

Closing Ceremony

Welcome and Introduction

Gao Fu, Institute of Microbiology, Chinese Academy of Sciences

Good morning everybody. After a long two-days discussion and dialogue, we are approaching for our closing ceremony. I say close approaching because after this closing ceremony, we will have our young generation -- we will have our young scientists panel discussion. So, I'm asked to chair this closing ceremony. I should first thank all of you, the audience, for coming here for this closing ceremony. Also, I would like to introduce my colleagues sitting in the front here -- Mr. Ma Yanhe. He is Acting Director-General, Department of Social Development, Ministry of Science and Technology, People's Republic of China. Mr. George Atkinson is the Science and Technology Advisor to the Secretary of State, U.S. Department of State, USA. Also, Dr. Ann Reid from the U.S. National Academy of Sciences.

So, I myself, Gao Fu, we are very pleased to have these three days dialogue between the Chinese and the American scientists.

Based on our program, Ann Reid and me, we are going to have this summing up, and then we will have the concluding remarks from both of our bosses here.

So, this is the summing up that Ann and I prepared yesterday. I hope we will cover everything we have discussed in the workshop. So, this summing up will be divided into two parts. I'm going to be the first part, try to include something we discussed of importance during the workshop. Then Ann will come on to say something about our future initiative and future plan for the collaboration.

I will start and give the background -- why we are here today. Because we are facing the 21st century that is emerging and re-emerging infectious diseases, I think you are the . . . from our . . . speakers Dr. . . . and also Dr. Paul Ahlquist, discuss something about the numbers problem we

have encountered because for the emerging and re-emerging of infectious diseases. So, obviously we are living in a changing world. The world is changing because we already entered into the 21st century and also from the disease point of view, we have the emerging diseases. So, what will we do, Ann? We need some reactions to changes. So, that is how we are reacting. We don't want to be an ostrich – we don't. The American scientists and the Chinese scientists want to be we want to do something We are asking the questions, and also we won't get the answers. Why I put a clock there? Because we want to do something timely. This is why we get here. We know we have a problem with the emerging and re-emerging diseases, so this is why we come here.

So, I just want to quote the Inaugural Address from Bill Clinton. . . . powerful forces are shaky and . . . our world. The urgent question of our time is whether we can make change our friend and not our enemy. So, obviously we want to change something for the emerging and re-emerging diseases. So, . . . is our enemy. So, we want to change them.

I also wrote to remind you -- . . . is a double-edged sword. My . . . can do something good once. So, I hope you turn some wine or yogurt . . .

So, that is the reactions of change. So, we got together our American and Chinese scientists. You see, we have all these pictures that are reminding you we are here and we got together. Then that is our . . . genomics and positives. I borrowed this one from Harry Young. What can we do? We can either So, the secret of life is at the As the same as any other forms of life, positives is a kind of form of life. So, we are products of the DNA gene. So what can the DNA tell us?

The DNA . . . DNA like a sequence and also like a copied from Terry Young's slide. I just remind you he give you a talk. So, also remind you the positives we discussed – avian flu, staphylococcus suis, HIV, and all the other viruses and bacteria. They are alive and they are We did something. . . . we traced down where the SARS corona virus come from, at least a SARS-corona like virus. But the closest relative from SARS is from bat or So, we

traced down the origin of the SARS-corona virus by using genomics. Genomics does make the revolution for our research in the positive.

. . . . H5N1, as you know, started from Southeast Asia, including China, and then we know what happened in . . . Lake. . . . bareheaded goose. We know now this virus is already in Europe and in Nigeria, Africa. We know the sequences are so similar, almost the same, so . . . mutations. So, that results is that genomics did help us to trace down where the virus might fly to.

So, now we come to see what we have learned from this workshop. I'm sorry Genomics, I want to say, has revolutionized and is revolutionizing our understanding of the Those are two examples that already tells you, and also you learn something from these workshops. Also, interrelationships among the . . . and the hosts and the environment we discussed a lot about the interrelationships. So, that is the place – the human beings, the scientists can try to get . . and interrupt. They stay to make a difference. So, that is what we know from this discussion.

So, I just want to summarize this workshop into a very big banquet. So, first, we have very good appetizers from our two keynote speakers – Professor talking something about population health in China. I hope you will remember that. From our American colleagues, Professor Paul Ahlquist and he mentions something about enormous burdens or threats of infectious disease, and . . . genomics and international cooperation. That is our Genomics and international collaboration, especially between the Chinese and American scientists . . .

Then we have the first course – on surveillance and detection. We have four speakers, Maria Penaranda talking about a good model for the developing countries – where the EIDS are still in epidemic. So we, in China, can learn something from her model.

Then we have Dr. Yang Ruifu talking about microarray for treating the . . . pestis.

Then Charles Chiu, using his viral chip to detect viral, especially for the discovery of a new virus in human, he mentioned something about the new . . . virus found in prostate cancer materials.

Then we have Biao Kan talking about . . . China. I think that is a very good start – to leave China . . . whole world for the infectious disease research. So, we followed the American’s legacy. We also set up our post-net . . .

Then our second course is predicting pathogenesis and adaptations to humans. We had Eric Eisenstadt talking about . . . and also Yang Huanming talking about pathogen-related genomics in the PGI – with the Beijing Genomics Institute under the Chinese Academy of Sciences where also . . . is a member. Also, we have Professor Gary Anderson, talking about the bio microarray and micro . . .

We have professor . . . talking about HbV – especially he talked about how genomics helped him to do some work for the HbV in China. Also, he talked about the signal . . .

Then we had the next course is diagnostics – U.S. and China perspective.

We have Dr. Stephen Popper talking about microarray host . . . blood test, and so on. Also, we have Dr. Wu Wenhan talking about . . . infection and also avian flu. Then we have Dr. Patrick Murray talking about genomics and the clinical diagnosis. Then me, myself, I gave some updates about two outbreaks in China in 2005.

Next course is vaccine development. I missed that one, but I hope I just outline the right . . . Professor . . . gave an overview of vaccine development in China, especially the . . . that is his own research field. Also, . . . talking about the reverse genetics and the vaccine development, especially the Sendai virus . . . Then we have Professor Youchun talking about HIV vaccine, especially talking something about preventive or therapeutic vaccines for HIV and some other . . . Then we have Professor Arnold Monto talking about origin of the . . . virus.

Then our next course is drug discovery. That is very important stuff so that we will have a new drug to help us to tackle any . . . So, 454 Life Sciences helps life. The sequence is the life. Digital is the life. So, life is getting easier because of 454. I hope everybody understands that.

Then we have Professor Wang Junzhi talking about vaccine and drug development in China. Then Professor Paul Ahlquist after his keynote speak, also talking about host and pathogens and useful use of the genomics. Then we have Jiang Hualiang talking about genomic guided drug discovery, especially his beautiful work on SARS corona virus as a good example.

Then we came to a new course, case studies: prevention and treatment. We have Professor Willard talking about HbV, especially the relationship between the genotypes and the disease. Then we have Professor Steve O'Brien talking about the new study with the new corona virus . . . and then HIV, and also address a lot of the host genetics. Again, host is the major factor and will play a major role for our . . . for the disease. And also, Dr. Li Taisheng talking about HIV treatment in China after one year's cocktail treatment.

Then we have Dr. Lance Gable talking about preparedness of a potential influenza epidemic, especially he talked something about beyond the science. Again, as all scientists, we are happy to know something about all these preparedness, not only the scientists, but also the social science, laws, . . . and a lot of stuff need to be involved if we have pandemic.

Then, though we are standing here to do the summing up, I think the dialogue does not end – it is just starting. I call this one the desert. So, after the appetizer, main courses, and we will have a desert. It is a very beautiful desert. It is a young scientist dialogue. That will be looking toward the future of the genomics revolution. So, we will have Professor Gu Jiang chair this. So the legacy is being continued by a new generation.

Let's work together to tackle the emerging or re-emerging infectious diseases. We will be the winner – either we . . . or that frog or bird will be the winner. So, don't give up. We will win this war against infectious disease. But, remember – we need to work together -- the Chinese scientists and American scientists.

Now, where are we going and what are we going to do? The legacy will be continued and it is your turn, Ann. Thank you.

Ann Reid, The U.S. National Academy of Sciences

Joint Initiative – Program Summary and the Future of Genomics and Infectious Diseases

Thank you, Gao. I want to just back-track a little bit and talk about the objectives of the GDEST program, Global Dialogues in Emerging Science and Technology. This is the third meeting under this program which is sponsored by the Department of State. There was one in Japan and one in Germany. The goal is to understand the new areas of science that are emerging all over the world and to provide American scientists the opportunity to meet with scientists in other countries to form relationships for American scientists to get out of America and meet people all over the world. In this meeting, the idea to form new collaborations with their colleagues in China and learn what is going on here, and to get across what is going on in America.

So, the goals for this meeting were to provide an opportunity for American and Chinese scientists to meet with each other, to learn from each other, and for American scientists to meet young Chinese, future leaders in science and learn from them, and let them know what is going on in the U.S., and to identify common interests between the current generation of scientists and the future generation of scientists in both countries. I think it is easy to see that all of these goals have been amply met in these two days.

Why emerging infectious diseases is a topic for this conference – I think that is very clear after these last two days. Not only are diseases that have been with mankind for thousands of years still causing death and suffering, but new diseases continue to emerge. There are some examples here of diseases that have emerged in the last 20 years, and we know there will be more in the future. Even we learned during these two days that many diseases that we never considered infectious in fact do have a microbial component and so understanding of the microbial world is

going to be very important not only for what we traditionally consider to be infectious diseases, but for many chronic diseases as well.

So, what are the challenges that we face? We know the challenge is global. Infectious diseases don't care about national boundaries. It is a challenge that is going to be long-term. Maybe in the 1950's we thought that infectious disease would be conquered by now, but clearly it isn't. It is not going to be taken care of by our generation, but the next generation of scientists is still going to face many questions. And, it is shared challenge. Scientists have to work together across national borders to solve these massive challenges.

Why genomics? Well, we know from the last two days the many ways that genomic information can help us with the challenge of infectious diseases, from the detection of them, the monitoring of them, from predicting their pathogenicity and whether they are going to be able to adapt to humans, to making accurate diagnoses, to predicting how people will respond to treatment, and to tailoring treatment to the individuals' genetic background, to developing new and more effective vaccines and other kinds of therapeutics.

So, what have we learned from each other in these two days? Certainly, we have all learned that life is digital, and it is very important for international cooperation because genomic information is extremely easy to work with across national borders, perhaps one of the easiest kinds of science to share over long distances. Researchers all over the world can work with the same data, can access the same databanks, and can make progress together. There is not even a language barrier because ACTG is the same in every language.

So, what do we hope to do in the future? We hope that out of this workshop we will have created opportunities for dialogue between Chinese and the U.S. researchers. We hope there will be more global conferences, that there will be other kinds of cooperative programs, and that students can go back and forth between the U.S. and China and learn from each other and from each other's mentors.

We hope there will be collaborative projects between American and Chinese scientists that grow out of the opportunity to meet each other this week, and we hope there will be more and better communication, better ability to share each other's data, and to make sure that new techniques and new technologies are quickly shared among scientists around the world. And, we hope especially that more, bright young scientists will be inspired by this meeting to go into genomics as a career because it is boundless in the possibilities of new discoveries.

We've learned that U.S. and Chinese researchers have a great deal in common. We are passionately committed to using genomics to lift the burden of infectious disease. Everyone here is dedicated to using the very best science and to use the very highest scientific standards to meet these challenges. I think you would all join me in agreeing that we hope we will all meet again very soon.

So, I will go back to Gao's last slide. We need to work together to tackle infectious diseases to be the duck and not the frog, and we need to work together.

Thank you very much for your attention.

Moderator - Thank you. So, now we move on to our next program. I'm very pleased to invite Dr. Ma Yanhe, the Acting Director-General, Department of Social Development, Ministry of Science and Technology of the People's Republic of China to make the concluding remarks.

**Ma Yanhe, Acting Director-General, Department of Social Development
Ministry of Science and Technology**

Concluding Remarks

Distinguished guests, ladies and gentlemen, over the past two days over Chinese and U.S. . . . convened in the China/U.S. dialogue on emerging science and technology and its . . . to combat infectious disease with . . . genomics technology. Thanks to the concerted effort of the Ministry of Science and Technology of China and to the U.S. National Academies, this workshop is grown to a successful conclusion. On behalf of MOST, I would like to extend my congratulations to the success of the workshop. This workshop . . . great meeting of Chinese and U.S. colleagues . . .

. . . infectious diseases is also a successful attempt for promoting changes and understanding and cooperation in the scientific and medical . . . as well as the government of both countries.

In the course of the workshop, . . . covering six areas: disease, the virus and detection, genesis and the ability to adapt to humans, diagnostics in development and the assistance, and infectious disease case studies in . . . form of discussion. . . and the dialogue were held on the . . . development and the successful experience of both China and the U.S. in . . . emerging technologies to the fight against infectious diseases.

A consensus has been reached on the fundamental . . . of the genomics technology in the fight and the possibility as . . . for more extensive China/U.S. cooperation in the field.

In recent years, China/U.S. scientific cooperation has witnessed steady growth. We have a China/U.S. Joint Commission for Science Technology Cooperation. This . . . cooperation has been entered into between the two countries in areas of common interest, such as public health and the environment, . . . research, and industrial technology. We have benefited from the

progress of science and technology not only in our two countries, but also elsewhere across the globe.

In the outline of national medium and long-term science and technology development . . . recently promulgated by the Chinese government, cooperation, public health, and the public's . . . has been . . . key area of social economic development, but . . . such issues as . . . early warning, diagnosis and the prevention and control of the emerging infectious disease.

During the workshop, the U.S./China scientists . . . for further exchange with their Chinese counterparts. I sincerely hope that both Chinese and U.S. scientists will take this opportunity to exchange . . . of communication and cooperation, learn from and complement each other, and make joint efforts to build up the capability of mankind to combat infectious disease.

Before I conclude, I'd like to express on behalf of the Chinese side, gratitude to all those who have done the marvelous job in the success of the workshop. In particular, I would like to pay tribute to the staff of the organizer committee. Thank you for your dedication.

Finally, all my best wishes to each and every person . . . cooperation.

Thank you.

Moderator – Thank you, Mr. Ma. So now, welcome Mr. George Atkinson, the Science and Technology Advisor to the Secretary of State, U.S. Department of State, to make concluding remarks.

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

Concluding Remarks

Following such eloquent and complete remarks is somewhat difficult. I would like to thank Dr. Ma and George and Ann for their wonderful way of summing it up. I like the Chinese cuisine approach that was used.

So, like most Americans, we always like to look for desert and so I'll keep my remarks very brief so we can have as much time as possible to listen to the students.

A number of things did occur to me during the two days that I thought I would share briefly with you. First, it is quite clear that China has become a full partner in the genomic revolution and its contributions to infectious diseases – that is the solution to infectious diseases. For that, we stand in recognition of appreciation to the Chinese scientific community for all of their achievements to date, and we are very pleased and honored to join, on the scientific level, to attack many of these problems which I would consider some of the great issues of our time.

I would also like to note again that not only is the scientific community here, but the Chinese government and the United States government are here in the form of people listening and hopefully learning from what avenues we might carry the message of this meeting forward.

To draw for a moment on the issue of infectious diseases, clearly this community understands quite well that these are not only emerging science issues, but reemerging which suggests there are lessons to be learned and perhaps unfortunately re-learned from a field like infectious diseases.

Meetings such as the global dialogues are methodologies or avenues by which we might consider how to not have to re-learn them again. So, the importance of having both science partners such

as the Chinese and American communities, plus governments present in one meeting, can be critical to addressing the question of not re-learning these issues over and over again.

We also understand quite clearly that it is not too just influenza, but it is cancer potentially. It would be difficult to convince most modern scientists that the molecular basis of understanding is not the fundamental first step. So, there is every reason to believe that the genomics that underlies our molecular understanding of this field is not also critical to understanding some of the critically major health issues of our societies.

Perhaps one of the most difficult things for governments to do, I've learned, moving somewhat slightly beyond being a citizen, is to understand how to take that degree of appreciation and turn it into action. I suggest and have suggested for a long time that meetings such as this one give us the answer that in modern society, science and technology is indeed the avenue to success. So, understanding the science opportunities, perhaps appreciating what potential risks might be involved, and certainly defining the uncertainty of those issues are really the responsibilities of governments around the world.

But, there is a responsibility of scientists as well, and these meetings begin to address that point. Scientists need to be better at explaining why they do what they do, and how they do what they do to the public, and that includes governments.

We certainly enjoy the benefits in a society of receiving resources, funding grants, the attention of talented students who spend time in our laboratories for much of their creative early years. These are tremendous benefits that most scientists enjoy. But, we also have to recognize that the public doesn't necessarily understand that, and certainly many governments don't understand it as well. The fact that science is not the source of just unmitigated miracles, but is the result of enormous hard work by devoted people over very long periods of time, I think is something we should all consider another product of this meeting.

What are the characteristics of that understanding? I would suggest three to you. I think they are embodied, as mentioned here earlier, in the global dialogues on emerging science and technology.

First is consistency. We have seen in the last decades movement from one principle investigator laboratory work, that is focused in one laboratory that one group of people, to multiple laboratories, to multiple generational research, to a greater emphasis on international research. Why? Well, the problems we face in a field like this one of infectious diseases are extremely complex and so we see a convergence of physicists talking to biologists, biologists talking to public servants, and so forth. We have made great progress in that sense. The problems demand that we do so. But, perhaps we also have to recognize that in this type of field, in this type of global community, we need to renew this particular commitment, to move from the results and the activities of laboratories to public understanding to practical applications. That requires multiple generations, as we will see in a moment. It is absolutely true that most scientists, and I certainly would say this of myself, have always learned much more from their students perhaps than we have ever taught our students. Our students always teach us. We don't like to admit that, but the fact is that students teach us a great deal.

The second point I would say is the obvious issue of having a room filled with Chinese and American scientists that is international. The movement from laboratory to institute to global communication has been facilitated by many aspects of the modern world, but I'm not sure we have taken full advantage of it. That is a lesson I think we should carry away as well. These complex problems will involve certainly cooperation among as many smart people as we can find.

The last one perhaps I would mention is the issue associated with the word "dialogue". We have moved from only written communication, which has been a staple in scientific communities for decade and centuries (we read each other's papers), to meetings, which in more recent decades has been *modus operandi* – a way of communicating – meetings like this one. I suspect that we learn more from the face-to-face meetings than we do from the papers. In fact, we learn a great deal about not only what has been concluded on the positive side, but perhaps the uncertainties

of what we have concluded – where the boundaries are, where the frontiers of our thinking lie. That is why getting together and flying from one part of the world to another to meet for even two or three days I think is a critical component. I would like to suggest that all of us – scientists and governments – have a biding responsibility to make that happen more and more and more often. There is absolutely no reason, given modern communications systems, by even given the fact that some of us live on airplanes, that we should not be seeing each other on a routine basis. It should not be the exception, but should be the rule. In that spirit, I think the global dialogues program was intended from the very outset, from the vision, to stimulate as many contacts as possible.

So, in government I've learned it is often most important to quote other people if you want to get a point. That way you can blame previous people for what they have said. If you choose people who are long dead, it is even better. So, I'd like to leave you at the end of these remarks with two that I really enjoy and I've used them often. So, for those in the audience who have heard me use them before, please forgive me.

There is a famous Chinese scholar, whose name is Winston Churchill. Churchill was a man of many cultures and certainly was well known in China. And, on a recent visit to Churchill College of Cambridge, I asked the man who was the archivist – the man in charge of the library system there, whether this quote was true, and he said yes it was. So, I confirm to you that this really was something Churchill said. He said, "The public does not have any interest in knowledge. It only has interest in certainty."

That is another way of saying that nobody wants to see your data. They want the conclusions. I think that is something to take away from this meeting. This community has shown its beautiful, eloquent, stunningly interesting data. We appreciate that as practitioners in the field. But, in my admonition to you to find ways of communicating to the public, please don't do that. No one will talk to you on airplanes if you tell them your data. They simply will not speak to you. On the other hand, if you tell them your conclusions, if you tell them why it matters to them, they are extremely interested. They are interested in the solutions to problems.

That is a bit unfortunate for scientists because we work very hard to produce the data. We have great standards. We set very high standards for ourselves. But, in fact, at the end of the conversation, that is probably not the way to convince people that your conclusions are valid.

The public still holds scientists in very high esteem. If you look at what people think of various parts of the professional careers, scientists and professors still occupy extremely high reputations. Therefore, they believe you are smart – they just want to know what you think.

The last point is another quote from a Frenchman, Voltaire, long dead – fortunately for me so that I won't get in trouble for this one either. Voltaire is said to have observed that we in the human race are much more responsible for what we decide not to do than for what we decide to do.

To avoid these tough problems is really not acceptable. You and the community of scholars here representing genomics and infectious diseases, have chosen your professional goals within the context of this field. You have chosen to work hard, to commit yourself over long periods of time. Those in the back of the audience unfortunately should be in the front of the audience. Those younger people who are making those decisions, you also have to make that decision – are you committed to an area like this one or to another area? Perhaps it is another part of science. Perhaps it is another part of societal commitments in the law or business or whatever. But, Voltaire's point I think should be well remembered – you need to make some commitment because it is really unforgivable to go through this life without some commitment to one of these fields. I would suggest strongly to all of the younger people in the back, from whom we are about to hear, making a decision that this is just a beautiful field which has tremendous impact on human health and human well-being.

So, I would also like to end by thanking all the people who have put the meeting together. It is enormously inspiring and pleasant to be here, and I could not look more forward to what George has called desert. So, thank you.

Moderator – Thank you, Mr. Atkinson. Now, it is time to close our closing ceremony. I just transfer my chair-ship to the next desert. So, I'm going to say something. I believe – I will repeat what I said for the first day -- globalization and the interdependency call us to work together. I think that must be the conclusion. Also, I want to see genomics from our workshop. Genomics is a niche for us to work together so that is our common conclusion. Also, I believe the global dialogue of the emerging science and technology, that program provided us with a platform to work together. So, let's work together to tackle, to work together for the war on the infectious diseases. I believe this is the war. It will be a long-term war. So, we need a new generation to join us for the long-term.

So, I'm closing this closing ceremony and then we will move on to the next program. It is called Young Scientist Dialogue. So, before that, we will have coffee. So, coffee and tea break. Thank you.

Young Scientist Dialogue: Looking Toward the Future of the Genomics Revolution

Moderator: Gu Jiang, School of Basic Medical Sciences, Peking University

We want to get started very soon, so please take a seat. I would like to ask the panelists to come to the stage so we have more time for discussions.

I think we can get started now. We have finished the cuisine, and now we start the desert. So, this comes to the interesting part of our dialogue. This part was initiated by the American delegates so we invited a lot of students, mainly from Beijing University and some undergraduate and a lot of graduate students. They have been looking forward to this day, and they are quite excited about this event.

We have distinguished panelists sitting on the stage, so we have arranged for five speakers from Beijing University. They are all young scientists, or relatively young scientists ranging from Professor to student. So, they are each going to have about 10 minutes to give presentations of their research.

I want to tell you that in our school, we have quite a few . . . medical students and quite a few hundred graduate students. So, these are just random samples of those relatively young scientists.

I would like to start by engaging some time to the American delegates, for each of you to say a few words and briefly introduce yourself. Then, I will ask Dr. Atkinson and Dr. Ahlquist to say a few words in particular. So, we want to get acquainted first and for the students to know you. Let's get started.

Speaker – It has been a great pleasure to be here first of all. It's also been very rewarding for me as a genomic scientist, whatever that happens to be, to see the revolution that genomics brought to the field of medical science and basic science, and now to watch it emerge again. I'm fortunate enough to be able to be able to ride that wave one more time where new technologies

are coming about. So, I look forward to hearing more about what the challenges are that are going to face us over the next few years, next decade, and how genomics can be directly applied to that.

When we started out to sequence the human genome and the other model organism genomes as we came along, there was not a direct purpose in the short-term – that six months to one year timeframe. It was a global purpose. We knew the data would be important. Now, I think we are looking at a situation where we can define goals, actionable items that we can set out for six months, one year, 18 months, two years, and apply these technologies to them to solve very critical problems. So, that is one of the things I look forward to over these coming months and years is how we can solve these problems directly and quickly.

Speaker – I'm an infectious disease epidemiologist at the University of Michigan. I do have a laboratory which is kind of unusual for an epidemiologist these days. It used to be that being an epidemiologist, as least for infectious disease epidemiologists, they had their own laboratory because they felt they couldn't rely on service laboratories to carry out the kinds of activities that were necessary.

Right now with the genomic revolution, I think we are more and more dependent on good laboratories to supply us with information which we can use in epidemiologic analyses. For this reason, I believe we heard the communication between the applied scientists (and I put myself in the category of an applied scientist, even though sometimes in the medical schools since I don't see patients, I'm considered a very basic scientist), but as an applied scientist, I think it is very important to keep channels of communication open, and for those people who are doing the basic sciences, who are working with the genome sequences, to realize the questions they are trying to answer with what they do, unless you keep focused on these questions, unless you relate to people who can formulate these questions or who know what is important, your work will not get the prominence it deserves. So, it is very important to keep these channels of communication open not at the very end, but at the very beginning – before you start your work – to know what it is that you're trying to look at.

For example, with avian influenza, and I've worked with influenza when it wasn't fashionable and now it is fashionable. With aviation influenza, what is the purpose of showing all the sequences, all the clades of avian influenza, all the diversity? Is it to be able to track this epidemiologically so you can see where it comes from? Yes, that is one of the answers. But, it may also be an answer to try to show cross-immunity because if we are going to develop a vaccine, will one vaccine work against all of the different kinds of avian influenza? We don't know. We don't know what differences are significant in terms of any kind of vaccine we will develop.

So, I urge you, as you get deeper into genomics, to see the importance of what you're doing at the start and to frame your questions around issues which are of medical and public health importance.

Thank you.

Speaker – I also want to express my thanks to all of you. It has been a real pleasure being here. I think what I'd like to do is share an anecdote from my graduate student days which began, it seems, several centuries ago, certainly in terms of where biology was and where technology was at that time.

I was a graduate student starting some 15-16 years after the discovery of the structure of DNA. So, that puts me back into the late 60's, and a very prominent molecular biologist from the University of California at Berkeley by the name of Gunther Stent, published a book called The Golden Age of Biology. When one is in his or her golden years, that conveys the notion that you're at the end of your life – you're in the sunset of your life – the autumn of your life. Dr. Stent was writing about the fact that in just a short 15 years, biology had reached a pinnacle and it had come mostly to an end. We knew the structure of the genetic material. We knew something about the rules governing gene expression and so on. We couldn't do sequencing. Restriction endonucleosidase as a tool hadn't been developed. Nevertheless, he was declaring biology is over and all we need to do is now figure out how the brain works and a little bit about how development works, and that was all that remained to be done.

Why am I telling you this? I'm addressing the young people of the audience primarily. Never believe that the development of technology has come to an end and that tools that you have in your hands now are the only tools you'll ever get to work with and apply to whatever area of science you've become interested. Progress never ends, especially in science. New technology, by definition, cannot be predicted. It's got to be created and the creation of the new technology will come from your generation, not from the generation of people who are up here. It is one of the major reasons why we invest in you, not only financial investment in terms of training you, but we personally invest in you. We want to teach you. We want to work with you. And, we want you to grow and prosper and change the world in positive ways. So, never forget that. Don't respect us too much. Never be afraid to challenge us. I think I'll stop there.

Moderator – Could you identify yourself for the students?

Eisenstadt – I'm Eric Eisenstadt from the Institute of Genomic Research. They say I'm the Vice President for Research at TIGR. I've been there for seven months, and I'm still trying to figure out what that actually means.

Willard – I'm Hunt Willard from Duke University and the Institute for Genome Sciences and Policy there. I'd like to continue a bit on the point that Eric just made. To me, we have spent the better part of the last two days talking about the genomics revolution as a scientific revolution. I tend to look at it just as much as a revolution in training, and the way one would approach your training as young scientists. I was trained originally as a human geneticist back in the 1970's, and trained fairly narrowly. The genomics revolution is the second revolution that people of my age have encountered. The first one was recombinant DNA. My own students are incredulous to think there was a day when there wasn't clone DNA and there wasn't sequence DNA, and that one defined a gene by purely genetic means rather than by physical means. So, that was the first major revolution in training and in science during my scientific lifetime.

The current genomics revolution, from a training standpoint, I think really points to the increasing need for interdisciplinary learning. I don't train students in human genetics anymore

– even the ones who are absolutely convinced they want to spend their careers in human genetics are trained in genetics, in genomics, in computational biology, on issues of health and science policy. The Institute that I head up, with its doctoral and post-doctoral programs, all focus on both science and policy because if we have learned anything, especially in the last two days, this isn't just about science anymore. This is science as it is applied to life in general and to society and many different societies all over the globe. The students who will have the greatest impact as they become the next generation of scientists will be the ones who are not only terrific in their science, but who have a sense of how that reflects off of the world's conditions and can identify very quickly what the likely implications are . . .

(Tape 15)

. . . health or in science more broadly, and in a whole range of social issues that increasingly lie before us.

So, I think for anyone who is contemplating training in this day and age, we've commented repeatedly on the digital nature of genomics information, and that cries out for the need to understand computational biology and bioinformatics, and to both develop and use those tools in order to help all of us understand exactly the nature of genetic and genomic information, and epidemiological data that will come along to help us solve some of the largest problems that we have.

So, I would urge you to be as broad as you can in your training. It requires quite a bit of flexibility, especially during the early years of training, you do need to focus on the problem at hand, and pay attention to the particular issues, experiments that need to be finished for your doctoral work or your post-graduate work. But, at the same time, one needs to be very broad and interdisciplinary about the nature of the approaches that might be relevant because you can't predict what approach is going to be responsible for the next break-through, whether that be in the life sciences, the computational sciences, the physical sciences. All of those, at some point, have to come together and it is teams of scientists who can learn how to speak a common language and common understanding in science, not to mention in our own languages that we

speaking as individuals, but the languages of science that will somehow allow us to tie together those very different disciplines to together make an impact.

Atkinson - My name is George Atkinson and I'm a Science and Technology Advisor to the Secretary of State of the United States, Condoleezza Rice. I've already said quite a bit this morning. I would only add a sentence or two, and reinforce these earlier comments by saying that one of the great things in science is it is always the unexpected result that makes it perhaps the most interesting. So, whether it is training in the other directions of why you do your science, these are the things that really make it exciting when the thing you didn't expect to have happen. So, you have to be prepared for those things. I'll pass it on.

Gable – My name is Lance Gable. I am a Senior Fellow at the Center for Law and the Public's Health at Georgetown University. For me, this has been a truly amazing experience, not only to have the opportunity to come to Beijing (it is my first visit here and everyone has been very wonderful), but it has also been a great experience because I am not a scientist by training. I'm an attorney and I work on issues of law and policy that are very much related and important to ensuring that scientific discovery makes it into application. It is truly wonderful to have the opportunity to see so much great work being done by the scientists who participated, and I'm very much looking forward to hearing from the students and some of the ideas that you all have for future developments in these fields.

I guess my other point that I want to add is kind of expanding on Dr. Willard's point which highlights the interdisciplinary opportunities that exist and that are very vital to the success of science that you all will be doing throughout your careers. Just as it is important to combine all of the different fields of genetics, genomics, and other areas of science and to do good work in each of these areas, and to try to see where they overlap and where they relate to each other, it is also very important to think about how the scientific work can be joined together with law and policy. As an attorney and someone who studies law and studies health policy, I think there is very often a large gap between the scientific community and the community of policymakers and of lawyers who are trying to either implement that policy or come up with the rules that govern that policy. I think lawyers need to learn much more about science. I know for certain that most lawyers do

not have much understanding of science and I think very often it goes the other way as well – scientists don't think about some of the legal and policy issues that may have implications for their work. So, I would encourage all of you to think very broadly about how some of the related fields of law and policy may affect your work and may actually allow you to advance your work further than just by staying within the scientific community.

So, I want to thank everyone again and I look forward to your presentations today.

Ahlquist – I'm Paul Ahlquist and I'm at the University of Wisconsin where I'm associated with the Institute for Molecular Virology in the Comprehensive Cancer Center. I'd like to take a moment and just touch on two transitions that I've gone through in my career and how they have enlightened me about some issues that might be relevant to this situation.

The first is that I started out in physics and then moved into biology in graduate school. That was a great shock in some ways. It was a great cultural shock to move from the environment in physics where all of the knowledge in general could be related in a very clear structure – usually a mathematical structure – where if you forgot something, then you could re-derive it from first principles and we not only could do that, but we would do that at need in the middle of exams and things like this. So, to come into biology certainly at that time, it was a great shock to encounter a situation where there wasn't the basis for such a coordinated, rigorous structure of knowledge, and to realize that biology at that time proceeded largely as a series of separate facts and biology was limited by what one person could hold in their mind.

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As is abundantly illustrated by the discussions here, we have dramatically passed that situation with the onset of the genomics revolution. Biology now is in a very different situation, and among our challenges are to carry our understanding of biology into a true analytical systems approach.

So, my point with all of this is that the future of biology, in many aspects at least, is going to be tied up with those who can combine an appreciation for the biological issues with quantitative, computational abilities that will allow one to execute the necessary analysis. So, not merely the

ability to collaborate with somebody who knows how to do that, but individuals who have knowledge in both of those realms. So, I encourage you all to consider whether or not that is the direction you would want to take.

The second point I want to touch on very briefly is the interface between basic biology and clinical research. Going into biology I worked on very basic research problems and have continued to emphasize such things. But, recently we have become involved in more aspects of clinically relevant research with analyzing human tissue samples and so forth. This has made it abundantly clear, as another education for me, about some difficulties in that regard. At least now in the United States, it is difficult to obtain good quality tissue samples from patients for research. There is a tremendous opportunity being lost there. So, I hope that both in our country and in yours some attention might be given to better integration between this tremendous ability we are acquiring to acquire and to store information, and the clinical resources that we have. If we can connect those two together so that we routinely are able to acquire some kinds of appropriate basic data from most patient samples going through hospitals, we might dramatically improve both our understanding and our ability in the much nearer term to translate that understanding into improved patient care.

Thank you.

Popper – My name is Stephen Popper. I'm a research associate at Stanford University. I thought I'd give you my perspective. I don't have some of the wisdom that some of my colleagues do, but my training is actually in the very recent past. I did my doctorate in HIV virology and epidemiology, and then was seized, as all of you are, by the notion that genomics may provide such a rich and powerful way of looking at infectious diseases, and in fact, provides us with the possibility of looking at things from multiple perspectives – so to speak, both looking at the forest and the trees.

One of the things I think is really important is to go back and forth between those two perspectives continuously in our research. And, in so doing, and in starting my work at Stanford looking at gene expression patterns and gene responses to infection using microarrays, one of the

things I'm continually struck by every day is how little I know, and in fact, not just how little I know, but how little we know as a community. I think the real trick is to recognize that and to see it as rather than a frustration, a real opportunity. I think that is what has driven previous revolutions in biology and is driving this one – the notion that we know so little and there must be some way out there to learn more.

The other thing that the other speakers have alluded to is the necessity for interdisciplinary approaches to these problems. Again, I think one thing I'm learning and valuing in my training is the need to be able to speak to people from different disciplines. So, while individually we have to recognize our own limitations, I think it is important to recognize again that as a group, we are capable of much, much more and particularly with these new technologies there is a real need for strong collaboration and a willingness to say that you don't know something, but you are going to go ask somebody who might.

Moderator – Thank you for the introduction and remarks. We will now start the second part. We will ask the five relatively young scientists to give presentations. I think for the panelists I think it may be more comfortable for you to sit downstairs for now, and when we finish, you can take the stage again when it comes to the question and answer session later on. Thank you.

So, the first presentation is by Dr. Lu Fengmin. The title of his presentation is . . . carcinoma, and . . . the X file. Each speaker will have ten minutes.

Lu Fengmin, Peking University Health Science Center

Calcium and hepatoma: The X file

I'm a relatively young scientist. TV program in America which is a story about some mystery. So, the "X" here means a small protease coated by the small genomic

First of all, I would like to introduce some background about the HbV. You see, there are six billion people live on this global. Two billion of them had been infected with HbV, the hepatitis B virus. There are 350 to 400 million people are chronically effected by HbV. One million of them will die from the liver-related disease each year. 25-40% of them will die because of the chronic infection that HbV cause, the serosis and hypotocellular carcinoma. So, it is a huge problem here in China.

I'm glad to know that some scientists in America are lobbying the HbV study and I think more American scientists join this research field expect huge progress in the near future.

Most of the hypotoma in China is caused by the HbV chronic infection. So, you can . . . HbV protease in the hypotoma cells. In 20 examples we tested, 18 of them show the HbV X protease. So, HbV X protease is a big draw in the hypotoma development.

. . . function of the HbV X protease. We already know the X protease is a . . . exhibitors which are involved in cell growth, cell differentiation, cell survival and The detailed . . . is unknown, but we do now Hb X can induce . . . released and increased . . . in concentration.

A type of disease . . . from Dr. . . . papers published in 2003, you can see the Hb X can increase through the . . . released from . . and mitochondria. The . . . restored or replaced from the outside of the cell, so there are three different type of . . . channels in the cell membrane. They are SOC, means a storage operated . . . channel and So, why . . . for my further study.

The HbV infection can cause chronic inflammation and this inflammation may change the potential of the cell membrane and we see here . . . channel is a low channel. That means there is a window current which will flew into the cell. So, this inflammation may play a role and to channel.

Another reason is

(too disjointed – remainder not transcribed)

Moderator – Thank you, Dr. Lu. We are going to move along unless anyone has any burning questions. Otherwise, we will ask questions at the end.

Next, I will introduce Dr. Yu Zhang for his presentation, also from Peking University. The title of his presentation is regulation of lymphocyte development by TLR-mediated signals and its implication for infection-induced lymphopenia.

Zhang Yu, Peking University Health Science Center

Regulation of lymphocyte development by TLR-mediated signals and its implication for infection-induced lymphopenia

I guess I can't even claim that I'm relatively young. Actually, I believe I was picked out by Dr. . . . because he wanted to find a representative of old guys.

Forget about the long title. What I'm going to talk about is try to understand a commonly observed phenomenon in infection that while infection is often found to be followed by a decrease in the lymphocytes, but this was not Before I get started, I want to make clear that this is not our typical presentation of data obtained. Rather, I would like to start a discussion over a long-standing, but poorly understood phenomenon.

As is shown here, the . . . blood lymphocyte count was often found to be decreased following infections, and this mostly in human and in animal models. Either in bacterial . . . or viral infections or even after administration of The animal model studies further indicate the primary defect is actually sitting in the bone marrow. So, the . . . is just a reflection of suppression of the bone marrow. As it is shown here in this slide, a study by . . . group indicated

that there is a general suppression of in the bone marrow, so each pre-cell precursors at each stage was found to be decreased.

So, what the . . . what caused this? Over the last ten years, not a lot of potential mediators has been identified, and this many cytokines like TLR, IL6 or the type 1 interferons. What are not clear is what actually initiates this cascade.

. . . so most likely it is going to be an effect of the activation of innate immune system and while recently . . . like receptor has been identified as one of the mostly important receptors that . . . mice . . . molecule of patterns. So, we were wondering whether the TRR signal actually played any role in this process.

So, this is just a brief summary of our current understanding of receptor in host defense so the innate immune cells sense the . . . using the toll like receptors and then while they signal lead to the activation of the cells, as is demonstrated by the surface expression of molecules and also the secretion of many inflammatory cytokines.

So, based on what we observed, we have that . . . we come up with a hypothesis that the toll like receptor mediated signal actually played a critical role in the induction of . . . following infection. So, the signals derived from the pathogen would be sensed by the toll like receptor on cells and then the activation of . . . cells lead to the release of pro-inflammatory cytokines and then while the cytokines work on the lymphoid precursors and suppress . . . element. But, potentially another pathway would be the toll like receptor signal might have some direct effect on the developing lymphocytes.

So, recent data supporting while this might be true, the direct effect of toll like receptor on the developing lymphocytes. So, a group from Brazil found that if you couch the . . precursors in vitro in the presence of the toll like receptor lipid A, it will increase the percentage of mature B cells from the culture.

So, in the same study, they also find that while the lipid A or . . . cyst, that is another toll like receptor . . . would inhibit the proliferation of pro-B cells in the presence of . . . So much for the literary review.

Now, I come to some preliminary data from our laboratory. So, while we have been working on lymphocyte development for more than ten years, back a few years ago we identified a small peptide or what we called hemokining and this small peptide is a homologue. It is structurally very similar to substance P. It has the typical tackikyne motif, our studies have demonstrated that if you block the function of this peptide, it will cause severe suppression of the B-cell development. This . . . data shows that while dissect the bone marrow B-cell populations and this population is actually the pre-B and immature B cells, as indicated here, if you block the function of that peptide, virtually you wipe out the population. So, the B-cell development there was blocked.

While try to make a link to what I'm going to talk about, actually the expression of this strain is regulated by a toll like receptor, one of the best long ligand. So, if you treat . . . this is a pre-B cell line and . . . isolated that gene from this cell line. This one highly expressed the genes we are talking about. But, if you treat the cells with . . . , you will find out that the expression of hemokine 1 is severely decreased.

As one of the observations following that LPS treatment is that the cells is going to die, in addition to many other changes. So, we were wondering whether the decrease in expression of that peptide someone correlated with the cell survival. So, we etched the . . . peptide into the culture system and the percentage of dead cells. But, if you add that peptide back into the culture, you will see the cells are much more happier, so you significantly decrease the proportion of dead cells.

So, the hypothesis will be that the peptide actually – think about it. If there is an infection, then the toll like receptor signal may lead to the decreased expression of a critical factor for the B-cells and then you have reduced the number of B cells.

So, another relatively recent work is a chemokine. This chemokine has belonged to be the known to be a potent attractant for nutrafills. Our recent studies indicate that this one actually also, while pretty potent on lymphocytes, and interestingly if you block the function of this chemokine, you will see the decrease of pre-B cells, the pre-B immature B-cells and also while you will see an immature population in the pre. . . Just to remind you, this phenotype is very similar to what you observed in the infection. So, that also makes us wonder whether actually it could be a potential mediator.

So far, there was just so many . . . some pieces of evidence that may support . . . may well play a role in that process. But, obviously we need further evidence for this. Some experiment that are ongoing in this laboratory include that we are trying to use a purified toll like receptor ligand to see whether they could somehow induce similar penia effect, and also we are trying to see whether in the toll like receptor deficient mice, would you induce the same effect after infection. Also, we are trying to, while using the in vitro system to further dissect the biological effect of those toll like receptor ligand on the B-cell development.

Finally, were . . . do more work on the two molecules we have identified. For example, we would like to see if you give the animals peptide or the chemokine, would you rescue the cells . . . would you somehow prevent the decrease of the lymphocytes.

Finally, I should have a slide – an acknowledgement slide, but somehow I think it is for discussions. Anyway, I am happy to be here and if you have any questions,

Moderator – Thank you, Dr. Zhang. May I introduce the next speaker – Dr. Yihong Peng from the Peking University. The title of the presentation is extracellular signal regulated kinase in replication of human simplex herpevirus.

Peng Yihong, Peking University Health Science Center

***The extracellular signal regulated kinase (ERK) in replication of
human simplex herpesvirus (HSV)***

Thank you, Dr. Gu Jiang. Ladies and gentlemen, I'm very happy to be here to be called a young scientist to give the presentation. I'm Yihong Peng from the Department of Microbiology, Peking University Health Science Center.

First of all, I'd like to give an introduction about human simplex virus (HSV2). HSV2 is a double strong DNA virus and is one of the most difficult viruses to be controlled. Now in China, the HSV2 can cause the sexually transmitted disease. Now in China, this disease is increased in the clinic and pregnant women infected with this virus can cause the child birth defects, even death in the newborns or infants.

This is the picture about the extracellular signal regulated kinase (ERK). As we know, the kinase, or ERK, a signal cascade is a very important signal pathway for cell growth, differentiation or other basic metabolism of . . . host. So, this single pathway is very important for . . . for the basic metabolism.

Recent studies shows this pathway also play a very important role in viral infection and . . . As we know, virus cannot replicate, duplicate themselves without a living host or cell. It means the virus needed to hijack . . . the host cell for their replication or their survival. So, from this point, if we can . . . how these pathways can function in the viral replication, in our experiment we studied the interaction of HSV2 replication and ERK pathway and this would be not only relieved . . . mechanism in host cell, but also can lead a totally . . . strategy for antiviral therapy by blocking this pathway.

In our experiment, we used the HSV2 particle to infect the Before the infection, we small interferon RNI for . . . into the cell line and then the CPE (cytopathic) effect and

harvest super latent for viral titer and harvester cell for detecting the viral protein express .
. This means the HSV2 DNA and detect to the cellular protein expression represented
by

This is the data of CPE caused by HSV2 infected in the cell. We can see the panel A.
This is a positive control. This culture cell not infected with virus, the panel B is a mock cell. It
means the native cell virus and The panel C, first we. we can see panel A have a
very typical CPE in the culture cell, but panel B and C, the cell conditions are quite normal. So,
we can gather the conclusion the DSSIRI in the indicated concentration can inhibit the CPE
caused by HSV2 and the concentration of SIRNA not toxic for the culture cell.

This is the data about the effect of DSSIR and A of HSV2 production. Here the virus
propagation represented by TSID50. Here was can see this is a of control. This virus titer is
very high.

(too disjointed – remainder not transcribed)

Moderator – The next speaker is Dr. Jun Zhang from Peking University. The title of her
presentation is PIASy, a negative regulator of Toll like receptor signaling.

Zhang Jun, Peking University Health Science Center

PIASy, a negative regulator of Toll like receptor signaling

It is my pleasure to be here to present my data -- PIASy, a negative regulator of Toll like receptor
signaling.

There is something wrong with the figure. I'm very sorry. Introduced by Professor very important in natural immunity.

The when stimulated by the ligands Toll like receptors will recruit . . . containing adaptive proteins, including . . . 88,

(not transcribed)

(Tape 16)

Ye Juxiang, Peking University Health Science Center

Molecular pathology of avian influenza and SARS

(not transcribed)

Moderator – Thank you. Now, we have had all the presentations. We move to the next stage. I would like to invite the panelists to take the stage. Then we have question and answer session.

We have a rare opportunity to have such distinguished panelists of American scientists and the government officials, lawyers and administrators on the stage. We can ask any question to anybody – the speakers and to the panelists. We won't give a priority to the student, but any questions from the students.

Question – Thank you. My name is and I'm an undergraduate student at Peking University. As is known now, we have often genome map and I think what we should do next is to use this digital map to find out how this gene functions for a human body to adapt themselves to the

outside environment. So, my question is, how do we identify new genes from the whole gene map, and how do we identify the functions and upstream cascades to regulate it?

Willard – I'm happy to start so I can quickly hand on the microphone to someone else. That is a terrific question. You've outlined probably the next 20 years of work after the human genome project, so you have a full career ahead of you. You've identified what are two of the critical components of our understanding or lack of understanding of the human genome. The first is, out of 23,000 or 24,000 genes, there are probably less than a few thousand where we really understand exactly what it does, what its function is biochemically, and what its role is within the organism.

That means there is the vast majority of genes about which we either have a very small clue, or we have no idea whatsoever. The approaches that are being taken are to analyze the expression of genes in a whole range of different tissues, both in normal and pathologic situations to get a clue of how they may respond to various environmental or medical conditions, and to look in different model organisms where one can manipulate genes and cause a change in that gene and see what effect it might have on a mouse or a . . . fruit fly or seaelegance. But this is many years of work. Some of it can be high throughput genomic approaches in which one can globally look at all 24,000 genes simultaneously, but others are going to be single projects for individual students who will have to analyze gene #4,316 and figure out what that gene actually does, either in the human or other complex genomes.

The other part of the equation, which I think you alluded so, is all the regulatory sequences and cascades that must control those genes. Less than 2% of the genome sequence is actually involved in encoding protein sequence. So, even if we understood all of that, we still have 98% of our genome that we really have very poor ideas about how it is working, why it is there, how it has evolved, and what the differences might be between that corner of our genome in the human genome, and that corner of the genome in a mouse or a plant or some other organism.

If finding the genes is two decades worth of work, then finding those regulatory sequences may be three or four decades worth of work. That is the future of life science research and that will

require all of the tools that you have seen presented here over the last two days and that we have discussed earlier. But, it a terrific question and I applaud you for that and wish you well.

Comment – I have to agree with everything that Huntington said. It would be good to be impatient and not accept the fact that it will take decades and hoards of graduate students from around the world to look one gene at a time. You ought to see this as an opportunity to develop new high throughput technologies that would allow you to navigate through the genomic space and the protein space and the interacting sets of proteins and all of that space at warp speed so that you could develop a comprehensive picture of how to connect sequence and protein, and on the one hand to cell animal physiology and behavior.

Question – I’m and I come from Beijing Genomics Institute of the Chinese Academy of Science. Luckily, I am trained in the revolutionary way because I am ethics as well as in genomics. So, I am a lucky one. My advisor is Young. Before I ask my question, I would like to thank you all for your . . . encouragement for us younger generation and for this reason I respect you more. So, here comes my question for Mr. Lance Gable. We talked before with George about the conflicts sometimes that occur when the curiosity of our scientists to search for knowledge and implications of our research results. So, if such conflict really occur, as a lawyer or policy maker, how do you reason such as the process of collecting human tissues or the cloning human beings as a heated topic discussed

Gable – Well, thank you. That is a very good question and one that is a very complicated one. I think that it is very important to be considering issues of bioethics throughout the scientific process and that scientists should always be aware of the implications to subjects particularly when we’re talking about things like the human subjects, use of human tissues, but also thinking about the implications of the research and how it may be used subsequently to the conclusion of the research. So, the adaptations and the applications of the research should also be considered from an ethical perspective. I think it is very good that you’re thinking about some of these things through bioethics.

I think in terms of some specific ideas, the idea of an independent review mechanism, an IRB (an Independent Review Board) that can look at research from a fresh perspective, not directly connected to the specific researcher, and to provide some feedback and think about some of the ethical implications. One of the things that I think works well with institutional review boards in the United States is that very often they are required not just to have scientists, but also to have ethicists and other professionals who might bring a slightly different perspective. I think that can be a valuable one. But, I think that overall these types of issues are things that should be considered very carefully by scientists as they pursue their work.

Question – My name is . . . and I'm from Peking University Health Science Center and the classmates of . . . she just asked a question. I have listened to the lectures these two days and I think although the scientists of both countries are concentrating on the same field – the genetics revolution – but there is still a long way for us to go. So, what is the difference do you think between the Chinese researcher and the researchers in the United States, and what do you think the most we should improve?

Answer – I think that from the biotechnology perspective, it seems resources, I know that in the United States we have . . . resources available to bring to bear on some of these basic questions as well as to fuel the technology development. So, towards Eric's comment about the first question, let's find a way to solve this problem and not be patient and let time solve it – we have the fortune of having the resources and the culture to allow that to happen potentially more quickly. That is my observation – perhaps it is not true. But, that I think that may be the major difference where in the United States we are blessed with that. I think Henry Yang in the first day also asked a question as to why the people of the United States allow a project like the genome project to go on at that great expense, and how did we convince them to that great expense. I think that is something we have – we have that ability to convince people that when we want to go to the moon or the equivalent, we can get that done and we have been very blessed with that and I think that is my perspective on the differences.

Comment – I don't disagree at all with that, but I do look at it from another perspective which is the scientists themselves, especially the culture of students in the United States and what I'm

sensing in this room and certainly what I sense when I get e-mails as I do frequently from young Chinese students who would like to find an opportunity to come to either my lab or the Institute that I run at Duke University.

My sense is that there is a greater degree of impatience among the Chinese student population, that you have set for yourselves great goals as a group and as individuals, and are not going to let anything get in your way in terms of the kind of training you need to receive, even at great personal expense of leaving your own country and going to a different country for a substantial period of time to get the training you would like to get as a young scientist.

My sense is that in part because we are as blessed as Bruce alluded to in the United States, that young American students find the road a little bit easier and sometimes it is better if the road is not so easy because it brings out the best in young people's motivations and reaches deeply into their sense of passion for what they would like to achieve. So, I think at this moment in time this snapshot in 2006 – that is a substantial difference between young Chinese and young Americans. Whether that continues or not will remain to be seen – but that is just one man's observations.

Comment – I guess the only other thing I would add is that I don't detect so much of a difference as I might have imagined there might be, given the very different histories of our two countries and cultures. If I can just share an anecdote – I'll be visiting Ching Hwa University of Monday afternoon and I'm very much looking forward to talking with students there. But, one of my colleagues back in the United States, who is a professor at MIT, visited Ching Hwa University maybe nine months ago and he came back with the story that he has been to all of the major American universities and lectured, including places that you've heard of CalTech, Stanford and so on, and he is at MIT. And, he said he has never been in front of a brighter group and more eager group of students than at the University. So, you should be proud of who you are and how much you have already accomplished as young as you are – the fact that you are here and you are in the university is already a wonderful accomplishment. I think the sky is unlimited for you in terms of your own personal potential, but also what you can contribute to science globally and to the welfare of your own country.

Moderator – Thank you for that compliment.

Comment – I agree totally with everything I have heard. I would like to put something into a bit of a perspective. I've been coming to China irregularly for maybe 20 years now and it is amazing to me how the approach of Chinese students has changed over the time from a more traditional, top-down approach which is typical of many developing countries, where it is what the professor said – what is your opinion. This is still interestingly the approach in some rather developing countries where it is the professor's opinion that counts. Here we have a total change in the approach in which the students question, the students challenge, and the students actually make you realize that some of the things you may be saying are wrong – that you may be going on assumptions which were incorrect because you heard them at a time when you were influenced very strongly by the professor. So, I think things really have changed for the better. This is a marvelous cultural shift that has occurred in China. It means you are going to be moving ahead rapidly in more ways than economically – you are going to be moving ahead intellectually and scientifically rapidly as time passes.

If I might, since I have the microphone and avian influenza was just discussed, I'd like to ask a question because I don't know if you all realize the importance of autopsy studies on avian influenza – there have been very few. We are all concerned about whether we are dealing with a disseminated infection. This has policy implications. It sounds like it is and when I saw the picture of the lung, it reminded me of descriptions of the 1918 hemorrhagic pneuminitis that occurred in the 1918 pandemic. I do have a question. In laboratory models, the avian influenza virus has multiplied and remained for long periods of time in the ferret and in the mouse, especially in the brain study. This has implications in terms of blood brain barrier and therapy. Did you look in the brain and did you find virus?

Answer – We had the permission, but we did not find the virus in the brain, but we did find . . . in the neurons. We were the first ones to report that. We did a quite extensive study on autopsies of 2 and a half cases of avian influenza and we showed some preliminary data on the distribution on the body. But, we didn't know how long the virus was going to stay in the body because those patients were killed. They were killed quite quickly. So,

. . . direct attack. So, as we are speaking, we are preparing . . . accumulating tissue samples of human data to study the pathogenesis. We have same problem here we encounter great difficulties in pursuing the family and the local authorities

Comment – That is why we have so few autopsies.

Comment – We have two cases. Hopefully we will have the third by tomorrow.

Question – My name is and I’m a post-graduate from Peking University. It seems I ask questions because my heart is beating so fast. We human beings have suffered from SARS, bird flu and some other infectious diseases in recent years. I want to know are there any infectious diseases come in to us in the near future, and what will they probably be? Your predictions?

Answer – I’ll take a first shot at that. I think it is quite safe to assume we will see more emerging diseases in coming years. I think there can be no doubt about that. I have to say a truth in advertising aspect of this is that, of course, I have a tendency to focus on viruses so others might want to waive the banner for bacteria and other agents. But, in terms of viruses, I think one of the recent lessons is the diversity of sources for such emerging infections. It was, to many people, quite a surprise to find that SARS was caused by a coronavirus. If anything, the strongest presumption was that it was quite likely to be a negative strand virus, in part because of some of the experience that preceded the SARS outbreak where we had several things arising in South Asia, paramyxoviruses and what-not. At the same time, human coronaviruses were well-known, but did not cause serious disease. So, one of the lessons of that whole experience was the past behavior of a human-adapted pathogen may not predict the total range of pathology that one can find for that class of agents. Of course, all of the dangerous emerging infections recently have primarily been zoonotic transfers from animals and what one typically sees is the dangerous pathology is often associated with a virus that is not yet well adapted to its host. So again, that is a reason why it is difficult to limit the potential for danger to any particular groups. This has important implications for science and policy issues in that it would be very dangerous to focus research efforts on a small number of agents because tomorrow’s problem may be very different.

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HIV is a good example of this. Prior to the emergency of HIV, retroviruses were principally a problem in chickens. So, one can easily imagine, and I think we can find some examples of how early retrovirus work, in some corridors, was derided as pointless waste of resources on chicken viruses. Of course, this has not turned out to be the case. So, presumably the lesson is that we should diversify our efforts and seek to advance the understanding of all of these agents.

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Comment – I just want to add that in terms of my own recent experience, I think I have now been involved in three recent international collaborations, each of which has focused essentially on febrile illnesses. As a non-clinician, I was really struck by the fact that in every one of these regions of the world, the majority of the febrile illnesses went undiagnosed. What I think it points out is simply the need for comprehensive international surveillance and new diagnostics. The odds are that whatever the next epidemic will be, it is going to be related to something that is out there that we're just not aware of.

Moderator – Thank you. I think we only have time for one or two more questions.

Question – I am a student from China CDC. . . . antibiotics and diseases caused by bacteria has been well-controlled, but now many antibiotics resist and strains emerged such as TB, streptococcus, pneumonia, and some other strains Because many patients could not have vaccines, sometimes when they go to the hospital, their illness is very serious and sometimes we could not . . . know how to detect the diseases, but sometimes we could not know how to treat such patients and we could not . . . to help them. I do want to know, and I do hope to hear good experience from you how to treat such patients. Thank you.

Answer – I'll say something. I think this is a broad question addressing a very complicated issue. First of all, I think we must make a distinction between resistance to bacteria to anti-microbials and resistance of viruses to anti-virals because the mechanisms are often different. Also, we don't use a whole lot of anti-virals. Aside from the situation with amantadine and recent emergence of resistance, which we had predicted because of the way resistance emerges and how frequently it emerges, with amantadine, we more or less expected this would happen.

But, with bacteria, we know that over-use and abuse is what is the major determinant of emergence of resistance.

The problem is that once resistance emerges, and there is some kind of a biologic or ecologic advantage of being resistant, for example, the pneumococcus, you don't usually go back. What you need is new drugs. That raises another issue.

Drug discovery is typically in private hands and it is driven by profit. Therefore, having new drugs developed for a small proportion of organisms is not very profitable for companies. That, I don't think, is going to change which just means that we have to be so careful in not using antibiotics as if there are no down sides besides side-effects to their use. This differs by society and in Japan, for example, where everybody can get prescriptions like crazy, there is very high levels of antibiotic resistance. It is lower in other countries, so it clearly is related to how much antibiotics.

Moderator – I think time is running out and I want to ask the panel if they have any other comments

Atkinson – The advice to the Secretary of State is a complicated issue. I would like instead to recognize one or two other points. First of all, Professor Jiang who is the Dean of the School of Medical Sciences at Peking University has played a major role in this program. I would like to publicly thank him for not only bringing these students, but I'm sure playing a major role of inspiring these students long before they came to this meeting.

I would also like to add a point. A very important detail – I wish I could remember my first public presentation, either in Chinese or English, as well as these very fine presentations. I would like to pay homage to all five of the presenters, as young or old as they are. They were superbly done. I would like to publicly recognize them as well.

Perhaps with your indulgence, since unfortunately the Embassy car is sitting outside waiting and wondering where I am, I would like to make one other observation and then with the permission

of the others on the dias, suggest that we take a picture. I think this is very much of a fulfillment of a long-time vision which is now manifested in this particular meeting. The hallmark of the global dialogue program has always been the majority of the time would be spent with young people, much to the distress, I'm sure, of my colleagues here. But, in fact, I think we have seen at this meeting a transition – a hallmark fulfilled. We have, in front of all, I think all of us who are in the science profession realized that the future is staring back at us. The quality of the questions, the presentations, the ideas that have been expressed both publicly and in private conversations, should give us a great deal of heart about how we are going to address these very complicated issues.

As far as the question about why or how Chinese students and institutions approach this relative to Americans, I have had the privilege now of seeing about ten Chinese universities and institutes and I'll see another approximately ten before I leave China next week. I think we simply see here the earlier time in an evolution of what really belongs to every new generation. The curiosity and skills that you bring to this were brought in the American system in different venues over a long period of time. It is clear we are very honored and pleased to be part of a conversation with you in how we are going to approach each of these issues, including the bioethical issues that this fine question raised.

So, if I may, I'd like to thank one more time all the people personally before we adjourn and I would suggest, with your permission and perhaps the permission of those people with cameras, that we might invite people toward the stage to take a picture that we all can look back on a few years from now with pride to say we were here. So, thank you.

Moderator – Thank you for that comment. Thank you all for being here and we really appreciate this opportunity. I support the motion that we take a picture together. So, with that remark, we conclude the session for the past three days. I think it has been very successful. Thank you again to the distinguished American delegates and also for all the speakers and all student and participants.

Let's take a picture and we'll have lunch.