

**Workshop on the Genomics Revolution:  
New Tools for Combating Infectious Diseases**

**March 29-31, 2006**

**Beijing, China**

**(Tape 1)**

**Wednesday, March 29, 2006**

. . . opening ceremony of Workshop on the Genomics Revolution: New Tools for Combating Infectious Diseases.

It is my great honor to introduce his excellency, Mr. Shang Yong, Vice Minister of Science and Technology. Vice Minister Yong just came back from . . . program in Howard University. He has personal experience . . . his belief in neutral benefits that could be generated by bilateral cooperation. Ladies and gentlemen, . . . Vice Minister Yong to give our welcoming remarks.

**Opening Ceremony & Welcome Remarks**

**Shang Yong, Vice Minister of Science and Technology**

Thank you, Mr. . . . . . distinguished guests, ladies and gentlemen – it is my great honor to join such a gathering of the more than 100 biologists, medical experts, and relevant officials from China and the United States. We're here today to attend a workshop on the genomics revolution: new tools for combating infectious diseases. This is the event jointly hosted by the Ministry of Science and Technology of China and the United States National Academies.

On behalf of the Ministry of Science and Technology of China, I would like to extend a warm welcome to everybody here. I deeply appreciate your great contributions to safeguard human health. Therefore, please accept my sincere congratulations to your great achievements.

Now, mankind is moving forward into knowledge of society, while enjoying the benefit of the modern civilization. Mankind is . . . to the spirit of the diseases. In particular, in recent years, the outbreak of . . . and the spirit of the . . . have caused general concern throughout the international community and attracted the attention of the scientific and the technology circles.

Looking back in the human history, we can see that millions of lives had been claimed by major infectious diseases, such as plagues, influenza, cholera and small pox, which has severely . . . economic development and the social stability.

In the . . . against the face of diseases, science and technology has overwhelming played crucial roles had there been no major scientific breakthroughs or improvement of particular health systems, mankind wouldn't have been about to identify new diseases, let alone to control them effectively. Obviously, the victory of mankind of infectious diseases will come from the investments of science and technology. This is also true in our fight against AIDS, avian flus, . . . and TB.

Scientists, the people engaged in science and technology are . . . with the . . . innovation and promotion of the human civilization bring out means and the measures to ensure human health as well as creating a most civilization.

Investment in science and technology in the new century is led by continued progress and major . . . in the life science and biotechnology which are becoming the powerful engine triggering . . . of revolution in science and technology. The major breakthroughs in genomics, protonomics, and stem cells technology have led to substantial improvement in

the . . . of mankind to identify and transform pathogenic microorganisms. The implementation and completion of the human genome project has not only transformed the human knowledge of origin of life, but also has placed increasing import in the roles and prevention and control of the infectious diseases.

Moreover, the last ten years mankind have . . . of genomic sequencing of dozens of animals of . . . . 190 . . . and 600 virus . . . of identification of the . . . virus in 2003. Scientists would ever choose . . . . . and the developed new type of DNA based on the infection of the reagent lead to optimize the . . . and the designs of several of the . . . vexings. They are moving towards clinical trials.

The tiniest garments attach the greater importance to the science and technology as the key roles in the safeguards of the public health. Every since the funding of the People's Republic of China in 1949, we have witnessed the occasion of small pox and polios and keep under controls posogenic infectious diseases such as plagues and cholera. The . . . of the routines of immunization in China have reached an advanced level in the world. Removing the infectious diseases from . . . in January of this year, the National Science and the Technology Conference would have helped in China to work out the . . . for the policies and the priority of China's scientific and technology development in the next 15 years.

We have set the objective to build China into an innovative country and improved national capability of the . . . innovation. Meanwhile, it has been decided that biotechnology is the key field in which China needed to catch up with the world. The prevention and the control of AIDS and other major infectious diseases and . . . innovative drugs has been . . . among the . . . are under the projects.

We will continue to increase our support to infectious diseases research and the development of innovative drugs.

The Chinese government highly values exchange and cooperation with other countries in research . . . infectious diseases.

This workshop will serve as the platform for the Chinese and the United States' scientists to have an exchange on techniques and . . . arising from the new gene science for converting the infectious diseases. We hope that this event will effectively teach the exchange and cooperation between scientists of other countries and accelerate . . . in the areas such as infectious pathogens, epidemiologies, diagnostic techniques, drugs, vaccines, and prevention.

I'm very pleased to notice that many countries, including China and the United States, have carried out intensive cooperation in the prevention and the control of the major infectious diseases. A significant achievement have come as a result. Chinese scientists have participated in the human genome project in the future. China will continue to take part in an international exchange and the cooperation over genomics research and have contributed to the . . . harassment of mankind suffering from infectious diseases.

Infectious diseases are the . . . of all mankind in the world. Let's join hands and work together to make greater contribution to the better health and auspicious life of mankind and to social progress.

Finally, I would like to extend once again our appreciation to you all. The Chinese government has pledged its continued support to the international cooperation and exchange in the spirit of science and technology. I wish this workshop be successful and fruitful. I also wish you all have a pleasant stay in China. Thank you very much!

Moderator – Thank you Vice Minister Yong. I would now like to pass over the microphone to his excellency, Dr. George Atkinson, Science and Technology Adviser to the U.S. Secretary of State. Dr. Atkinson has been very committed to boost China/U.S. efforts in scientific research and technological innovation. Ladies and gentlemen, Dr. Atkinson.



**George Atkinson**  
**Science and Technology Adviser to the Secretary of the State,**  
**U.S. Department of State**

Good morning. It is obviously a great pleasure for me to be here today to come back to Beijing and to China. It has been my good fortune to enjoy a number of visits and to benefit from the hospitality of the Chinese people and certainly the Chinese government.

Mr. Shang has been very eloquent in describing much of the motivation for all of us to come here. So, I would like to dwell for a few moments on issues that reinforce this very accurate and very inspiring description.

One of the key principles of science, and as a scientist for some years now, has been the international nature by which we attack problems. The great problems of our time in the area of science and technology engineering are always anticipated on an international basis. They are identified by the scientific community. We bring our best efforts to bear on understanding them first, cataloguing them, and then addressing questions to pertain to how to successfully deal with them.

Infectious diseases is perhaps one of the great examples that affect all mankind, and in fact, inspire scientists to approach them with their very best efforts. What the global dialogues on emerging science and technology hopes to do, the vision for it, is to improve and enhance the opportunity by which rooms like this are filled with people devoted to these principles. But, to do so, we should also remember the second tenant of science – not only is it international, but it spans many generations. It falls to us as human beings to be effected by problems that go beyond our ability perhaps even in one lifetime to address. So, part of the scientific principles and scientific endeavor is not only to commit one's own best efforts, but to hopefully inspire the next generation through the process of education and research to take up the gauntlet where we leave it off.

In the global dialogues program, the element of transcending more than one generation is a critical element. So, in the room we see people across generational boundaries here. One of our tasks here, I believe, in Beijing is not only to discuss the current status of our understanding and our ability to address questions of infectious diseases through the genomic revolution, but also to listen carefully to the next generation and to inspire them to continue on in this very complicated issue.

Why do I suggest that these issues cannot be solved in a relatively short space of time? Clearly history teaches that infectious diseases have dominated much of human concern. And, today is no less an example of that. Perhaps the acceleration, the complexity, the globalization of modern life has emphasized this beyond the imagination of most people in the room. We have seen infectious diseases occur many times. We have yet to, I believe, be comfortable with the ways in which we approach them, the ways in which we have attempted to contain them.

Genomics, the wonderful achievement of the genomics field, offers yet a new opportunity to bring to bear on these subjects some of the great talents of human beings across the international stage. A meeting like this one is an example of how we want to facilitate it.

But, there is yet another element of this meeting that I would like to point out to you or emphasize, and that is the presence of the governments. Mr. Shang and his colleagues represent the interests of the Chinese government. I have the privilege, with other colleagues in the room here, members of the Embassy here in Beijing, to represent the interests of the American government, the U.S. government. In many ways, scientists are being asked in the modern community to move continuously toward finding methods, procedures, engagements, that allow some of their achievements to be used, understood first by the public, and then used to the benefit of the public. Governments have the same type of pressure, only in the opposite direction.

I think we have responsibilities, as our stewardship demands of us, to look for opportunities to understand science and to facilitate ways in which they can be utilized for the public benefit. By recognizing the first two principles of the GDEST meeting, that is the international nature of it and the multiple generational nature of the problems, I think governments have an opportunity find ways both to understand what the opportunities are, and to find ways to facilitate their benefit for the public, for the international community.

Infectious diseases I think also is a particularly germane topic today, not only because of the nature of our immediate concerns with diseases such as have been mentioned, whether it is malaria, tuberculosis, whether it is avian influenza. But, because it represents a need for scientists to look in the long term, the virology, the genomics, the epidemiology required to attack these problems, require long periods of time and great talent. But, the message should also be clear to governments that we also have to look over the long term and define methods by which we can effectively address the questions that are not going to be solved in the short term. Long term engagements are important.

So, it is indeed a great pleasure to see such a room filled with so much talent and enthusiasm, and perhaps a few sleepy faces for those that have arrived a short time ago. But, I think the next three days will show us what the outcome of your enthusiasm, your skills, your commitment to these ideas are. I am very eager to listen and to learn, and I think along with Mr. Shang and his colleagues, we in the U.S. are eager to find method where we can fulfill our responsibilities as well to take advantage of your good work and perhaps as well to take advantage of the enthusiasm that will be available to us at the end of this meeting, not just at the beginning. So, I look forward very much to learning a lot, both as a scientist and as a member of the government, and I wish you all a very pleasant and productive meeting.

Thank you.

Moderator – Thank you Mr. Atkinson for your kind words. Now, let's give the floor to Ms. Cheng Donghong, Executive Secretary of China Association for Science and Technology.

**Cheng Donghong, Executive Secretary  
China Association for Science and Technology**

Good morning. Vice Minister Dr. Shang Yong, Science and Technology Advisor to the Secretary of the State, Dr. George Atkinson, Deputy Chief of Mission of the United States Embassy, Mr. David Sedney, distinguished guests, ladies and gentlemen, it is my great pleasure to be invited to the GDEST workshop and address at the opening ceremony.

On behalf of the China Association for Science and Technology, I sincerely hope that the workshop will be able to establish the connections and bring about more productive collaborations in a subject area between our two countries.

Since the mid-1970's, more than 30 new diseases have been emerged. After entering the new millennium, human health has been threatened by some severe infectious diseases like SARS and avian flu. It is even worse that the range of these emerging diseases expands much wider than ever before, partly due to the personal mobility brought about by globalization and partly due to the mobility of the diseases' agents. Therefore, defeating these emerging diseases necessitates international collaborated efforts.

Biotechnology, genomics and informatics offer a growing range of approaches to help prevent, monitor and detect diagnosis and treat infectious diseases. The public look to a bright future in fighting back infectious diseases with the advent of the genetics revolution. Improved diagnosis and better management are expected from genetic

research. However, scientists are still confronted with big challenges, both in their own research area, and in having access to international support and collaboration.

China Association for Science and Technology is a non-governmental, non-profit organization. It has 167 national institutional members, say learned societies, in the field of natural sciences, medicine and engineering. Among these members, nearly 60 are medicine and health-related learned societies which have been actively engaged in the basic research, prevention and treatment of some infectious diseases either through their members who are working in the universities, institutes and hospitals, or through holding academic conferences and publishing reports and proceedings. Whenever synergy is necessary, China Association for Science and Technology helps them to break through the barriers and provide opportunities for cross-field and trans-national exchanges and cooperation.

Biotechnology and genomics are such sensitive areas that any abuse of the technology is doomed to be disasters not only to the human being, but also to the whole world.

Therefore, there is a big challenge for governments to set up proper rules to regulate the related research and application. China Association for Science and Technology and its member societies taking an ambitious stand might contribute in providing consultation to the policymakers and facilitate informed decision-making.

We follow the principle that science and technology should be human-oriented and is to serve the welfare of human beings. What we expect to achieve is, as an OECD report states, that is “appropriate policies are necessary to ensure that the right tools reach the right people at the right time.”

The 2006 GDEST workshop has caused great attention from the medical science community in China. There are only a limited number of scientists who have the opportunity to participate. The related scientific bodies and learned societies want to take this chance to call for more favorable policy and environment that facilitate the exchange and collaborations between non-governmental scientific bodies of our two countries.

They also expect more participation and involvement in some of the joint projects sponsored by the two governmental agencies. The workshop is particularly welcomed by young scientists in the field. Thanks to the vision and the considerate thought of the sponsors and organizers, some young scientists are here and will have chances to have a dialogue with the prestigious scientists.

Furthermore, there is the concern that experts alone do not defeat communicable diseases. Public participation and involvement is equal important. Taking avian flu as an example, China has some 40 billion poultry, many of them saddled about in backyard farms in intimate contact with other livestock and people. That is a considerable challenge and to make public involvement a vital aspect to the prevention and the management of the diseases.

Some scientists argue that disease agents are all around us – they are part of the natural world. It is our behavior that creates the circumstances for them to move into human populations. If so, great efforts are needed to persuade people to change their behavior.

One of the missions of China Association for Science and Technology is to facilitate public understanding of science and initiate science in society programs aiming at facilitating the interaction between science and society. On one hand, we try to assist the science community in better communicating their research findings to the general public, and on the other hand, help the latter to better understanding and to cooperate with the science community.

One of the outstanding advantages of the public involvement is to ensure that the science community has improved access to publish opinion and suggestions and concern with the research work. This is valuable for stopping the science community going as . . . . from the vast interests of the society.

I believe the workshop has set a great example for enhancing the cooperation between scientists of different countries and regions in fighting against emerging infectious

diseases. Again, I wish the workshop to be successful and all the participants a joyful stay in Beijing.

Thank you.

Moderator – Thank you, Ms. Cheng. Ladies and gentlemen, may I ask you to join me in welcoming Mr. David Sedney, Deputy Chief of Mission of U.S. Embassy in China.

**David Sedney, Deputy Chief of Mission,  
U.S. Embassy in Beijing**

Thank you very much, Mr. . . . I would like to enthusiastically second the remarks of Vice Minister Shang, Executive Secretary Cheng and Dr. Atkinson. The fact that you are all here is something we take great pride in and is something that we in the U.S. government treasure and have worked hard to make possible. The U.S./China scientific relationship has been developing for over 28 years and it has made a lot of accomplishments. Because of the structure of the society here in China and because of our society, I think in scientific exchange with China, the U.S. government takes a greater role than it does almost anywhere else in the world. I think we are seeing the fruits of that now.

I had the pleasure last summer of opening the second and very expanded National Science Foundation Program that brings U.S. graduate students to China to work with people in their fields. I think all of you know about how many Chinese scientists go to the United States – how many Chinese students. We give tens of thousands of Visas to Chinese who go to study, many in the science and technology. Just for our Chinese audience, I would stress that we welcome Chinese students to come to the United States for education. Our Visa process is very easy. Over 80% of the Visas for students are approved today, and the percentage is going up. If anybody ever has a Visa problem, please be in touch with me. I'm saying that because I want to say that we welcome this kind of cooperation and I know that Visas are often a touchy issue for people and it is not touchy for me – it is something that is important. So, I want to assure our Chinese colleagues this is an area we want to move forward.

We also are very interested in moving forward with things such as this program, which is taking place here in China and bringing Americans here, and the young scientists program that I mentioned earlier, and many other things, because the pace and scope of development of science in China is something that is significant not just for China

(because it is very significant for China), but also for the rest of us in the United States and everywhere in the world. Cooperative efforts are going to be much more successful than individual efforts. We believe very strongly in that.

In the last year, at the U.S. Embassy, we have opened an office of the National Institutes of Health. We have opened an office of the National Science Foundation. And, we have opened an office of our Department of Energy which does the vast majority of what they do with scientific exchanges. That is a huge increase in the amount of resources that we are devoting to scientific exchange. We also have increased the staff from our Department of Health and Human Services and from our Centers for Disease Control. With the amount of money we spend funding research here in China, a lot of it collaborative research in the United States, continues to increase. The Department of Health and Human Services people told me before I came over they expect this year to fund about \$35 million in research programs here. The majority of that is in life sciences. The remarks that Vice Minister Shang made and Secretary General Cheng made about the importance of what you're discussing here today in the area of emerging infectious diseases is something we recognize and we are trying to provide the resources. But, in the end, the government's role is only as a facilitative one. We recognize that all of you – the Chinese scientists, American scientists – you're the ones who do the work and I'm not going to stand up here and talk for very much longer about what we're doing. But I do want to promise you as the representative for the Americans of your government and for the Chinese as the representative of the American government that we are committed to facilitating this type of cooperation. We take it very seriously. I can't say it any more eloquently than Dr. Atkinson did about the benefits of this kind of cooperation – so I won't try. But, I think what he said is something I hope all of you take away from this as a goal for us in having this kind of exchange. It can really be of great importance to all of our people.

I do, however, want to say what a great pleasure it is for me to be here to help open this. I want to pass on greetings from our Ambassador to China, Ambassador Sandy Rant who couldn't be here today – he is off with our Secretary of Commerce visiting China. But,

he places a high value on scientific exchanges as well and if he could have been here, he would have.

So, with that, I will close my welcome, give my enthusiastic congratulations to all of you for being here, whether you are jet-lagged and tired or fresh from your work in one of the Chinese institutes. It is really great to see so many of you here. One thing I know about science is scientists like to talk about science. They don't like to hear a lot from bureaucrats, so this bureaucrat is going to congratulate you and leave. Again, thank you very much.

Moderator – Thanks Mr. Sedney for your warm remarks, especially thanks for your promise regarding the Visa issue.

Next . . . give the audience the keynote speech delivered by Professor Liu Depei, President of the Chinese Academy of Medical Science and Vice President of Chinese Academy of Engineers.

### **Keynote Lecture**

#### **Liu Depei, President of CAMS and Vice President of CAE**

Distinguished guests, dear friends from the United States and China, good morning. First of all, sincere thanks to the organizing committee for . . . good opportunity to share the understanding of . . . developmental strategy in the program of science and technology and population . . .

The policies . . . development . . . run The population . . . fundamental guarantee. For . . . basic human rights, . . . progress, one of the . . .

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Moderator – Thank you, Professor Liu. Finally, now certainly but not certainly last, let us give a full round of applause to Mr. Paul Ahlquist, University of Wisconsin-Madison.

**Keynote Lecture**  
**Paul Ahlquist,**  
**University of Wisconsin-Madison**

Thank you very much. I'd like to join others in thanking our Chinese hosts for hosting this conference on such important topics. We are very happy to be here and to have the chance to interact with you.

I've been asked by the U.S. organizers to provide, by way of some background for the meeting, some brief comments overviewing some of the challenges and opportunities and future directions in the area of genomics and infectious disease. In conjunction with underlining the importance of addressing these topics, it is appropriate to consider the tremendous burdens that infectious diseases place on the world.

Early in the 20<sup>th</sup> century, a number of advances made many experts predict an early and complete conquest of infectious disease. Sadly, we know this is not true. This has not been achieved. In fact, today worldwide, infectious diseases still cause 1,500 deaths per hour. Before I finish these remarks, 500 additional people will have died from infectious disease. Over half of these will be children under five years in age.

Now, looking beyond China and the United States, infectious disease places a particularly severe burden on less developed countries. In these countries, infectious disease still

causes approximately half of all deaths, and the majority of deaths in children and in young adults.

Now, we are talking here about tens of millions of deaths per year. These are the leading causes. They include respiratory infections, including influenza and other causes of pneumonia, HIV/AIDS, diarrheal diseases including Rotavirus and other causes, tuberculosis, malaria, and measles. These diseases are very terrible in their toll. This slide, however, is encouraging from the standpoint that it points out how if we make good use of genomics and tools to understand and better control these diseases, actions on a relatively small number of diseases could have tremendous impact.

Now, in more developed countries such as China and the United States, the burden of infectious disease is less, but still severe. The U.S. experience has been that from 1900 to 1950, infectious disease deaths declined approximately ten-fold. But, after that point, progress largely stalled and infectious disease losses remained largely steady from about 1950 to 1980, and since that time, since about 1980, infectious disease rates have actually increased due to emerging and reemerging diseases. Now, HIV/AIDS has been a major component of this, but in fact, even if you factor out HIV/AIDS, there is still a clear general increasing trend.

So, emerging diseases like AIDS and SARS and influenza then, as other speakers have commented, are unfortunately a major factor in our public health situation today, and the prospects for such emerging diseases and their impact have only increased. The reasons for this are well-known and they include the expansion and urbanization of the world population and consequential to that, encroachment further on the environment leading to new interactions between people and animals which foster zoonoses – that is the transfer of diseases from animals to people, the major source of these emerging diseases.

Other factors that make such zoonoses particularly dangerous then include such things as globalization of trade and travel which have allowed diseases to travel across the world in a few days, drug resistance and rapid microbial variation that lead to reemergence of

disease and to our difficulties in our ability to control diseases, strained public health systems, climate shifts, and other factors.

So, emerging diseases, particularly emerging viruses then, are a continuing aspect of our situation with infectious diseases. Just in the last few decades, we have seen the emergence of a significant number of high mortality viruses with the potential for devastating epidemics. Just a partial listing includes HIV, SARS, H5N1 avian influenza and other influenza strains with pandemic potential, Ebola and Marburg hemorrhagic fevers, Nipah virus, and so on. This is not a single component problem, but a multi-dimensional problem involving viruses from many different families. We can be sure that we are going to continue to see additional emerging viruses in the coming years and decades ahead.

Now, when we think about infectious disease, we usually think in terms of acute infections such as influenza and SARS. But, in fact, there are substantial infectious components to chronic diseases, including the chronic diseases that are becoming of greatest importance in the most advanced countries such as cardiovascular disease, cancer, neurological disease, diabetes, and so forth.

A number of bacterial and viral and parasite agents have been either firmly established as contributors to these diseases or strongly implicated. The link is particularly strong in terms of viruses and cancer. So, although this is often not so well appreciated, in fact, it is now firmly established that viruses cause at least one in six to one in five of all human cancers, and are suspected to cause a greater number of cancers or suspected in additional cases.

Recent research makes it clear that in many, if not most of these cases, viral genes are required not only for the initial development of the tumor, but are also required for the continuing survival of tumor cells in the final malignant state, leading to the important point that if we can use our genomic opportunities and other tools to understand and

control these viruses better, to inhibit either the initial virus infection or viral functions, then we could prevent or potentially cure many cancers.

Now, such tumor viruses that are well established include the Hepatitis B and C viruses which together chronically infect about 8% of the world population, and together cause about 80% of all liver cancers, liver cancer being, in fact, the third leading cause of cancer death worldwide. So, these viruses pose a tremendous burden on human health. In addition, the human papilloma viruses cause essentially all cervical cancers, still a major cancer in women worldwide, and a substantial fraction of head and neck cancers, a significant cancer in all countries.

Two herpes viruses, Epstein Barr virus and Kaposi's sarcoma-associated herpes virus cause a number of lymphomas and carcinomas, and additionally, the retrovirus HTLV1 causes leukemia. So, in this meeting in further talks, we will hear more about at least Hepatitis B virus and Epstein Barr virus, and possibly some others as well.

From the standpoint of genomics analysis, genomics analysis of these infectious disease problems must include analysis both of the pathogen and the human host, and of course, their interactions in disease and in resistance. Additionally, many pathogens, of course, persist in animal reservoirs that have to be considered, and many pathogens further are transmitted to human hosts through vectors or intermediate hosts. So, in terms of the genomic analysis of such systems, this must include at least analysis of pathogen virulence and control, host resistance and susceptibility vector efficiency, the genetic variabilities of all of these organisms as well as their population dynamics and so forth and so on.

In this meeting we will see this played out in terms of talks on the impact and insights of genomics for epidemiology and surveillance, diagnosis and prognosis of these disease, functional studies of infection and transmission pathology, susceptibility and resistance and so on, and discussions of protective strategies and therapeutics, including both vaccine development and drug development.

In terms of future directions and needs in these areas, we will shortly have discussion of some of the continuing advances in sequencing technologies that are greatly increasing the speed of DNA sequencing and promising reduced costs in these processes, offering us substantially increased access to the characterization of more genomes and characterizing more individual variation in pathogen populations and in human populations as well.

I would like to emphasize that in parallel with this, we also need to invest further not just in increasing the capacity of other genomics tools like microarrays, but also in reducing their costs in order to overcome barriers that currently seriously limit the application of these tools in many experimental designs and clinical applications.

One of the reasons that making such technologies more inexpensive and more accessible is important is that the field appears to be poised for significant advances in a number of areas where we already have a substantial foundation of knowledge, but where incremental additions are likely to provide quantum leaps by providing us with a critical mass of data that is sufficient to reveal the crucial connections and mechanisms underlying the processes we're trying to study. This is very much a situation of getting the last pieces of the puzzle out so that we can see the connections and resolve the underlying questions.

Some of the kinds of data that seem particularly likely to produce such quantum leaps would be further accumulation of physical interaction data, functional networks, comparative analyses and synergistic combinations of different genomics approaches.

Another major factor in all genomics-based efforts is data analysis and, in fact, effective analysis by a statistical and bioinformatic analysis of the large data sets that are produced in genomic experiments is very often a limiting factor for progress in our understanding. It is also true that, in fact, communication between biologists and biostatisticians unfortunately is often poor.

So, there are major opportunities in these areas then to improve our progress by improving and deepening and extending this interface between biology and biostatistics and bioinformatics. This includes investing additional effort in advancing biostatistics and bioinformatics by algorithms and so forth. I believe others may have comments on this. This includes as well investing in cross-training between biologists and biostatisticians to improve their interaction, both for the training of new students and for empowering existing researchers on both sides.

So, finally then, another important aspect of future directions in this field include the issue of international cooperation, as others have said. So, the ability of pathogens and diseases to spread rapidly and globally means that the health and well-being of all of our populations across the world are increasingly closely connected and that today, as well as national strategies, effective control of infectious diseases requires also international strategies both to allow effective global surveillance of critical pathogens, early identification and control of potentially world-threatening outbreaks, and international support of similar efforts in less developed countries that lack the resources to perform these important functions on their own.

This conference is an important, encouraging indication of such international cooperation and we are very certain that we'll see in these days the establishment of many connections in and beyond the topics that we discuss directly.

Thank you very much.

Moderator – Mr. Ahlquist, thank you very much for your remarkable speech and your . . . in science in the world.

Let's give our speakers Mr. Liu Depei and Mr. Ahlquist a round of applause again.

Ladies and gentlemen, thanks again for joining us at the opening ceremony. Before we proceed to the final session, we will have ten minutes tea and coffee break. Please help yourself to some refreshments in the foyer outside the hall. Thank you.