

Discussion

Moderator: Masashi Yatabe (Commentator, Japan Broadcasting Corporation (NHK), Japan)

Panelists: Kazuyuki Aihara (Graduate School of Frontier Sciences, University of Tokyo, Japan)

Soichiro Iwao (Ministry of the Environment, Government of Japan)

Ichiro Kono (University of Tsukuba, Japan)

Chisato Mori (Graduate School of Medicine, Chiba University, Japan)

Takeshi Yoro (Kitasato University, Japan)

John Peterson Myers (W. Alton Jones Foundation, U.S.A.)

Yatabe: Thank you very much. We have touched on the subject of the difficulty in understanding, and now we would like to discuss this topic from now on. There are three people who have still not had a chance to speak, and in keeping with the rules, there is a problem with time, so we will have the three who have not yet spoken each take a turn and speak for about three minutes, and then we'll let each person briefly comment for about one or two minutes for our discussion.

Mr. Iwao, who is the Director-General of the Environmental Health Department of the Ministry of the Environment, will talk from the standpoint of the government, how the difficulty in understanding concerning environmental endocrine disrupters is perceived and what they perceive the problems to be.

Iwao: As several professors have also stated, there are very many things about environmental endocrine disrupters that are yet unknown, and we will hear about these today, tomorrow and the day after tomorrow. There are however serious effects passed on from generation to generation. Because of this danger, we of the government must appropriately consider the aspects that involve citizens' safety and peace of mind.

From the perspective of environmental conservation, the Ministry of the Environment is conducting studies of wild animals and studies of the condition of country's air, water and soil. This requires international exchange of information; we just heard about how research is being conducted between the U.K. and Korea.

One of the reasons this symposium is being held in Tsukuba is because a new research building called the Endocrine Disruptor Research Laboratory has been completed at the National Environmental Research Center, and hopes to take leadership and contribute to accumulation of scientific knowledge.

As for the "difficulty in understanding" that was mentioned a little while ago, what the government must do is to achieve communication. We must show the public how to communicate the risk of not only endocrine disrupters, but other chemicals as well. As was included in the report of the "Wa no Kuni Conference" put together under the Koizumi administration, there was talk of holding a round table discussion on chemicals and the environment. Some time ago, on December 3rd, producers and users exchanged opinions with scholars in a round table discussion in order to facilitate communication. Along with carrying out such communication, we must know exactly whether such substances have an effect on the environment or not. This is a very perplexing problem. I would therefore like to hear any advice the scientists, panelists or anybody else here with us today may have concerning risk communication.

Yatabe: Thank you very much. How to communicate risk concerning substances for which risk is uncertain and how to make appear that a line has been drawn in the case of things for which a line cannot be drawn are very difficult problems.

Next we will hear from Dr. Myers. Dr. Myers wrote a book about substances that may or may not be environmental endocrine disruptors and is attempting to spread the significance of these substances throughout the world. I would like to ask Dr. Myers how to spread the word about ideas that are difficult to convey and difficult to understand.

Myers: There certainly is a lot of uncertainty about all of the issues we have been discussing here today and I am not an expert in communicating about that, but I would like to offer some comments beginning with a question to the audience. And that is; what will historians think of this issue? Perhaps historians in the 22nd Century and how will they deal with the uncertainty. My bet, and the answer clearly is uncertain, is that they will view the 20th Century as the century of the great uncontrolled experiment with synthetic chemistry.

When we foolishly allowed thousands of unknown chemicals out into the environment and did not begin asking questions about their affects until after the bodies started to fall. And what will biologists like myself think in the face of this uncertainty? I predict that biologists in the 22nd Century will look at this time as the period of very rapid human evolution at the molecular level, perhaps the fastest in the entire history of our species. This is because many of the thousands of chemicals that are now out there, affect survival and reproduction of humans and because there is significant genetic variability, we do not know exactly how much, but there is significant genetic variability in resistance within and among human populations.

So by definition, with that variability, gene frequencies are going to change. And what that means, in essence, is that the chemical industry inadvertently has become a massive, selective factor affecting human evolution through its commercial choices. No one intended that it would be that way, but I think that is what has happened.

How did we get there? A lot of it has to do with uncertainty. Particularly, uncertainty of a key type. As a society we are much better at creating new technologies than at understanding their impacts. The pace of chemical synthesis has outstripped the pace of scientific understanding of those impacts dramatically and that is introduced huge uncertainties into the sorts of decisions that we, the government have to make about how to approach the protection of human health. Not only is there a problem with the difference between the pace of science and the pace of synthesis of chemicals, there are also inherent time lags between the exposure and the effect of many of these things.

There is a second key problem, the second key issue that has lead to us being in this dilemma, which is that we do not have in place the economic mechanisms that internalize the health costs and the environmental costs of chemical mistakes. At least in the United States, there is a long and sordid history of companies profiting from compounds that were only later we found to have deleterious effects. And in fact, when they were discovered to have deleterious effects, the companies employed lawyers, law firms, and corrupt scientists to seize upon the uncertainty and to escape the responsibility for just compensation and clean-up.

We have just been through an episode like that in the United States involving GE, General Electric and its responsibilities to clean up massive PCB spillage in the Hudson River. Fortunately, despite uncertainty, the government has decided to hold GE responsible for the clean up of the remaining PCB wastes, but the settlement does nothing at all for the many families whose children who were probably affected with learning disabilities or some of the other costs of PCBs and whose health impacts will not be compensated by this settlement.

So I think there is a key question in all of this. There is unquestionably a lot of uncertainty, but who is it that bears the cost? The costs and the risks of the uncertainty. Today, as the system currently works, it is the public that bears those

costs. The system allows companies to pursue economic gain while imposing the uncertainty and the risk on society.

I think we are at the stage now where we need to really seriously think about how to alter that approach, that system of governing the use of chemicals and I think that there are three key principles which I will just mention them and perhaps we can discuss them. Three key principles that will lead us to a better approach.

One, Dr. Jansson spoke about at length this morning, which is the precautionary principle. Second, we need to have a much better system of internalizing the environmental costs and health costs of exposure and that is going to involve some adjustments in the tax system and there is also some creative thinking going on about using performance bonds where before a company is allowed to take a product to a large commercial scale it has to set up performance bonds so that there are resources to compensate if, in fact, they made the wrong bet and they exposed people to compounds that have caused health effects.

Thirdly, there is what the United States has called the right to know. So that even though there are circumstances where, in fact, almost invariably there are uncertainties in the decisions that the government has to make, that companies have to make and that the public has to make. If the public has information about what risks it should take on itself, then we are going to see individuals responding by reducing unnecessary risks and balancing them in different ways than they are currently balanced where in essence the public does not have a choice about the risks to which it is exposed. Thank you.

Yatabe: Thank you very much. Dr. Myers' comments are full of suggestions. I hope we can include some of this in our discussion.

Last we have Prof. Mori who has pointed out a lot of facts concerning the problem of endocrine disrupters as passed on from generation to generation.

Mori: Our research group is reporting on the complex exposure of endocrine disrupters on fetuses that could have an effect mostly among human beings.

In the next phase, the problem is whether or not this complex exposure is really dangerous to the fetus. In other words, we have to think about the risk of complex exposure to fetuses. However, many people understand that at this stage it is very difficult to accurately assess this risk. In other words, I think the issue should be the effect of complex exposure to fetuses as unclearness from the theme of this panel.

Now as for what to do about it, first people must acknowledge, "This problem exists." Next, we must make clear, "What do we not understand?" In other words, the simple fact that we come to know "We don't understand" is very important, I believe.

Yatabe: We have heard everybody's general comments, for example, doping in some respects acts like hormones, so we create a framework and draw a line. A case study where we must draw a line at what we don't know or there is nothing to talk about is extremely easy to understand. Prof. Kono, would you care to comment on how we can make a black and white distinction?

Kono: Just as was mentioned, it is definitely hard to make a black and white distinction. If there is evidence of certain substance clearly having the effect of a banned substance, it is added to the list and a consensus is formed. Now you must measure and test it, so there is the problem of where to draw the cut off line. However, once the consensus is formed, we run once, and if it doesn't look good, we change at the next term.

We touched on this a little while ago, but you could say the situation we have now causes the action by which the decision is made.

Yatabe: Depending on where you draw the line, each opinion differs - whether fairly, unfairly, unsatisfied - according to the standpoint.

Kono: That's correct. Consequently in the case of athletes, there is oppositely the standpoint of supervision. For the time being however, one of the biggest problems for us is how to handle test results when there is such dissatisfaction and whether we have a system to handle test results. Currently if we attempt to prepare such a system and possess it, we are in possession of it.

Another problem is, when considering the human rights of athletes, how should we handle them. We have established a court of arbitration as a third-party organization in the sports world. The system should be such that it draws a line and makes black-and-white decisions at the court.

Yatabe: Go ahead Dr. Myers.

Myers: I think the doping example is very interesting. But there is also a key difference between the choice that an athlete makes as to whether or not to use a doping agent and the choice that a child does not have the opportunity to make because they are exposed through chemicals that they encounter in the environment. It is a very fundamental difference in that and I would be curious to hear your reaction about that.

Kono: Just as you pointed out, there is a big difference. But even in the case of athletes -- I gave the example of East Germany a little while ago -- there are cases where the athletes were not aware they were ingesting those substances, such as in food provided by a third party. Such cases have something in common with infants and children.

Yatabe: I think Mr. Iwao will agree that the government must draw lines of distinction. I think there is probably risk communication for drawing a line. From this standpoint, can we learn something from the problem of doping?

Iwao: The government probably must draw a line of distinction in the talk about doping and in conjunction with Prof. Aihara's presentation. But when drawing the line, if we try to find the no-effect dosage that fit from a high concentration

and the dose at which some effect occurs as the dose is raised from zero, there may be some discrepancy in the values.

Concerning this problem, even for effect in this case, we disclosed information about the effect of nonylphenol, an endocrine disrupter, on fish in August, but must eggs forming in the testicles of males not be permitted? Furthermore, just as Prof. Yoro stated, due to change in receiving individuals, if the total number of individuals ultimately increases, even if this exists in the cell itself, in terms of the entire population, if a certain amount is increased, you might not be able to say it was a negative influence. Thus, I think we need to get a consensus of the people about where the line should be drawn.

Yatabe: Prof. Yoro, you are fascinated with organisms, but what about where to draw the line concerning change in organisms, for example, where do we draw the line to separate what is permissible and what is not? What do you think?

Yoro: If that is an administrative problem, the line must naturally have to be drawn. What I was talking about however is a very basic problem, and what I wanted to say was that the problem itself lies in the thinking of modern society. The same goes for a so-called "information-oriented society." If you are wondering why there is such enormous information going around, I think it strongly resembles the manner in which chemical substances are released into the environment. What we really need could be something like this. I know that there is not enough time to discuss this, so I'd just like to leave you with a suggestion.

I think these problems are all in the same vein. I stated a little while ago that chemical substances and information strongly resemble each other. This especially rings true if you think in terms of DNA. DNA is sometimes referred to as "information." We thoroughly flooded this with such things. Relative to this, our system is being tacitly accepted as stable. Because this problem has developed here, it is truly a so-called "environmental problem."

Having listened to Dr. Myers' talk, although I can't express this briefly, I believe he really hit the nail on the head. I also feel that at the same time that kind of thinking may have brought this about. That is my gut feeling, so I think it would be difficult to say in unequivocal terms. Our world may appear extremely ambiguous to Dr. Myers. I think that it is perhaps by merit of this ambiguity that we get by without going to extremes.

I think this should be discussed for a considerable amount of time.

Yatabe: Such ambiguity and difficulty in understanding can be taken as the nonlinearity that Prof. Aihara spoke of a little while ago. Even on top of research, for example, with difficulty in understanding, if for example an organization becomes an independent administrative company, if it does not produce specific results, it will not get research funding. How do you view this Prof. Aihara?

Aihara: We are comparatively lucky that our study object is a theory and does not require money. We can get by this type of research with time, paper, pencils and a small computer, so it is not affected all that much.

Yatabe: Then probably only the experiments would require money. Prof. Mori, what do you think of this? Do you think there is too much pressure to produce results?

Mori: It's difficult to answer. If I may be able to direct my answer to the many researchers that will be involved in this field in the future, it is a fact that research cannot be conducted without research funds. I have participated in these symposiums on environmental endocrine disrupters since the first one, and have felt this every time. By the time the fourth symposium was held, various research funding had been obtained and various research had been conducted. This time I think the research results and data from Japan has clearly advanced as compared to earlier

symposium. In order to advance the research in the future, there must be an increase in new scientific research funding. It is the wish of researchers to do more advanced study on this problem and the return to society will be great.

Aihara: As I listened I thought we should follow this for experimenters. Collecting data is of course extremely important. Like us, it is Newton's job to find the original starting point for theoretical research. Considering the process in which Newton's job appeared, Tycho Brahe collected data on Mars for twenty years. Inheriting this data, Kepler continued to observe Mars for a long period of time. The results were compiled as a rule of thumb called "Kepler's 3 Laws."

It was only after this long accumulation of data that the elegant theoretical research called "Newton's equation of motion" was realized. From then to now, our work is based on this theoretical model of research. In this sense, the accumulation of data is the basis of research. It could be said that budgetary steps to supply funds for experimental researchers to collect data are very important.

Kono: The problem of funding goes for doping as well. Doping has recently entered the age of gene doping, where gene treatment is actually being conducted. I'm not saying whether it's right or wrong, however, when the side that has been conducting research advances, in a certain sense, if the side that regulates this has money, this is not research that produces money, so Japan clearly does not have money. How we deal with this problem is therefore very important. It resembles environmental endocrine disrupters in this sense as well.

There is also the perception that Japanese international sports organizations are getting a "free-ride." The reason I say this is, each time they hold the Olympic games, Japan sends a big delegation. Of the main countries, Japan ranks about tenth. Concerning the problem of doping, as for the number of doping tests which serve as a standard, Japan has up to now been one of the

fastest to consider from the bottom. Numerically speaking, about 1000 tests. America is doing at least twenty times this. Thus concerning things that do not produce money, I think it is extremely important to approve and provide the necessary funding.

Yatabe: Now let's hear an American's point of view. Would you please?

Myers: I do not pretend to talk on behalf of all Americans, particularly not the current administration. As I look at the impact of our stolen future, I am very proud of the fact that it has stimulated a huge amount of research and government funding for research. That is very good, but we can use research to hide in uncertainty. Sooner or later, we have to act. If you think about epidemiology, which is a key part of the research in endocrine disruption and in toxicology, epidemiology only works once there is an epidemic, once people have died or once people are sick. We need a better approach that prevents them from getting sick in the first place.

This is why the approach that Dr. Jansson described when he was talking about POPs, is so important. He was saying there are some criteria that we can identify that are not individual chemical by individual chemical, but they allow us to say we know enough already to get those chemicals out. In the United States the system still depends upon testing chemicals one by one. And a congressman, Mike *Sainar*, once did a calculation. He calculated that at the rate, which EPA was testing pesticides it would take 1,570 years to do all the tests and the congressman said, "I believe in science, I believe in research, but I do not believe in geological time." We need to create a system that copes with uncertainty without imposing the cost of that uncertainty on the public but instead internalize it into the sectors of the economy that benefit from making the product.

Yatabe: We don't have anyone here to represent business, so I think it would be quite difficult to follow this aspect, but funding is sometimes

obtained from an administrative perspective. We then request funding if we can expect results from some specific action, or appropriate the single year budget – there are various problems with funding. What do you think should be done about this?

Iwao: Speaking just about environmental endocrine disrupters, several years ago, it became a social problem after being picked up by NHK, so I recognize that the budget probably actually increased. The total budget for 2001 for all ministries and agencies was ¥9.644 billion. The budget for the Ministry of the Environment was about ¥1.8 billion, ¥2 billion for the Ministry of Education, Science and Culture. I understand they used almost all of funding allotted as the research expenses.

What we do is to obtain our budget and use it effectively. That is how we want to conduct research in this field. Beginning with the Millennium Project, what I was heard most from those who conduct evaluations of the program is criticism about the thinness of the layer of researchers and overlapping of research themes. After the passage of two or three years – maybe it's because we are Japanese – there are aspects that tend to heat up or cool down, and the topic tends to drift from one thing to another. Recently the themes have been dominated by BSE and bacillus anthracis.

Thus, when the same budget or a more budget is obtained, we must tweak something. One of the things tweaked has come to be known as "evidence." Scientific evidence is accumulated, and if brought to the point where it might be used by society or the government, we are able to persuade the authorities in charge of financial affairs. But maybe there will be nothing. If we look at these four researchers, when we are told that their research areas are redundant, our current state is what you might call a "late departure," or it is described as the pain of giving birth to new fields of research. I get the impression that this state of affairs is continuing.

Yatabe: I think the reason we will not know unless we spend a lot of time is because we must consider that environmental endocrine disrupters are passed from generation to generation and we must consider in which generation will the effects of substance to which previous generations were exposed appear. At the present I don't think that Japan will be able to deal with this problem. Do you have an opinion concerning this Prof. Yoro?

Yoro: I definitely wanted to talk about that. I attended "Wa no Kuni" conference, where I made one suggestion giving an example of dioxin in Tokorozawa that was in question. We know the current concentration of dioxin, but we don't know what it was in the past. We must therefore take earth surface samples. I don't think this will be all that difficult. We often freeze samples after boring. I wanted to propose that land developers be obligated to do this when developing land.

If we furthermore invest a lot of time, in a certain sense, if data is not obtained from the past it will be back and forth argument. Just as were told now, when asked if we have evidence, if the evidence itself disappears, there is nothing to talk about. As for neutral accumulation of data, I am collecting insect samples, as is Prof. Aihara, and have kept specimens from way back. Japan however is probably hardly interested at all in maintaining the specimens. All such collections are maintained privately. It's okay to maintain them privately, but if so, the data may become extremely important at some time. How much there was among them when organism specimens are taken always becomes necessary.

I think that constantly investing a certain amount of money and property in this is necessary for this society no matter what.

Yatabe: A little more than ten years ago, I also studied the problem of chemical substances in countries such as Denmark and Sweden. Antiquities from the nineteenth century such as eggs and seal specimens were preserved and neatly cataloged, and I thought about how different it is over here.

Dr. Myers, I think you have probably seen how this is in Europe and in Japan. What do you think the difference in the way research is carried out on the international level? Do you think the approach to research of environmental endocrine disrupters differs according to the country?

Myers: There are very large differences among countries and the approaches that they have taken to this issue, and I believe that they stem from many different factors. I am very impressed by the investment that Japan has made. It is really quite extraordinary to see the public interest in this issue and the government interest and the growth of this remarkable society, the Japanese society for the study of endocrine disruption. There is nothing else like it in the world.

In the United States, things have unfolded somewhat differently and there are many factors that have contributed to that as you were describing the samples and the information available in Northern Europe, I was thinking about how what an extraordinary public health system they have in Denmark and the Netherlands and other Scandinavian countries where the public health records allow them to ask questions in research that in the United State we cannot even begin to ask because there has not been the commitment to build a long-term database. There was one growing, starting, but when the Reagan administration came into power, they gutted much of the funding that was available for that research and so we are left with almost a 12 year gap in efforts to build a surveillance system for studying public health in the United States.

Even with that, there are little nuggets, little pieces of information that almost by accident have been saved. One emerged this summer. Fascinating research on DDT based on samples that had been gathered and stored in the 1950s and the 1960s of cord blood. This was reported by the US Centers for Disease Control this summer and it revealed that the United States, at least in the estimation of the researchers, there was an epidemic of pre-term birth in the United States due to DDT exposure and they estimate that up to 15%

of infant mortality could have been caused by DDT exposure in the United States during that time period. That is an amazing number and we are just discovering it now. If we had better surveillance systems in the United States I believe we would have much more examples like that.

Yatabe: I have the book "Silent Spring" close at hand. In this age, does such data actually already exist? In the days when the book was written, what should have been collected as data was left alone. What about this?

Myers: That is correct. There was a fierce battle mounted by PR firms hired by the chemical industry to suppress that information and to impact on the evolution of laws in the United States on chemicals that today do a better job at protecting the products than at protecting people.

Yatabe: If things go that way, from the standpoint of various types of research, in order to get an understanding of the element of the unknown, the place where we can see more or less the direction and the problem of making chemical substances, has also come out to a certain degree.

Another thing has to deal with the term "risk communication." Concerning whether this can be explained to people without expert knowledge, when Prof. Mori talked about the blood of the umbilical cord, he was asked what should be done, and he said it was extremely difficult to answer. Although I think there may be no way to answer that question, what approach do you think should be taken concerning this area?

Mori: I think we should utilize risk communication to deal with the problem of fetuses being exposed to the massive quantity of environmental endocrine disrupters for which we cannot make black and white decisions, or the degree of risk is unknown.

In other words, at the stage where risk is still unknown, what should be done about such substances is uncertain. In such a situation, it is important to transmit the situation accurately

without attempting to obfuscate the situation. Our group has proposed establishing a method of two-way risk communication that is better than one-way communication and then tie that into measures for dealing with the problem. It however will take a great deal of effort to establish this method.

Yatabe: There is not easy answer in any case. It is of course important to accumulate data and results.

Mori: Yes. Taking measures of risk communication that include environmental education, I believe are important in the sense of "more haste, less speed."

Yatabe: If we try to oversimplify, the problem will become even greater. It will oppositely be harder to get people to understand.

Mori: The target is of course people, particularly mothers. We must therefore place great importance on communication. I also think we must furthermore provide subsequent psychological support.

Yatabe: Returning to the topic of doping, risk communication is of course needed for the problem of doping. In this case, it should be easier because one of the parties is athletes. What do you think of that, Prof. Kono?

Kono: In a certain sense, that target is more limited than with environmental endocrine disrupters, so in that sense, it would probably be easier. Just like with endocrine disrupters, however, information must be provided over many generations, and that is extremely difficult. Athletes for example come and go, including the top ones. If you take this into consideration, proper communication of information at this stage itself would probably not be easy.

Yatabe: When making drugs used for doping for example, would it be difficult to get the

manufacturers to stop through risk communication?

Kono: That's what we are currently thinking about. With the current state of affairs, if they write, "this product contains banned ingredients," it would not be very good for sales. If this basically becomes possible, just because a certain drug is banned by organized sports doesn't necessarily mean that the drug is bad for you. If the manufacturers would agree to communicate this information accurately, it would be much easier.

Yatabe: The potential for Prof. Aihara's hard-to-understand chaos theory being a good tool to explain the element of the unknown will probably come up again and again in future discussion. It may of course be important to have citizen's understand the theory of chaos, but it will show just what the state of the unknown is – whether or not the potential is there, for example, if we attempt to explain environmental endocrine disrupters.

Aihara: I don't know much about environmental endocrine disrupters, but the fact that there is an intimate connection with chaos is a "weather report." As for the term "weather report," with such a degree of difficulty, it would have a "butterfly" effect on the important nature of chaos. There is a famous metaphor that says, "if a butterfly flaps its wings in Beijing, a storm will occur in New York two months later." In other words such a slight difference is a case where the effect spreads exponentially as time passes. Consequently, it is said that it might be difficult to predict the weather. At this time what some researchers are thinking is that we can estimate something in which the effect of a slight error spreads at a certain speed. We can then make a prediction with the accuracy of a weather report.

Because error is always involved, if the influence spreads slowly, when the weather report is issued, you could say there is confidence in the prediction. If we however know that it spreads swiftly, a weather report is issued, you might say

we are confident that we are not confident in the prediction.

Then there are Lyapunov exponents that measure the speed of spreading effect of errors. These values account for the accuracy of the prediction information. It would be nice to have such a scale for the risk communication of environmental endocrine disrupters.

Yatabe: So you think a scale to measure degree of uncertainty could be established. If so, it would be easier to understand uncertainty.

Aihara: Yes indeed. Concerning the weather report, it has become quite an important research theme.

Yatabe: Our remaining time is growing short, but we have time for about one more comment. Dr. Myers, how do you think this uncertainty can be accurately communicated to citizens? What sort of devices are being carried on to accurately communicate the state of affairs without alarming the people?

Myers: Well, that is a very important question, but I think that there are two aspects of risk communication we need to focus on here. One we have spent a lot of time talking about which is communicating to the public what the risks are in the face of uncertainty. But what about the economic ways you communicate to companies about the risks that they are imposing on the public? That is a flip side on this issue of risk communication, and we do not have in place the right mechanisms so that they get the economic signals to minimize risks to the public. And I think there has to be a whole other focus on that issue of risk communication as well.

Yatabe: I know what you mean. Prof. Yoro, I don't think there is a high degree of awareness concerning risk communication. I think you probably have a lot of experience with communicating risk, but what about whether or not it's all right to communicate risk as it is? For example, excessive coverage by the media has

produced misunderstanding, and it is often written about in books. What do you think about the difficulty in communicating risk, including these examples?

Yoro: This would take a long time to comment on, but to put it briefly, in the case of when a program about the brain was made by NHK, several learned professors, namely Dr. Masao Ito and Mr. Takashi Tachibana, said before making the program that the problem could produce misunderstanding throughout the world. They therefore urged NHK to be careful that this doesn't happen. When it was my turn, because I am a perverse fellow, I said the opposite. I don't completely understand my own wife, even though we've been together for decades, so I think it is a matter of course that misunderstanding occurs. In this case, misunderstanding is not the problem. In other words, what you are saying should be correct. As for the misunderstanding, I often say the responsibility lies with the one who misunderstands.

If this is not said sometimes, I think the opposite tends to become habitual. The misunderstanding is that there was something wrong with the NHK broadcast. I think that is a habit with NHK – the fact that they are always accepting complaints.

Yatabe: If I'm not mistaken, only NHK accepts complaints. Thank you. So we shouldn't be worried about misunderstandings. When explaining something, we must explain it correctly.

We are almost out of time. Mr. Iwao, I was wondering if you could give us a summary. Do you think today's discussion provided any insight as to the direction of the government and research?

Iwao: I think the most important point is to get the people of Japan to understand uncertainty and chaotic situation. As administrative officials, we have an opportunity to meet the press after we reach a certain level. We are always being told to provide information thinking of 120 million

people who will obtain information through interviews, on television and in newspapers.

When we talk face to face with reporters however, things the reporters aren't interested in hardly ever get reported. Not only through government media, we have to think of how intelligibly to explain things in these cases as well.

Especially, in the case of crisis management as well, we must consider how to communicate in frequent interviews. Especially to this age, we also recognize the importance of the media, and we think there is a need to communicate accurately through the media. I think we, speakers and people in the audience, can reduce risk, even if just a little, by accurately communicating at conferences such as this while gauging the expressions of other people.

Yatabe: Thank you very much. That's all the time we have. That brings our discussion to a close. Each of our panelists expressed his ideas well, and it is my job to make sure those ideas have been summarized. I hate to say it, but the responsibility for risk communication always seems to be left up to the media. As for communicating what needs to be told, what needs to be studied is studied and the government does what it has to do. If these efforts are not executed correctly, they have absolutely no meaning whatsoever, so we all need to do the best we can. Thank you for being here today.