities education today. A history textbook, for example, explaining the history of Russia before 1917, maintains all the same positions that were taken during Soviet times: the Decembrists, having betrayed the monarch, having betrayed their oath, are among the nation's heroes. There are many such examples. Therefore, innovation requires changing technical education and developing not only the technical sciences, but also the humanities. Thank you.

O. Kharkhordin:

Well, I think I will have to answer here, as I represent the social sciences here, and moreover because we are just about finished with our time. Actually the social sciences were on the rise in Russia for the simple fact which I stated in the beginning, they were not capital intensive. And in a sense, what we had was that the old production of the brains in this country, and lots of intelligent people who could, with the help of a pencil or a pen or a computer write something which will be noticeable internationally pretty soon as an influx of good social sciences. In terms of history we will do that as well.

Pretty soon, good new schoolbooks will be in demand from the new generation. And what I wanted to say summing up, is that we will try next time at the Conference of the Russian Scientific Diaspora one year from now, as I said in the beginning of our panel, and we will bring some of the best results which Russian Social Science has produced internationally.

I mean, these people are usually with tenure somewhere in the States or Western Europe, some of them are in Russia, some of them are capricious, and it is hard to bring them over to Russia to give presentations as is the case with many mathematicians, chemists, and physicists, but we will do that, and actually, you might be surprised to what extent this thing has actually developed in Russia rather than stating that this is a crisis, we should be saying that there was a growth point here.

Now, in general, I guess I would like to, right now, to thank all the panellists. I did not give the last chance to comment in even 30 seconds, but I hope the conversations will continue during the break between the panels. And well, thank you all.