Science and Technology in Society (STS) *forum*

"Lights and Shadows of Science and Technology"

Second Annual Meeting

September 11-13, 2005, Kyoto

Kyoto International Conference Hall

SUMMARY OF PROCEEDINGS

STS *forum* SECRETARIAT

Sanno Grand Building 419, 2-14-2 Nagatacho, Chiyoda-ku, Tokyo 100-0014, Japan

Tel : +81-3-3519-3351 Fax : +81-3-3519-3352 Website: http://www.stsforum.org

All of the names, job titles, and functions stated herein reflect those current as of the date of the forum; personal titles have been omitted.

PROGRAM

September 11, 2005, Sunday

September 12, 2005, Monday

September 13, 2005, Tuesday

SEPTEMBER 11, 2005, SUNDAY

14:00-15:00 Opening Plenary Session

Session Chair:

- **Omi,** Koji, *Member House of Representatives, JP*

Speakers:

- **His Imperial Highness the Crown Prince of Japan**
- **Koizumi**, Junichiro, *Prime Minister, JP*
- **McKinnell**, Henry, *Chairman of Business Roundtable and Chairman of the Board and CEO, Pfizer Inc., CA*
- **Okuda**, Hiroshi, *Chairman, Nippon Keidanren (Japan Business Federation), JP*
- **Meyer-Krahmer**, Frieder, *State Secretary, Federal Ministry of Education and Research, DE*
- **Cicerone**, Ralph, *President, National Academy of Sciences, US*
- **Mehta**, Goverdhan, *President-Elect of International Council for Science (ICSU), Director of Indian Institute of Science (IISC), IN*

Imperial Highness the Crown Prince of Japan

His Imperial Highness the Crown Prince of Japan expressed his pleasure that the Second Annual Meeting was convening in Kyoto, with so many international participants. He noted that in the past two decades, the advancement of science and technology has exceeded all expectations, particularly in the field of life science, information and communication technology. His Imperial Highness pointed out how society has greatly benefited from these developments and how they have truly changed our lives. These remarkable advancements raise some basic questions, such as whether the fruits of innovation have been shared fairly among all groups of people, whether the development of science and technology can be harmonized with nature, and whether science and technology should be allowed to develop simply because it seems to be infinite.

Junichiro Koizumi

Junichiro Koizumi remarked on his observations of the Space Shuttle Discovery's successful two-week mission. He expressed amazement on what astronauts are accomplishing so far out in space. In contrast, back on Earth, a difficult mission of protecting the planet and preserving it for future generations has been embarked upon. Environmental protection and economic development are mutually achievable and sustainable. It is science and technology that holds the key to achieving these dual goals. It is no longer the era of mass production, mass consumption, and mass disposal. It is now an era characterized by the 3Rs: Reduce, Reuse, and Recycle.

Koji Omi

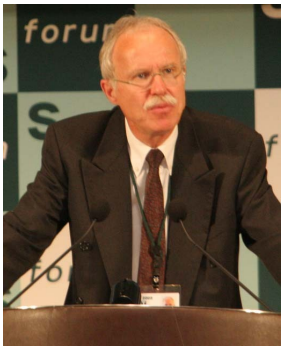
The rapid progress of science and technology has brought prosperity and an enriched quality of life. However, the advance of science and technology raises important ethical, safety, and environmental issues. Possible negative applications are threatening the future of humankind itself. Progress in science and technology is expected to accelerate and become mandatory for sustainable human development in the 21st century. The most pressing problems we face today include: harmonizing economic development with global warming; preventing terrorism; controlling infectious diseases; and assessing the potential health benefits and ethical factors relating to cloning technology. **Koji Omi** promulgated that this is what symbolizes the "Lights and Shadows of science and technology."

The focus of this forum is rightly placed on illuminating the benefits of advanced technology and investment in science. **Henry McKinnell** referred to two news items - a private company offered trips into space and made front page headlines. A private U.S. company won regulatory approval of a genetic blood test that will allow doctors treating cancer patients to more accurately adjust the dosages of certain powerful medicines and minimize their side effects. The contrast between the two news stories could not be greater and yet they are linked. Both concern private investment into industries of the future - space travel and advanced health care. Both developments depend on ambition and great foresight, a high tolerance for risk, and a close partnership between private industry and government.

Hiroshi Okuda

Hiroshi Okuda agreed that new knowledge in science and technology has brought social and economic advancements and improvements in our lives. Although science and technology have "lights" or positive aspects - intelligent transport systems, nanotechnology, and global positioning systems; they also have "shadows" - mass consumption of energy and resources, mass disposal of goods, global warming, and

ecosystem destruction - caused by human arrogance when humankind came to possess advanced science and technology. When the Kyoto Protocol came into force in February 2005, a full-fledged effort to prevent global warming had finally begun. Efforts to build a sustainable society are founded on the voluntary actions of people and corporations - not on laws and regulations.



Frieder Meyer-Krahmer

Frieder Meyer-Krahmer observed that people are amazed by the power of science and technology and expect that scientific progress will solve most of the problems society faces, such as epidemics, unemployment, poverty, and world development. Concurrently, this admiration of scientific achievements is shaded with fears relating to possible side effects or misuse. Germany and other Member States together with the European Commission are striving to build an area without borders for scientific and technological knowledge in Europe. It is clear that knowledge must flow through internal borders as freely as goods and people. With the acknowledgement that the challenges are many, he gave encouragement by saying that the *forum* can be the tip of the iceberg in terms of coordinating efforts to address global challenges at a global level. "How many humans can be sustained by our planet earth?"

Ralph Cicerone

Ralph Cicerone pondered which element would limit the population - food, fresh water, waste disposal, or overcrowding. He asked how much consumption there can be, how much time for travel and recreation should be set aside, and how much land should be designated for plants and animals in nature. Above all, communication is necessary. This *forum* is an excellent opportunity for such communication.

Goverdhan Mehta stated that it is now the "century of knowledge". The era of the knowledge-driven world has arrived. He noted that while the pivotal role of science and technology in advancing human development, promoting industrial growth, and eradicating poverty is undisputed, science and technology's role in the 21st century needs to be recalibrated without diminishing its centrality. The scientific revolution has outpaced social transformation for a century now and progress in science and technology in recent decades has been somewhat insular and unitary. The need for synergy between scientific and societal progress and a broader engagement of science with other knowledge streams, is a matter of urgency and prime importance.

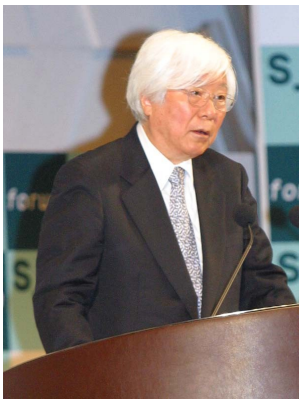
15:00-16:00 Plenary Session: "Science and Technology in Society"

Session Chair:

- **Yoshikawa**, Hiroyuki, President, National Institute of Advanced Industrial *Science and Technology, JP*

Speakers:

- **Bement**, Ardent, *Director, National Science Foundation, US*
- **Rattanapian**, Pravich, *Minister of Science and Technology, TH*
- **Sasaki**, Hajime, *Chairman of the Board, NEC Corporation, JP*
- **Taha**, El-Zubier, *Minister of Science and Technology, SD*
- **Van Ginkel**, Hans, *Rector, United Nation University, NL*



Hiroyuki Yoshikawa

Hiroyuki Yoshikawa stated that the five speakers' diversity was not accidental and was of importance. The STS *forum* was an integration of two sub-purposes: (1) to identify the right direction of the development of science and technology and (2) to find out the correct way to use the knowledge of science and technology. A fundamental assumption is that the creation of knowledge and the use of knowledge are closely connected. Scientists and technologists are the creators and society is the user. Everyone wishes that science and technology will develop technology that is good for society, but society does not know how to create it. Therefore, communication between society and scientists should be encouraged.

Pravich Rattanapian

Pravich Rattanapian expressed that the globalization of technologies and the emergence of knowledge-based economies and societies have given rise to tremendous opportunities to apply science and technology for developmental purposes. Both developed and developing countries are facing the problems of energy shortages, terrorism, spreading of new infectious diseases, and depletion of natural resources. There is ample room to learn from one another and to cooperate.

El-Zubair Taha

El-Zubair Taha identified HIV/AIDS in Africa as an immediate concern. "The most immediate population concern in Africa is HIV/AIDS with 25.4 million people living with ADIS in Sub-Saharan African alone. The need for appropriate biomedical, sociological, psychological AIDS research, and AIDS control programs need hardly to be stressed. Despite efforts to raise public awareness regarding AIDS precipitating factors, adult infection is up 7.4% with 2.3 million deaths a year among African children and adults. He asserted that there is much to be done at the national and regional levels for forming and reforming national knowledge institutions.

Arden Bement

Arden Bement observed that we have crossed a threshold into a new era in which new knowledge has the power to transform the human condition. The challenge is to harness and maximize this potential to benefit humankind through genuine collaboration and action. As director of the US National Science Foundation, he noted that he had a bird's eye view of research across all disciplines at the frontiers of discovery. Commitment to international cooperation requires a continuous search for ways to renew and deepen international partnerships. As science and engineering enterprises of today are international in scope, this is an absolute necessity.

Hajime Sasaki

Hajime Sasaki addressed "Toward Symbiotic Computing," a proposed approach to achieving continuous development towards a ubiquitous information technology society. Information mobility is rapidly improving. The scope of accessible information is expanding. However, whether advantages can be derived from such new opportunities, depends on the human ability to analyze and use the information. He stressed the importance of recognizing that new technology brings convenience to not only well-intended people but also malicious people. A symbiotic life in which anyone can use IT safely, securely, and appreciates its value can be achieved by combining computing technologies.

Hans van Ginkel pointed out how science and technology can contribute to society: "we must have the courage to re-think the ways in which we do things". Science and technology enjoy a high prestige in society, but it is not a given. This position must be deserved and come only with excellent performance. Crucial for success is close cooperation among experts from different fields of science. Proactively tackling future challenges and needs is absolutely essential for human well-being. Science and technology must focus on complexity, nuance, diversity, synergy, and process. To understand the real problems in everyday life, such as hunger, disease, poverty, and violence - close cooperation among all sciences is needed.

Hans van Ginkel

16:30-18:30 First Series of Concurrent Sessions

A1: Sustainability – Energy and Environment

To draw a perspective as to how science and technology can contribute to saving humankind in the 21st century from the crisis of the global sustainability upon which a series of warnings were presented in the 20th century. To seek ways to establish a social system that creates a harmonious advancement of energy, environment, and economy toward the restoration of global sustainability.

Session Chair:

- **Komiyama**, Hiroshi, *President, The University of Tokyo, JP*

Speakers:

- **Doucet**, Gerald, *Secretary General, World Energy Council, UK*
- **Phodhivorakhun**, Praphad, *Chairman, The Federation of Thai Industries, TH*
- **Rowland**, Sherwood, *Donald Bren Research Professor of Chemistry and Earth Systems, Science Department of Chemistry, University of California, Irvine, US*
- **Tai**, Ichiro, *Corporate Vice President, Toshiba Corporation, JP*

In the 20th century, an understanding of the challenges presented by energy and the environment began and this new century must be one of solutions. CO_2 is the dominant contributor, and will be for decades. Control of CO_2 concentrations, due to their long lifetime in the atmosphere and the near certainty of continued major use of fossil fuels, will be a major challenge. The world must implement significant changes to provide energy for growth of economies in much of the world, while reducing CO_2 emissions and other negative impacts on health and the environment. However, whether that can be done on a necessary scale is not evident, and in any case, adaptation of some global changes will be necessary. Participants agreed on the following points: (1) a climate change is underway; (2) it is driven by greenhouse gas emissions; (3) it will continue for some time as a result of past CO_2 emissions; and (4) climate change is disruptive to society.

B1: Life Sciences

Recent developments in life science, such as decoding human genome, protein synthesis, and regenerative medicine are remarkable. Moreover, the impact of developments in life science is all the more important as it is directly related to human life and our daily needs. What are probable major directions and impacts of life science and technology in the 21st century?

Session Chair:

- **Corr**, Peter, *Senior Vice President, Science and Technology, Pfizer Inc., US*

Speakers:

- **Hayashizaki**, *Yoshihide, Team Leader Genemo Exploration Research Group, RIKEN, JP*
- ***Mocumbi**, Pascoal, High Representative, European and Developing Countries Clinical Trials Partnership (EDCTP), MZ*
- ***Russell**, Alan, Director, McGowan Institute for Regenerative Medicine, University of Pittsburg, US*
- ***Tjian**, Robert, Professor, Molecular and Cell Biology, University of California, Berkeley, US*
- ***Akimoto**, Hiroshi, Managing Director, Member of the Board, MPDRAP Advisor, Takeda Pharmaceutical Co., Ltd. JP*

The world faces the best and worst of times in the development and delivery of health care. While advances in technology are quick in industrialized countries, developing countries in the world are struggling to control disease. Aging demographics, increased rates of infectious diseases, coupled with the increase in healthcare costs were creating "the perfect storm." A participant cited how genetic sequencing will lead to breakthroughs in medicine. The future of medical treatment, based on pharmaco-genetics, will create preventative medicines, individualized therapy, and tailor-made medicines. Not only will the general quality of life be improved, these developments will also reduce the public economic strain. However, these advances are not without problems. For example, there are questions of the ethical implications on the commercial use of genetic information. Collaborative relations that empower and enable the proper uses of technology must be encouraged. The panel members agreed that a global culture of shared accountability and commitment to human society must be developed.

C1: ICT's Impact on Human Society

How will ICT technological development impact: human society, business, work environments, and government services? Will it contribute to reducing the problem of lagging human welfare in the South?

Session Chair:

- ***Gage**, John, Chief Researcher and Vice President of the Science Office, Sun Microsystems, Inc., US*

Speakers:

- ***Barlow**, John Perry, Co-founder and Vice-Chairman of the Board, Electronic Frontier Foundation, US*
- ***Hara**, George, Managing Partner, Defta Partners, JP*
- ***Murenzi**, Romain, Minister of Education, Science, Technology and Scientific Research, RW*
- ***West**, Geoffrey, President, Santa Fe Institute, UK*

This session explored a number of issues and questions including:

(1) Equity - Is there a real digital divide?
(2) Are less privileged people in the south going to be able to use the new technologies to "leapfrog" the development patterns experienced in the north?
(3) Proprietary vs. open source systems,

Costs of proprietary software to the south are enormous. Brazil was spending more on licensing proprietary software than it did to fighting hunger, so now it is moving to open source systems. The Internet, with its enormous positive impacts, will also give way to a flood of data, of variable quality, giving rise to various issues. The participants agreed that to tackle these questions will require new ways of thinking, trans-disciplinary research, and a great deal of imagination.

D1: Capacity Building: Conditions of Knowledge-based Society - including Brain Drain, Brain Gain

We see now a "Knowledge-based Society" in which knowledge plays a central role in economic and social development. A competition over the economic use of new knowledge is going on worldwide. In order to create new knowledge, to develop applications, and to provide practical benefit to society, how can we best (1) motivate and educate human resources expected to continuously create and apply knowledge; (2) maintain the organizations (including universities) that provide thoughtful perspectives on applications; and (3) address questions of basic rights to access knowledge?

Session Chair:

- **Kroó**, Norbert, *General Secretary, Hungarian Academy of Sciences, HU*

Speakers:

- **Esaki**, Leo, *Chairman, Science and Technology Promotion Foundation of Ibaraki, JP*
- **Laffitte**, Pierre, *Senator, Vice-President, Parliamentary Office of Evaluation of Scientific & Technological Choices (OPECST), FR*
- **Motuzas**, Remigijus, *Minister of Education and Science, Republic of Lithuania, LT*
- **Shirakawa**, Tetsuhisa, *Deputy Minister, Ministry of Education, Culture, Sports, Science and Technology, JP*

How to establish competence was one of the most critical issues discussed. The brain drain issue has become more recognized than ever before. In particular, the reform of the higher education system is now required for attracting researchers. A panelist classified the issues around human resources in science and technology into three categories: 1) attracting outstanding researchers; 2) fostering human resources with response to societal needs; and 3) enlarging the basis of human resources for future scientific and technological activity. Brain drain and brain gain issues are of importance. Additionally, the panel agreed that public support is crucially important for science and knowledge.

E1: Science and Technology for Human Security

Science and technology have been contributing to improve the quality of human life. Science and technology are also expected to help maintain security, health, and play a role in preventing or mitigating disasters. How will science and technology be able to contribute to human security and peace keeping?

Session Chair:

- **Aho**, Esko, *President, Sitra Finnish National Fund for Research and Development, FI*

Speakers:

- **Chirwa**, John, *Minister of Industry, Science and Technology, Republic of Malawi, MW*
- **Choudhury**, Jamilur, *Vice Chancellor, BRAC University, BD*
- **Kourilsky**, Philippe, *former President, The Pasteur Institute, FR*
- **Noyori**, Ryoji, *President, RIKEN, JP*
- **Orbach**, Raymond, *Director, Office of Science, US Department of Energy, US*

This session focused on the advances in health care, life sciences, IT application, and many other fields, noting that all are shadowed by risks and threats to security and sustainability - including natural, manmade, accidental, neglectful, and intentional risks. The discussants agreed that most of the inventions of this century had originated with either a marketplace or a military need. To supplement science and technology, panelist agreed that more institutional, methodological, and social innovation is necessary. In the field of drug development, excessively high regulatory standards can multiply the cost of drug development. Just as there is evidence-based medicine, some discussants recommended "evidence-based regulation." "Knowledge-flow" will likely accelerate because of the global IT revolution. Energy shortages call for diversifying energy resources and creating suitable infrastructures for solar, thermal, sunlight, fusion power, biologically-derived fuels, hydrogen-based fuels, and others. Such transformational change can reduce the gap between energy usage and production, reduce conflict, and thereby promote security. Regarding the cost of meeting the highest regulatory standards, rich countries and markets can withstand that cost, while other countries and users can not. There is a tendency to globalize standards, but each nation should decide for itself.

F1: New Frontiers Opened by Science and Technology

Science and technology have explored the spatial frontiers, for example in the ocean, and between the earth and the rest of the universe. At the same time, science and technology have largely improved human's quality of life. What can we, humankind, expect from science and technology in the future? What kind of impact will advanced science and technology have on humankind?

Session Chair:

- **Newton**, Richard, *Dean of the College of Engineering and the Roy W. Carlson, Professor of Engineering, University of California, Berkeley, AU*

Speakers:

- **Tanahashi**, Yasufumi, *Minister of State for Science and Technology Policy, JP*
- **Bai**, Chunli, *Executive Vice President, Chinese Academy of Sciences (CAS), CN*
- **Endy**, Andrew, *Fellow, Assistant Professor, Biological Engineering Division, Massachusetts Institute of Technology (MIT), US*
- **Kusaka**, Kazumasa, *Vice-Minister for International Affairs, Minister of Economy, Trade and Industry (METI), JP*
- **Laughlin**, Robert, *President, The Korea Advanced Institute of Science and Technology (KAIST), US*
- **Morris**, *James, Vice President, Engineering and Manufacturing, The Boeing Company, US*

The panel made the following predictions:

(1) Applications of nanotechnology findings will be expanded further, especially in developing new nanomaterials and nanostructures;

(2) A revolutionary change will occur in energy usage according to the full development of hydrogen fuel cells for guaranteeing energy security and reducing carbon monoxide emissions;

(3) New kinds of software will be developed, capable not only to support knowledge, but also to transmit knowledge from one generation to the next, thus speeding up future discoveries;

(4) A massive change in daily life will occur with the introduction of many kinds of robots;

(5) More knowledge on catastrophic events on earth (e.g. earthquakes, hurricanes, etc.) and on the consequences of the natural warming of the environment.

In addition to these predictions, the panel concurred on the need to improve the efficiency of interdisciplinary research centers. It has been also recognized that research, especially at its basic stage, may not directly generate big economic advantages, but as a spin-off effect, will certainly have a positive effect in forming the right mentality in youths, especially in motivating them.

19:30-21:30 Official Seated Dinner

Master of Ceremonies:

- **Tsukamoto**, Hiroshi, *President, Japan External Trade Organization (JETRO), JP*

Speakers:

- **Lazaridis**, Mike, *Founder, President and Co-Chief Executive Officer, Research In Motion Limited, CA*
- **Wigzell**, Hans, *Director, Karolinska Institute, SE*

Hiroshi Tsukamoto extended his thanks to the participants of the STS *forum*. He relayed how impressed he was with the Japanese Prime Minister's "cool biz" policy and his commitment towards the issue of global warming. It is sometimes difficult coordinating what is right into real committed action.

Mike Lazaridis conveyed his passion for physics and noted that it is the international year of physics and also the 100th anniversary of Albert Einstein's miracle year. In 1905, people believed that theirs was the advanced society and it could not get any better. In 2005, the belief is still the same. However, the discoveries made in science now and over the next decade will last and build the society and technology of the future.

Hans Wigzell talked about the speed of progress. In 1983, when the HIV virus was discovered, it took two 2 years to analyze it. In contrast, it took roughly 2 weeks to find out about SARS. The current speed of information is phenomenal and the complexity of science is increasing. The challenge is not only to keep graduate students excited, but also to transfer that feeling to politicians and decision makers. The basic point is to inform.

SEPTEMBER 12, 2005, MONDAY

08:00-9:30 Plenary Session "Setting the Tone"

Session Chair:

- **Yeo**, Philip, *Chairman A*STAR (Agency for Science & Technology and Research), SG*

Speakers:

- **Tonegawa**, Susumu, *Picower Professor of Biology and Neuroscience, Massachusetts Institute of Technology (MIT), JP*
- **Hassan**, Mohamed, *Executive Director, Third World Academy of Sciences (TWAS), SD*
- **Wambugu**, Florence, *Chief Executive Officer, A Harvest Biotech Foundation International (AHBFI) KE*
- **Lee**, Yoon-woo, *Vice Chairman and Chief Executive Officer, Samsung Electronics Co., Ltd., KR*

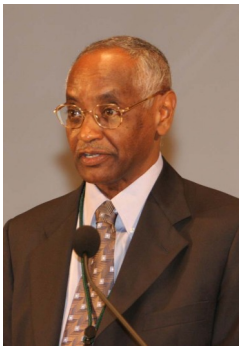
Philip Yeo

Philip Yeo stated that the specialization and fragmentation of science and technology has made the acquisition of new knowledge and skills require longer education and training time. In some nations and societies, the rigorous pursuit necessary for an education in science and technology has made it less attractive. Nations and societies that are successful in expanding their science and technology human capital will gain a competitive advantage. This is the key challenge for nations and societies, especially developing ones.

According to **Susumu Tonegawa, t**he 20th century was a period when physics went through an amazing revolution. In the second half of the 20th century, biological sciences went through a revolution. The discovery of the DNA double helix and the emergence of molecular biology uncovered the secret of life. Today, this knowledge is widely being used for the benefit of society in medicine, agriculture, and

Susumu Tonegawa

many other fields. The hallmark of the human being is in its mental self. The highly evolved brain and the central nervous system enables sophisticated mind activities such activities such as creation, abstraction like mathematics, languages, and all scientific pursuits, and technological inventions. For the first time, research on all these human activities is now being combined into one discipline of science that might be broadly called brain research. The U.S. Congress declared the 1990's as the decade of the brain and Tonegawa proposed that this century, the 21st century, would be the century of the brain.



Mohamed Hassan

Mohamed Hassan reported that scientific capacity building in research, education, and communications has been at the heart of the Academy of Science for the Developing World since its inception 22 years ago. He said the Academy's primary objective has been to promote scientific and technological capabilities and to encourage the pursuit of scientific excellence in research and education in developing countries. It is important to note that scientific capacity building is a critical challenge for the developed world as well. A nation's capacity building efforts are more likely to succeed if that collaboration is done with others. The good news is that collaborative scientific capacity building is now easier to pursue than ever before.

Florence Wambugu said that science and technology had made unprecedented breakthroughs in all spheres of life, bringing enormous wealth and prosperity to developing countries. However, the majority of people in developing countries, especially Africa and Asia are still poor, hungry, and undernourished. The core problem with the developing countries, especially Africa is the lack of investment in R&D, especially in science and technology, even in agricultural research. Africa has about 800 million people of which 200 million are undernourished.

Florence Wambugu

Out of them, 20 million are on food aid, provided by the developed countries. Wambugu said that there must be a more sustainable way to help developing continents through science and technology; through wide partnerships that involve technology transfer, capacity building, keeping the African scientist in Africa, and providing some infrastructure where they are able to practice the science they have learned. Otherwise they become brain drained and never return. The many challenges in Africa and developing countries cannot be solved without investment in science and technology.

Yoon-woo Lee

Yoon-woo Lee addressed the positive and negative influences information society has on society and how they should be dealt with. The recent advancements in digital information technologies and Internet distribution have brought dramatic changes. They have mainly been used for business, entertainment, and information activities. While it can be said that IT so far has been focusing on business, government, and individuals; it is projected that ICT in the future will expand its usage to include problem solving. The most common problems that threaten humankind today are the aging population, safety, natural disasters, and environmental issues. ICT in the health care industry has been attracting much attention with the aging population and the decrease of the economically productive population. Positive applications of ICT have come hand in hand with negative aspects, which include hacking, violation of privacy, and the circulation of unhealthy information. Lee concluded that what is of importance is how to utilize IT in order to promote social acceptance and dissemination of new technologies.

10:00-12:00 Second Series of Concurrent Sessions

A2: Sustainability - Energy and Environment: Global Warming and CO_2 Emission Control

The world has become aware of the problem of global warming, and most accept the necessity to reduce projected CO_2 emissions. As an outcome of efforts of many countries, the Kyoto Protocol came into force on February 16, 2005 although some nations have not yet signed the agreement. How should the international community address CO_2 emission controls beyond the Kyoto Protocol provisions? If we do not act significantly and soon to reduce projected CO_2 emissions, what will happen to our climate and to extreme weather events? How can we solve this issue without hindering economic development?

Session Chair:

- **Salje**, Ekhard, *President, University of Cambridge, UK*

Speakers:

- **Acosta**, Nereus, *Congressman, House of Representatives, PH*
- **Gagosian**, Robert, *President and Director, Woods Hole Oceanographic Institution, US*
- **Kawaguchi**, Yoriko, *Special Assistant to the Prime Minister, JP*
- **Kaya**, Yoichi, Associate Director for Research for Joint Program, Research Institute of Innovative Technology for the Earth (RITE), JP

All panelists agreed on the necessity for conservation. While many believed that the mitigation of consequences is the primary approach to dealing with global warming, some believed that the action to slow warming is urgent. The comparison of costs and risks is unclear, as is the future mix of energy options. Industry will not and cannot act without more clarity. There was a consensus that economic growth need not be sacrificed in principle (on a timescale in which new technologies can be implemented). There were different perspectives on the cost of nuclear power. There were also differences in the coal option due to very different coal qualities (e.g. 6% vs. 30-40% ash). The panel concurred that there is widespread awareness, but not enough traction and or action. So a multi-dimensional program is needed, including: government incentives and subsidies; and use of markets, by understanding the economics. The panel agreed that the carbon economy drives global warming. There is an economic case for nuclear, but there are issues of waste disposal and public perception.

B2: Life Sciences: Ethical Aspects of Stem Cells and Regenerative Medicine

There is opposition on ethical grounds to obtaining human stem cells to use in regenerative medicine. On the other hand, there are high hopes for this type of medicine for people who have no hope to be healed by other means. How should humankind deal with this issue?

Session Chair:

- **McLaren**, Anne, *Group Leader, The Wellcome Trust/Cancer Research UK Gurdon Institute of Cancer and Developmental Biology, UK*

Speakers:

- **Burrill**, Steven, *Chief Executive Office, Burrill & Company, US*
- **Murray,** Thomas, *President and Chief Executive Officer, The Hastings Center, US*
- **Nielsen,** Linda, *Rector, University of Copenhagen, DK*
- **Tandon**, P. N., *President, National Brain Research Center, IN*
- **Ten Have**, Henk, *Director, Division of Ethics of Science and Technology, UNESCO, NL*

The panelists believed that how to deal with science and use it within humanity, for example in balancing economic and health benefits, was of significance. Educating the populace is critical to advancing not only science, but also the general understanding of the balance between ethical considerations and scientific discovery. Another important aspect of better education is to avoid sensationalizing advancements in science, so that the public is not led to unrealistic expectations in the time between scientific discovery and practical therapeutic usage.

C2: ICT's Impact on Human Society: Interoperatibility

To secure interoperability is becoming more and ore significant for further applications of ICT within society, which is leading to calls for standardizations. What will be the issues and obstacles to standardization in ICT? Who will be in charge of solving these issues? And how should they be solved?

Session Chair:

- **Anzai**, Yuichiro, President, Keio University, JP

Speakers:

- **Bentzin**, Ben, *Chief Executive Officer, World Congress on Information Technology, US*
- **McCoy**, Thomas, *Executive Vice President, Legal Affairs and Chief Administrative Officer, ADM, US*
- **Murakami,** Mitsuo, *Senior Vice President, Systems Engineering Department, NTT Communications Corporation, JP*
- **Nishimura**, Koichi, *Member of the Board of Directors, Fortinet, JP*
- **Rombach**, Dieter, *Executive Director, Fraunhofer Institute for Experimental Software Engineering (IESE), DE*

The full impact of the ICT revolution will not be fully realized until interoperatibility is achieved. The fragmentation resulting from lack of interoperatibility tends to slow down the uptake of technologies and to complicate their use. In addition, it limits the spread of a network of users, where the ultimate strength of the ICT revolution can be felt. Interoperatibility requires setting some common standards that are accepted by designers and manufacturers, not only consumers. There are risks associated with interoperatibility. If unsecured and secure systems are allowed to integrate, security will be compromised. In the same vein, people are tempted to use some systems, like SMS on mobile phones, because of their simplicity and interoperatibility to undertake sensitive transactions, such as banking, despite current inadequate level of security. ICT is a global phenomenon and global decision-making is slow. Government driven processes tend to seek political consensus rather than best serving the needs of society. The advantages are transparency of inter-governmental agreements and it is possible to issue interim standards while the negotiations are still proceeding. That is common in the EU experience. Inevitably, competition means that in the early stages of technological development there will be different standards as producers market their new products. There is a crucial need for convergence towards one standard that will allow interoperatibility. However, while common standards are highly desirable, they can be harmful when they slow down the pace of change or when they are adopted too early. Standards should be flexible and expandable. It is desirable to see the governments acting as a trusted party, disseminating information, and encouraging interoperatibility.

D2: Capacity Building: Science Education and Communication

Gilbert Omenn

Improving ordinary people's capability to understand science and technology is a worldwide problem. There is broad concern that science may become increasingly like "a black box" for most of the public and that children and student might be "shunning away" from science. How can the educational system, including continuing education for all ages, improve all people's capacity to understand science and technology and let them fell it closer? How can educators and scientists help all people to appreciate the scientific methods of observation, experimentation, and challenge of prevailing views, especially when faith and religious beliefs dominate many people's thinking?

Session Chair:

- **Omenn**, Gilbert, *President, American Association for the Advancement of Science (AAAS), US*

Speakers:

- **Ernst**, Richard, *Professor Emeritus, Laboratory of Physical Chemistry, ETH - Swiss Federal Institute of Technology, CH*
- **Holmgren**, Sven-Olof, *Professor of Elementary Particle Physics, Stockholm University, SE*
- **Hopt**, Klaus, *Vice President, German Research Foundation (DFG), DE*
- **Shuler**, Sally, *Executive Director, National Science Resources Center (NSRC), US*
- **Syka**, Josef, *President, Czech Science Foundation, CZ*
- **Xue**, Lan, *Director, China Center for Science and Technology Policy, Tsinghua University, CN*

The two main themes of this session were: (1) ways of teaching, learning and understanding mathematics, science and technology; and (2) ways of thinking about the physical biological, behavioral and social worlds. One panelist suggested that there are two ways of learning, "discovery learning" and "mastery learning." There is a trend of the declining interest of youths in science. The panelists believe the issue on science as a "black box" is well-known, but that the real challenge is the size of the box. Although many organizations have tried to tackle the "black box," the gap between science and children is widening. Major concerns addressed in further discussion were: better communication for science education; attention to the medium of communication; and exchanging good practices more effectively - the exchange can also be useful for developing countries to narrow the gap of capacity building ability. There was an observation that the pattern of students' interest in science differs across countries. Finally, the session ended on the note that wider participation is needed in science education.

E2: Science and Technology for Human Security: Infectious Diseases

Infectious diseases are a continuing and unpredictable threat. Meeting that threat is complicated by the high and increasing costs of dealing with rapid development of drug resistance. How can we deal with this problem, using science and technology?

Session Chair:

- **Rubinstein**, Ellis, *President and Chief Executive Officer, New York Academy of Sciences, US*

Speakers:

- **Arai**, Kenichi, *Trustee, Tokyo Metropolitan Organization for Medical Research, JP*
- **Gallo**, Robert, *Director & Professor, Institute of Human Virology, University of Maryland Biotechnology Institute, US*
- **Matangkasombut**, Pornchai, *President, Mahidol University, TH*
- **Montagnier**, Luc, *President and Co-Founder, World Foundation for AIDS Research and Prevention, FR*

There was agreement among the panel for the need to prepare for an "epidemic tsunami" of unknown cause and proportion. Emerging or re-emerging germs, e.g. avian flu, are increasing because of travel and globalization. There is also an increase of chronic diseases like cancer and Parkinson's, due to aging, climate changes, food and nutrition variables, and other factors. For a disease such as AIDS, numerous solutions must be found since a single one may not cure the disease, and stronger strains are evolving steadily. 3 major needs exist: (1) getting the drugs to people everywhere; (2) dealing with drug resistance; and (3) developing a preventive vaccine for HIV. Antibodies that block the virus "at the gate" offer a promising vaccine possibility. Now that more nations have experience and capability in fighting or controlling infectious diseases, greater collaboration between more nations is called for. The time and ability to conduct "network research" has arrived.

New knowledge is necessary to fight infectious diseases and better apply the existing knowledge, through improved public health systems, cleaner water, better sanitation, and other fundamentals. Panel recommendations were: (1) develop high-impact initiatives to produce an online global database providing up-to-date information on global health challenges; (2) better integration and planning with respect to infectious diseases; (3) hold a forum for global discussions of social, philosophical, and ethical issues presented by the potential of a new pandemic; and (4) radically reforming the global public health infrastructure.

F2: New Frontiers Opened in Nanotechnology

What are the latest opportunities offered through research and development in the NT field? What can we expect from the development of NT in the near future; in the long-term future? What are the fears and risks of these latest applications?

Session Chair:

- **Kishi**, Teruo, *President, National Institute for Materials Science, JP*

Speakers:

- **Bhandhubanyong**, Paritud, *Director, National Metal and Materials Technology Center (MTEC), TH*
- **Ferrari**, Mauro, *Professor of Internal Medicine, Mechanical Engineering and Materials Science, Ohio State University, US*
- **Singer**, Peter, *Director, University of Toronto, Joint Center for Bioethics, CA*
- **Williams**, R. Stanley, *HP Senior Fellow and Director, Quantum Science Research, Hewlett-Packard Laboratories, US*

Rapporteur:

- **Tanthapanichakoon**, Wiwut, Director, National Nanotechnology Center, TH

The high priority of nanotechnology in the research and development strategy of many nations is now a reality. The future benefits that nanotechnology may bring include using nanoparticles or nanovectors to check and manipulate biological cells and solve dramatic problems for entire humanity such as cancer. Another example may be to use nano-structured materials to build more affordable and flexible high-efficiency energy conversion devices such as photovoltaic cells. This action will counteract the unavoidable future energy shortage problem. This may include the development of revolutionary photovoltaic cells based on completely new principles and capable of energy storage in the infrared light field. The importance of using nanotechnology for ensuring a pure water supply and solving pollution problems were also discussed. These issues may be resolved with the development of new filter devices whose structure and functionality will be designed on the nanometer scale. In the field of nanotechnology applied to advanced issues of medicine, it has been predicted that cancer therapies will be greatly improved especially regarding two main aspects: the improvement of cancer detection procedures using biological fluids and thoroughly searching for tiny combinations of cells, indicating the presence of cancer in the human body by screening the nanostructure of blood; and, the improvement in drug delivery procedures for the treatment of metastatic cancers with high selectivity, without inducing major collateral effects. On the ethical side, however, the development of the above nanotechnology tools will involve problems, mainly related to the necessary disclosure of genetic information from individuals in order to precisely locate the most appropriate therapies and treatments. To provide strategic focus to nanotechnology efforts, project priorities have to be carefully selected and common plans built with a total view in mind. All in all, nanotechnology is not a “quick play” but is a goal that must be pursued over several decades.

12:15 – 13:15 Working Lunch: Women in Science

Speakers:

- **Friedman**, Jerome, *Professor, Massachusetts Institute of Technology (MIT), US*
- **Wallberg-Henriksson**, Harriet, *President, Karolinska Institutet, SE*
- **Colwell**, Rita, *Distinguished Professor, Center for Bioinformatics and Computational Biology, University of Maryland, US*

According to **Jerome Friedman**, while there has been progress in recent decades in increasing the participation of women in science, there is still a long way to go. There are two basic reasons why the number of women in science has to be increased, he insisted.

First, there are many serious problems afflicting the world that can be mitigated by applications of science and technology, and half of the talent cannot afford to be lost; and the second reason is a question of fairness. All members of society, irrespective of gender, race, and ethnicity should be given the encouragement and opportunity to fulfill their potential.

Harriet Wallberg-Henriksson remarked that even with the significant progression of the proportion of women professors at Karolinska over the past couple of years, it is still 17 percent. The Karolinska Institutet conducted a study in 2001 of the working conditions of men and women senior lecturers and analyzed the differences - women had lower salaries, fewer career years, fewer active and examined Ph.D. students, more teaching hours, and less working space.

Rita Colwell emphasized mathematics as a very important gateway to science and engineering that deserves special attention. Today, far too many females fail to even cross the threshold into science and engineering. Colwell went on to explain that the 21st century is the age of knowledge and knowledge is currency. It is important to educate women at every level. It is important for public health, economics, and the vitality of each nation.

13:30 -15:30 Third Series of Concurrent Sessions:

A3: Sustainability - Energy and Environment: Long-term Energy Paths

What should we do given the outlook of: (1) global energy demand and supply, especially rapidly growing demand in developing countries; and (2) future technology, energy conservation, nuclear power, renewable energy, cleaner use of fossil fuels, and hydrogen in the future. Which combination will be the best to use, and how can we, developed and developing countries, work together in this challenge?

Session Chair:

- **Kodaira**, Nobuyori, *Director-General, Agency for Natural Resources and Energy, JP*

Speakers:

- **Brouwer**, Hugo, *Director General for Energy, Dutch Ministry of Economic Affairs, NL*
- **Gopalakrishnan**, Adinarayantampi, *Honorary Professor, Energy and Security Department, Administrative Staff, College of India, Hyderabad, IN*
- **Jacometti**, Jack, *Vice President, Shell International Gas Ltd., UK*
- **Richter**, Burton, *Director Emeritus, Stanford Linear Accelerator Center, US*

Oil and gas, at current use rates, would last approximately 40 to 70 years. Fuel must be used more efficiently and an increased share for nuclear must be achieved. There should be as much renewable energy contribution as possible, even though energy density is low.

Global approaches are needed, including in science and technology. Points on which the panel was unanimous in this session were: expediency in conservation, efficiency, and public awareness. Engaging developing countries is critical. There are a range of potentially important R&D directions in the bio area, that is, biometrics-copying natural process to make hydrogen. The panel agreed on the importance of nuclear fuel and of closing the fuel cycle. Cooperation among government, industry, and international parties is necessary. Bioenergy presents diverse and complex possibilities that need exploration. Nuclear is an option, but policies differ.

B3: Life Sciences New Applications of Genomics to Agriculture

It is hoped that applying genetic engineering to agriculture will increase food production and improve nutritional quality. At the same time some people are skeptical about applying genetic engineering to agriculture, on safety or environmental grounds. What is the current situation of agricultural biotechnology? What regulatory and information environment is needed to apply genomics to agriculture in ways broadly acceptable to society? There is need to harmonize international trade regulations for transgenic seeds and foodstuffs.

Session Chair:

- **Peacock**, Jim, *President, Australian Academy of Science, AU*

Speakers:

- **Datta**, Asis, Director, *National Center for Planet Genome Research New Delhi, IN*
- **Fauquet**, Claude. *Director, International Laboratory for Tropical Agricultural Biotechnology, Danforth Plant Science Center, FR*
- **Fischhoff**, David, *Director, Technology Strategy and Development Department, Monsanto Company, US*
- **Thomson**, Jennifer, *Professor, Department of Molecular and Cell Biology, University of Cape Town, ZA*
- **Kast**, Hans, *President and Chief Executive Office, BASF Plant Science Holding GmbH, DE*

Jim Peacock

In the next 30 years, the world's food production must double to keep pace with global needs. Food production must be done more reliably and on less land than before. The demands are great, but there is a great opportunity to meet this demand with genomic and other plant related technology. Currently, plant biotechnology is at an impasse. The science and technology is available, developed in a relatively short time period in recent years. This has resulted in significant improvements in the breeding of transgenic organisms. However, the world has largely not accepted the idea of eating genetically modified food. To say no to these new developments is to cause serious negative consequences to human health and human life. Discussions centered on engendering intelligent public debate on the usefulness of various gene-based technologies. One of the major hurdles in this regard is in improving the popular image of GMOs. Scientists should find a way to communicate the potential role that these new technological advances can play in the service of society.

The pressing need to increase the yield of crops and also plants, to meet the exponentially growing needs of feeding and fueling human society was discussed. Naturally, the benefits should be balanced against the risks in pursuing these goals. That is, in the development of GMOs, close attention should be given to the impacts on humans, animals, and the environment. In Europe, a stakeholder dialogue has begun between the state, private sector, and consumer groups. Together with political leadership, a consensus in the general population is the basis to move forward. In sum, the way forward is through creative partnerships between different stakeholder (business, state, farmer, consumer, etc.) groups from which consensus can emerge.

C3: ICT's Impact on Human Society: Digital Archiving

A "digital library" is not just collection of text and data in digital form. To be sure, a collection is part of such a library, and by itself that enables a number of good things-easy and inexpensive distribution of humankind's totality of collected knowledge to the developing world.

Session Chair:

- **Omi**, Asako, *Professor, Research Institute of Science and Technology, Tokai University, JP*

Speakers:

- **Adly**, Noha, *ISIS/ICT Director, Department of Information and Communication Technology, Library of Alexandria, EG*
- **Hung**, Ta Ba, *Director, National Center for Scientific and Technological Information (NACESTI), VN*
- **Keller**, Michael, *University Librarian, Green Library, Stanford University, US*
- **Murakami**, Norio, *Vice President, Google Inc., JP*
- **Okerson**, Ann, *Associate University Librarian, Yale University, US*
- **Zich**, Otto, *Chairman of the University Council, University of Salzburg, AT*

Asako Omi

There is a need for new search engines based on semantic analysis, which provide credibility to the data they retrieve and can accommodate multiple languages. These engines have to tackle a large amount of data that is unstructured, unorganized, and in several different formats. A new information infrastructure is needed to support scholarship, especially for allowing young researchers from developing countries to publish their work. Effective on-line publishing must address quality control and peer review issues. Institutional repositories can serve as a building block for the development of the desired new infrastructure but they need to go beyond normal publishing regimes. They should not only capture and store, but also nurture objects with metadata, provide safe storage, manage assets carefully, migrate objects as formats change, and

provide transparency. There are also other challenges represented in the cost, the expandability, and privacy and rights management. However, they will be most viable and sustainable when they are built on open standards. Meeting the technological and financial challenges of developing countries is essential if they are to have their digital libraries of the future and join the international digital library community. Digital libraries need a robust digital infrastructure, which is difficult to achieve in developing countries with limited means. Other challenges for them include access to digital databases (essential for research and competitiveness), dealing with language minorities, and the provision of adequate content. A success story has been reported in Vietnam where digital libraries have been deployed in rural areas, creating hubs of knowledge villages. Digital archives and active digital libraries are the future. There are many experiments ongoing and new ideas are evolving and new developments will continue.

D3: Capacity Building: University Reform

Many universities in the world are now facing a passing through a difficult situation in that they are not able to create the world-class research and the education expected by the society and the corporate world. What reform is needed for universities to meet these expectations?

Session Chair:

- **Zehnder**, Alexander, *President of the Board, ETH - Swiss Federal Institute of Technology, CH*

Speakers:

- **Badran**, Ibrahim, *future President, Nile University, EG*
- **Bassi**, Davide, *Rector, The University of Trento, IT*
- **Kirtikara**, Krissanapong, *President, King Mongkut's University of Technology Thonburi (KMUTT), TH*
- **Leslie,** Ian, *Pro-Vice-Chancellor, Research, University of Cambridge, UK*
- **Nagata**, Toyoomi, *Chancellor and President, Ritsumeikan University, JP*

Rapporteurs:

- **Burnside**, Mary, Vice Chancellor, Research, University of California, Berkeley, US
- **Moore**, C. Bradley, Vice President, Research Department, Northwestern University, US

The key to successful reform would be an external review, strategic planning, diversity, and strong leadership. Globalization was a recurring topic throughout the session,

Alexander Zehnder

and it was seen as an important factor in considering university reforms. Stimulating the cooperation between universities and increased mobility of academicians, students, and staff were presented as possibilities. Reform policies in one country may not work well in others. Based on demographics and populations, different countries have different needs.

E3: Science and Technology for Human Security: Science and Technology to Reduce the Vulnerability of Critical Infrastructures

Disruption of infrastructure has been caused intentionally by activities such as cyber terrorism or terrorists' attack on transport facilities. Damage can also be the result of accidents or infrastructure weakness or overloads, for example leadings to power blackouts or an atomic power accident. How can science and technology be used to increase the resilience of infrastructures? If major incidents or accidents occur, what can science and technology do in order to minimize the damage?

Session Chair:

- **Shah**, Haresh, *Professor Emeritus, Stanford School of Engineering, Stanford University, US*

Speakers:

- **Pan,** Tso-Chien, *Dean of Civil and Environmental Engineering, Nanyang Technological University, US*
- **Ross**, Nick, *Independent Journalist and Newscaster, UK*
- **Van Anne**, Craig, *Chief Executive Officer, OYO RMS, US*
- **Yakushiji**, Taizo, *Member of the Council for Science and Technology Policy, JP*

The panelists agreed that science and technology can be used to implement building codes, and improve dams and waterways. It is believed that all infrastructure risk cannot be eliminated. So the risk should be diversified. Economic loss from disaster is on the increase because of population growth and coastal and urban concentration. In making a "system assessment," avoid single point solutions. After September 11 the assessment was about individual infrastructure components - employing "smokestack thinking." A more integrated analysis on how to handle infrastructure-affecting emergencies is needed, as demonstrated with Hurricane Katrina in the US.

It proved that science will fail if human systems do not work well. In assessing how to use science and technology to reduce risks to critical infrastructure, one must consider: 1) hard infrastructure such as transportation systems, water systems, power plants, and hospitals; and (2) soft infrastructure such as the command and control systems. How these work together will determine the outcome.

F3: New Frontiers Opened in ICT

What is the present situation and near future prospects of research and development in the ICT world? What possibilities will the development of ICT offer us in a longer range?

Session Chair:

- **Elliott**, Roger, Treasurer, International Council for Science (ICSU), UK

Speakers:

- **Bishop**, Robert, *Chairman and Chief Executive Officer, Silicon Graphics, Inc., US*
- **Fayyad**, Usama, *Chief Data Officer and Senior Vice President, Yahoo! Inc., US*
- **Mundie**, Craig, *Senior Vice President & Chief Technical Officer, Advanced Strategies & Policy, Microsoft Corporation, US*
- **Nakamura**, Michiharu, *Executive Vice President and Executive Officer, Hitachi Ltd., JP*
- **Sekiguchi**, Satoshi, *Grid Technology Research Center, Director, National Institute of Advanced Industrial Science and Technology (AIST), JP*

Developments of both hardware and software have to be focused on the actual needs of the consumers. The world is entering into a digital era in which everything will be digitalized, stored and then transferred easily. However, analyses of data in real time and the ability to extract "intelligence" out of these data will be mandatory. Information navigation is still a problem and the best "algorithms" to navigate are yet to be established. It is necessary to know if what we read is true and a tool must be developed to understand if the information retrieved from the web is reliable and to what extent. Search information has to be used in an intelligent way to predict future market trends and to reduce marketing risks. One of the answers for solving the above problems will be to build new human/computer interfaces with a better efficiency and is easier to use. A continuous search for an answer on whether ICT actually makes people happier or not and to drive future research efforts on clarifying this issue is essential.

16:00-18:00 Fourth Series of Concurrent Sessions

A4: Sustainability - Energy and Environment: Strategies for Efficient and Renewable Energy Use

How and to what extent renewable energy can penetrate into the energy market? What are required policies to promote those energy supply systems to reduce CO_2 emissions? Is there an efficient framework to promote renewable energy system internationally, and or domestically, especially in the developing world?

Session Chair:

- **Ishitani**, Hisashi, *Professor, Graduate School of Media Governance, Keio University, JP*

Speakers:

- **Pereira de Carvalho**, Eduardo, *President, São Paulo Sugarcane Agroindustry Union (UNICA), BR*
- **Gonzalez-Finat**, Alfonso, *Director, EC Transport and Energy Directorate, European Commission, BE*
- **Hirst**, Neil, *Director, International Energy Agency (IEA), UK*
- **Masuda**, Yukio, *Senior Executive Vice President, Mitsubishi Corporation, JP*
- **Reilly**, John, *Associate Director for Research for Joint Program, Massachusetts Institute of Technology (MIT), US*

This session focused on new and renewable energy options, taking into account that local conditions impact these options. In the past economic consideration prevailed over environmental factors. Now, a most important challenge is the implementation of efficiencies to combat CO_2 emission on a global scale. There was a consensus that other new and renewable options still need R&D. Key factors affecting efficiency are: public attitudes; standards; incentives for market deployment; and R&D. One recurring theme was that government subsidies were necessary to explore some of the new and renewable energy options. The panel agreed on the importance of identifying long-term solutions and bringing developing countries together with industrialized countries. The Gleneagles Plan of Action on Climate Change Clean Energy and Sustainable Development is very important to achieving a "clean, clever, competitive energy future." Conservation is of vital importance.

B4: Life Sciences: Translation of Science to the Marketplace - The Development of Medicine for Global Health

What will be a suitable form of medical development in order to promote human health all over the world, including poor populations? When an outcome of science and technology is brought to the marketplace as a product, how can health benefit to the public be maximized consistent with appropriate benefit (and therefore incentive) for the company that developed the product?

Session Chair:

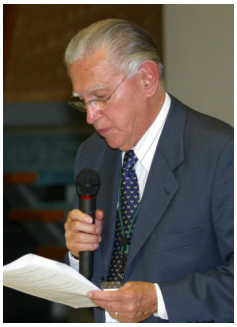
- **Krieger**, Eduardo, *President, Brazilian Academy of Sciences, BR*

Speakers:

- **Cassell**, Gail, *Vice President of Infectious Diseases, Eli Lilly and Company, US*
- **Laoubdia-Sellami**, Karim, *Director, Campaign for Access to Essential Medicines, Medecins Sans Frontieres (MSF), FR*
- **Marshak**, Daniel, *Vice President and Chief Technology Officer, Cambrex Corporation, US*
- **Yamada**, Tadataka, *Chairman, Research and Development, GlaxoSmithKline, JP*

Rapporteur:

- **Choudhary**, Muhammad, *Iqbal, Acting Director, H.E.J. Research Institute of Chemistry, University of Karachi, PK*



Eduardo Krieger

This session addressed the need to design new systems that assist in the identification, treatment, and prevention of disease. Further, in order to improve the quality of human life, people must be educated and adapt a healthy lifestyle. For the benefit of humanity as a whole, developing countries must have access to the scientific and technical information necessary for improving health and welfare facilities. Improving access to higher education and the infrastructure to support scientific and technological progress is therefore essential. Global systems need to be developed in order to deal not only with drug delivery and treatment, but also for general education. A solution was presented for the conundrum of developing drugs for neglected diseases, such as malaria and tuberculosis. A number of public-private initiatives in this regard have been initiated by both the Rockefeller Foundation and the Gates Foundation. Unfortunately, the public sector has lagged behind these initiatives in terms of funding, though several governments have backed these efforts. One of the results of these initiatives is that as of 2005 there will be six new drugs in clinical trials for the treatment of tuberculosis.

C4: ICT's Impact on Human Society: Security/Privacy

It is essential to guarantee appropriate privacy of information, but public security and law enforcement also have needs for access to certain information. Based on ethics, which principles should we respect in order to protect private information appropriate limit on access to information for public security reasons?

Session Chair:

- **Ito**, Joichi, *President and Chief Executive Officer, Neoteny Co., Ltd., JP*

Speakers:

- **Fruchterman**, James, *President and Chief Executive Officer, Benetech Initiative, US*
- **Goggans**, Chris, *President, Security Design Inerational Inc., US*
- **Ilolov**, Mamadsho, *President Academy of Sciences, TJ*
- **Shirai**, Katsuhiko, *President, Waseda University, JP*

The primary concern on the issue of privacy was not so much the commercial intrusion into the lives of individuals, but the potential abuses of governments against the rights of privacy of their citizens. After much debate, the participants opted for supporting "Privacy for citizens and transparency for governments." National security may call for the access of the enormous data assembled on each individual. However, this should be subject to judicial approval based on probable cause. The Privacy issue would be best addressed in a Human Rights framework that draws on the established formulations in the Universal Declaration and other documents, extending them from "papers and correspondence" to include e-mail and other forms of electronic and digital communication. Indeed the issue was seen to be central to democracy. In many cases this privacy – or even anonymity – made possible by the Internet was giving voice to freedom and advancing the cause of liberty. Calls for the limitation of this privacy in the name of national security were being made by autocratic and not just democratic governments. It was going to be very difficult to differentiate between cases and it was therefore better to start from the Human Rights framework.

D4: Capacity Building: Intellectual Property Rights

The outcomes of research and development need an appropriate balance of protection of intellectual property rights to promote future progress of R&D and availability to the public and to other researchers to continue progress. They are problems for researchers due to inconsistencies in intellectual rights systems between different countries. How can this situation be improved? Can more global standards for intellectual property rights be established?

Session Chair:

- **Arai**, Hisamitsu, Secretary General, Intellectual Property Strategy Headquarters, Cabinet Secretariat, JP

Speakers:

- **Brimelow**, Alison, *President-Elect, The European Patent Office, UK*
- **Chu**, Victor, *Chairman and Chief Executive Officer, First Eastern Investment Group, HK*
- **Meyers**, Mark, *Visiting Executive Professor of Management, The Wharton School, University of Pennsylvania, US*
- **Nowotny**, Helga, *Chair, European Advisory Board - EURAB, AT*
- **Yu**, Geoffrey, *Deputy Director General, Economic Development Sector, World Intellectual Property Organization (WIPO), SG*
- **Wilbanks**, John, *Executive Director, Science Commons, Creative Commons, US*

This session focused on international property rights. The purpose of the Intellectual Property (IP) system is twofold: (1) to give incentive to creators by granting exclusive rights in order to promote development of science and technology; and (2) to ensure public access to benefit of such development. The IP system is not only for the IP owners, but also for the public. One panelist stressed the necessity of harmonization of IP rule, which is now different country-by-country. Standardization of IP system is of importance, because it would enhance global capacity building ability in an internationally cooperative manner. It is important that everyone and every country should be involved. Overall, the efficient exploitation of IP in the market place is a goal.

Participants agreed that a series of dialogue is significantly important. The dialogue should be created among government sector, business sector, academic sector, civil society, and lawyers. Such a dialogue will also contribute to deal with the issues about the relationship between developed and developing countries. One panelist stressed the "light and shadow" of IP with regard to developing countries not being comfortable with the biomedical IP system. A viable and rational solution should be sought.

E4: Science and Technology for Human Security: Science and Technology against Natural Disasters

Natural disasters such as the Tsunami in the Sumatra Area cause tremendous damages to human life and economic society. In order to minimize the damages, how can accurate forecasts and rapid alarm systems be put in place? How can science and technology contribute to an efficient information system for prevention, warming, and recovery all over the world?

Session Chair:

- **Katayama**, Tsuneo, *President, National Research Institute for Earth Science and Disaster Prevention, JP*

Speakers:

- **Chen**, Yong, *Professor of Geophysics, China Earthquake Administration, CN*
- **Kato**, Teruyuki, *Professor, Earthquake Prediction Research Center, Earthquake Research Institute, University of Tokyo, JP*
- **Loster**, Thomas, *Chairman, Munich Re Foundation, DE*
- **Sopaheluwakan**, Jan, *Deputy Chairman for Earth Sciences, Indonesian Institute of Sciences (LIPI), ID*
- **U. Than Myint**, *President, Myanmar Engineering Society, MM*
- **Thiruppugazh**, V., *Joint Chief Executive Officer, Gujarat State Disaster Management Authority, IN*

Science and technology can contribute to better forecasting and warning capability. Real time continuous monitoring and modeling are the direction of science and technology. As one panelist pointed out, an earthquake early warning system has been developed to a high art in Japan, and seismometers are placed all around Japan to measure what's happening. The panel agreed that a major shift is underway toward predisaster funding. Many see natural disasters as a public awareness problem and not a science and technology problem. As for the recent Sumatra tsunami, it is believed that no scientist could have predicted it with the current tools. Scientists are still stuck with only "best efforts." Information is always relative, and it is agreed that we will never have perfect knowledge. But the weak link is the human side, the human awareness. The developed world has high telecom facilities, but these don't yet exist

everywhere, so some people are more vulnerable than others.

F4: New Frontiers Opened in Manufacturing

What is the present situation of cutting-edge research and development in manufacturing? What possibilities can we expect from its cutting-edge research and development?

Session Chair:

- **Warnecke**, Hans-Juergen, *former President, Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), DE*

Speakers:

- **Ahtisaar**, Marko, *Director, Design Strategy, Nokia Corporation, FI*
- **Chang,** Morris, *Chairman, Taiwan Semiconductor Manufacturing Co., Ltd., US*
- **Hobbs**, Robert, *Director of Research Operations, United Technologies Research Center, US*
- **Mařik**, Vladimir, *Head, Department of Cybernetics, Czech Technical University in Prague, CZ*
- **Schlögl**, Herwig, *Deputy Secretary-General, Organization for Economic Co-operation and Development (OECD), DE*
- **Yoshino**, Hiroyuki, *Director and Advisor, Honda Motor Co., Ltd., JP*

It can be safely stated that in manufacturing industries the main point is not or at least is not only how to gain knowledge but also how to translate this new knowledge into wealth and profits. Commercial capability is also an issue, probably more important than searching for cutting-edge research because this latter practice may unfortunately lead to significant loss of money. There may be inconsistency in the dualism between opening new research frontiers and the search for new values added at low costs. Customer stabilization may be more important than cutting-edge research, especially for companies like semiconductor companies for which product reliability is one of the most important issues. Therefore, research should be primarily directed toward the solution of customers' problems rather than toward high-cost searches for cutting-edge research topics. There are two rising challenges to modern competitiveness for manufacturing companies in the high-tech field: (1) globalization has to be adequately dealt with, taking into proper consideration the subtle balance between sales internal and external to the country of manufacturing; and (2) translating models among different factories have to be promptly built without hindering the individual policies of the individual factories.

18:30 – 20:30 Special Buffet Dinner: "Experience Kyoto", at Shokokuji Temple

SEPTEMBER 13, 2005, TUESDAY

08:00-9:45 Plenary Session: Summaries from Concurrent Sessions

Session Chair:

- **Arima**, Akito, *Chairman, Japan Science Foundation, JP*

Speakers:

- **Cicerone**, Ralph, *President, National Academy of Sciences, US*
- **Imura**, Hiroo, *Chairman, Foundation for Biomedical Research and Innovation (FBRI), JP*
- **Serageldin**, Ismail, *Director, Library of Alexandria, EG*
- **Meyer-Krahmer**, *Frieder, State Secretary, Federal Ministry of Education and Research, DE*
- **Goldin**, Daniel, *Chairman, The Intellisis Corporation, US*
- **Yoshikawa**, Hiroyuki, *President, National Institute of Advanced Industrial Science and Technology, JP*

Ralph Cicerone

Ralph Cicerone observed that the linkage between energy and the environment is clearer now more than ever before. While climate change is disruptive to society, a significant part of the world's population currently needs increased energy for a decent life. Energy usage in developing countries may exceed that of developed countries in the coming decades.

Nuclear power, which does not emit carbon dioxide, must play an expanded role in meeting electricity needs. Citizens, business leaders, and governments must be more aware of the implications of energy usage.

Hiroo Imura

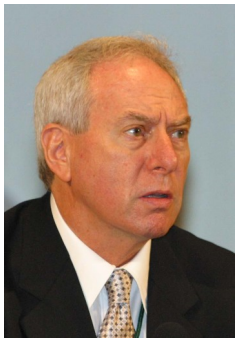
Hiroo Imura opened his remarks by stating that the 21st century is the century of life sciences. A diverse panel addressed the issue from three main perspectives: (1) advances in life science and its future potential; (2) public policies, societal choices, and regulatory systems that advance innovation in life sciences; and (3) the need for knowledge transfer in life sciences. In discussing the ethical aspects of stem cells and regenerative medicine, embryonic stem (ES) cells, and therapeutic cloning were major subjects of discussion. Dialogue between scientists and the public as a way to gain public support was also stressed. New Applications on Genomics to Agriculture, focused on ways to promote agricultural science. Commercial transgenic plants have been accepted in some countries in order to reduce pesticides or to control diseases. The use of genetically modified plants for the production of alcohol fuel was also discussed. In discussing the translation of science to the marketplace, the development of medicine for global health, focused on the health care of developing countries. The magnitude of the problems in these countries must be understood in order to establish a strategy to eradicate certain diseases.

Ismail Serageldin

Ismail Serageldin observed that the four sessions devoted to the ICT revolution were very rich in content and animated in debate. The main issues were a true revolution in ICT: Equity: the information revolution will favor the privileged; Interoperability is necessary to realize the full impact of the ICT revolution; Heritage management: the future digital library will be able to archive an enormous amount of data; Privacy and security: the participants opted for "privacy for citizens and transparency for governments." Finally, there was a call for new thinking. Can we bring information and data into the public domain that can be for public purpose, but respects the privacy of individuals? Tackling this question requires new ways of thinking, trans-disciplinary research, and a great deal of imagination.

Frieder Meyer-Kramer

Frieder Meyer-Kramer described the four sessions as having a general theme of "Capacity Building." A recommendation that resulted from the session was one for international mobility by offering an international scholarship system. Another was for brain circulation instead of brain drain or brain gain. The goal of enhanced science literacy for students, communicators, and society, was the theme of the next session. The session on intellectual property rights revealed a very board spectrum of ideas and perspectives. The purpose of the intellectual property system is twofold: (1) to give the creators incentives by inclusive rights in order to promote development of science and technology; and (2) to ensure public access to the benefits of such development. The intellectual property system is not only for the owner but for the public.



Daniel Goldin

In summarizing the sessions on Science and Technology for Human Security, **Daniel Goldin** remarked that the session revolved around the necessity to respond to threats as an integrated system. Comprehensive and constant surveillance, real time diagnosis, interconnectivity with established social institutions, and continuing societal education must play a role in the prevention of loss of life due to disasters, and the intentional and unintentional actions of individuals. The challenge for technology is to improve surveillance and diagnostic accuracy for all disasters. A primary tool for this is international cooperation in the conceptualization and development of these systems to assure that they are interoperable, secure, highly effective, regionally appropriate, and bolstered by highly reliable communication systems that are integrated with existing social networks. A point that strongly came out in the discussions is that a new longer term view must be developed. Priority decisions made today about emissions, energy investments, diseases, hunger, agriculture, and biodiversity will have a tremendous impact on the lives of those who have yet to be born.

Hiroyuki Yoshikawa

Hiroyuki Yoshikawa reported on new frontiers in science and technology consisting of four sessions: (1) general issues, (2) nanotechnology, (3) information technology, and (4) manufacturing technology. The effects of science and technology in the past and the expectation for the future, such as human-friendly technology, the security of energy, less costly technology, and the expectation for science and technology to guide society toward sustainability were discussed. Nanotechnology can be applied to almost all fields of science and technology. Through manufacturing, science and technology will be of tangible value to society. Therefore, manufacturing must be viewed as an exciting realm in science and technology, which is not the case in modern society.

10:15 – 11:15 Plenary Session: Innovation as a Source of Growth

Session Chair:

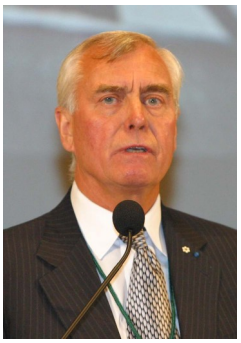
- **Desmarescaux**, Philippe, *Chairman, The World Life Sciences Forum, Scientific Foundation of Lyon, Biovision, FR*

Speakers:

- **Carty**, Arthur, *National Science Advisor to the President, Government of Canada, CA*
- **Kotanchek**, Theresa, *Global Research & Development Director, Dow Chemical Company, US*
- **Lee**, Yuan Tseh, President, Academia Sinica, Chinese Taipei
- **Mimura**, Akio, *Representative Director and President, Nippon Steel Corporation, JP*

Philippe Desmarescaux

Philippe Desmarescaux remarked that altogether the participants had identified the different challenges for the next century, which are in line with the development goals of the Millennium Declaration of the United Nations. Science and technology can contribute to the solution of these challenges and goals. Nevertheless, it must be recognized that there is often a delay in implementing these solutions, due to the need for cooperation among different countries, and the scientific and industrial community, as well as building trust between these communities and society.



Arthur Carty

Arthur Carty stated that research and development, innovation, and productivity are keys to economic growth in today's knowledge-based society and remain top priorities for developed and developing nations alike. It is a commonly agreed axiom that investments in science, technology, and innovation are the infrastructure of the "knowledge economy" on which growth and productivity are built. Government's role is to ensure that a healthy environment for innovation is in place including an adequate supply of highly trained people, a strong research base, and a competitive business sector. Without open-ended, curiosity-driven research to produce new ideas, new discoveries, and new technological advances, there is a risk of running the wellspring of innovation dry. Innovation is not just a source of growth for industrialized countries. It also presents the best opportunity for developing nations to escape from the grip of grinding poverty, disease, and despair. Education, science, technology, and innovation embedded in a sound, stable system of governance with good leadership are the keys to economic growth and advancement.

Yuan Tseh Lee

Yuan Tseh Lee cautioned that if not careful, the earth, which used to be "infinite" or "unlimited" for humankind for thousands of years, has now become "finite" or "limited", with earth's dramatic population increase during the 20th century. Globalization of human society during the past two decades is only half-way through, and because of it we are suffering from many consequences. In a half-globalized world, only those people who use the entire world as their stage for their activities have benefited. Sustainable development for all of humankind will not be accomplished by merely having "overdeveloped countries" help "not yet overdeveloped countries" to reach their same standard of living with science and technology. Necessary modifications based on the structure of society in terms of local environments and different regions must be made.

Theresa Kotancheck

Theresa Kotancheck, opened her remarks with a quote by Herbert H. Dow, a chemist and founder of the Dow Chemical Company, "If you can't do it better, why do it?" It is that spirit to innovate and to do it better that has been motivating the employees of Dow in their drive toward innovation, sustainability, and growth. The chemical industry, takes molecules and rearranges them and gives them new functionality and purpose. This is done through the application of chemistry, biotechnology, applied mathematics, material science, nanotechnology, and engineering. The ultimate situation is the link between chemistry and sustainability.

Akio Mimura

Akio Mimura, with over 40 years of steel industry experience, spoke about the "light" and "shadow" of the steel industry. Contributing towards improvement of living standards being the "light.", steel production technologies have advanced steadily, incorporating subsequent advances in basic sciences, mechanical and electrical engineering, as well as computers and information technologies. Steel products manufactured in this manner have made major contributions to improving the living standards and welfare of the human race and building the social infrastructure. On the other hand, the steel making process produces CO_2 emissions when iron ore is deoxidized using coking coal. He pointed out that about 50% of the gas produced as a byproduct of this process is made up of hydrogen - a clean form of energy - and also that it has recently been learned that it is technically feasible to further extract hydrogen from ethane and other substances contained in such gas by making use of yet unused heat energy generated from the steel-making process. If there is success in commercializing this technology, it is calculated that the hydrogen produced by the coke oven of the Japanese steel industry would be able to run a million fuel cell cars. It could be said that this innovative technology represents a future light.

11:15-12:00 Closing Plenary Session: Act Now For The Future

Session Chair:

- **Kurokawa**, Kiyoshi, President, Science Council of Japan, JP

Speakers:

- **Gregorian**, Vartan, *President, Carnegie Corporation of New York, US*
- **Omi**, Koji, *Member, House of Representatives, JP*
- **Alberts,** Bruce, *Professor, Department of Biochemistry & Biophysics, University of California, San Francisco, (USSF), US*

Kiyoshi Kurokawa

The final theme is act now for the future, **Kiyoshi Kurokawa** said. It is expected that the world population will rise to 6 billion in 2050. If changes are not implemented, greenhouse gas concentrations will increase, temperatures will rise perhaps by one degree centigrade at the end of the century. The issues include: emissions control, population control, energy conservation, climate change, the environment, food security, HIV/AIDS, poverty, and starvation. It is necessary to become a responsible part of humanity and human society, and to exercise collective wisdom.

Bruce Alberts

Bruce Alberts stated that he remembered Taizo Mishimuro's statement from the closing session of the previous year: "In the past, science has changed society. In the future, society must also change science." He viewed this statement as a fundamental challenge to all scientists, one that reflects the increasingly large role that science and technology are playing in the world. Stronger worldwide capacities in science and technology are necessary to allow humanity to achieve the UN Millennium Development goals. Scientists must work much more effectively to prepare society to deal with science and technology. There are enormous challenges ahead for scientists. It is essential for everyone to become more deeply engaged with their own societies, as well as reaching out more broadly across the world.

Vartan Gregorian

Vartan Gregorian stated that in recent years, there has been increasing discussion about the advent of the information revolution that may parallel or even outdo the impact of the industrial revolution. The fact that so much information is available to the public, particularly through the Internet, means that for the first time in history, individuals have access to much of the world's stored knowledge. The issue that must be confronted, however, is not the availability or volume of information, or the speed at which it can be accessed alone. The content, meaning, and quality of the information must also be dealt with. In that regard, the question of how to transform information into structured knowledge becomes an issue. The greatest challenge to society, and by extension, to universities and scientists, is how to distill information and organize knowledge. At present, higher education is struggling with the difficult choices associated with the question of how to balance, analyze, synthesize, and integrate knowledge through transdisplinary formats.

Koji Omi

Koji Omi affirmed that it is key to future sustainability for humankind to live in harmony with the environment. It is necessary to develop a practical and effective framework that all countries and regions will participate in to deal with CO_2 emissions. It is also vital to establish common international rules concerning bioethics that will enable researchers worldwide to collaborate and compete equally in their research activities. A consensus was reached on the future development of Information and Communications Technology to build a thriving future for humankind. There was agreement that the creation of opportunities for universal access to education, regardless of race or national origin is of importance for the future. There was substantial support in the proposition to establish a global, integrated system of intellectual property rights. A common awareness on using science and technology to defend against acts of terrorism was reached. Furthermore, it was recognized that developing vaccines and medical measures against infectious disease like AIDS is crucial to humankind's future. Every year, science and technology bring new discoveries and innovations that influence people's lives, society, and culture. It was acknowledged by the participants that the *forum* serves as an important venue for exchanging views on the latest developments in this field and their overwhelming impact on society.

12:00-13:00 Farewell Buffet Lunch

INDEX OF PLENARY SESSIONS SPEAKER

All of the names, job titles, and functions stated herein reflect those current as of the date of the forum ; personal titles have been omitted.

The Science and Technology in Society (STS) *forum,* holds an annual meeting in Kyoto creating a global human network based on trust and providing a framework for open discussions regarding the further progress of science and technology for the sake of humankind while controlling ethical, safety and environmental issues resulting from it. In seeking to ensure further progress in science and technology throughout the 21st century, it is necessary to keep possible problems under proper control based on shared values, and establishing a common base for promoting science and technology.

Because international efforts to address these problems are needed now more than ever, the forum gathers every autumn top opinion leaders of various backgrounds including scientists, researchers, policymakers, business and media from all over the world