Science and Technology in Society (STS) *forum*
"Lights and Shadows of Science and Technology"

Fourth Annual Meeting
October 7-9, 2007
Kyoto International Conference Center

SUMMARY OF PROCEEDINGS

Science and Technology in Society (STS) *forum* (NPO)
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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

October 7, 2007, Sunday

October 8, 2007, Monday

October 9, 2007, Tuesday

October 7, 2007, Sunday

10:30 – 11:30 Opening Plenary Session

"Lights and Shadows of Science and Technology"

Chair: Omi, Koji, Member of the House of Representatives; Founder and Chairman, STS *forum*, JP

Speakers:

- **Fukuda**, Yasuo, Prime Minister of Japan, JP
- **McGraw III**, Harold W., Chairman, Business Roundtable; Chairman, President and Chief Executive Officer, The McGraw-Hill Companies, Inc., US
- **Mangena**, Mosibudi, Minister of Science and Technology, ZA
- **Nakamura**, Kunio, Vice Chairman, Nippon Keidanren (Japan Business Federation); Chairman of the Board, Matsushita Electric Industrial Co., Ltd., JP
- **Schavan**, Annette, Federal Minister of Education and Research, DE
- **Wan**, Gang, Minister of Science and Technology, CN

Yasuo Fukuda

Yasuo Fukuda said that the dramatic progress of science and technology during the 20th century made mass production possible. Japan has developed into a major economic power by focusing on mass production and mass consumption, and developing countries want to grow in the same pattern. However, because of the resulting depletion of natural resources and pollution, there is a need for a new, sustainable model. Reducing emissions, slowing global warming and minimizing fossil fuel use, as exemplified by Japan's Cool Earth 50 program, are the keys to this new model. The coming G8 summit will be a chance to invigorate such sustainability initiatives and protect the planet.

Koji Omi

Koji Omi opened the STS *forum* by noting that although rapid progress in science and technology has benefited our daily lives, it also has brought about such problems as global warming, ethical concerns in biosciences and information security issues in IT. These are the "lights and shadows of science and technology." The discussion at this forum helps to promote needed international cooperation among business, media, academic and political leaders. It has shaped international opinion in such areas as creation of an international post-Kyoto framework and an internationally harmonized system for intellectual property rights. Our main themes this year are harmony with nature and innovation.

Annette Schavan

Annette Schavan noted that the importance of science and technology on the international agenda is increasing, as policy makers apply scientific findings to global challenges. The new definition of peace is development from an economic, social, cultural and humane point of view. Creating a joint research agenda on an international level will help us pool our strengths and competencies and let us develop joint strategies for sustainable development.

Gang Wan

Gang Wan explained that China believes that progress in science and technology is the key to solving obstacles to development, such as a shortage of resources and environmental degradation. China is implementing plans to simultaneously accomplish energy savings and emissions reduction while raising citizens' awareness of conservation. In light of the current transition from industrial to knowledge-based societies, the government seeks to identify common challenges so that people may benefit from science and technology developments.

Harold McGraw III

Harold McGraw III stated that US employment in the knowledge sector has grown as the manufacturing sector has shrunk. Education unlocks opportunity, yet too many students lack access to high quality schools and educators. Business should financially assist schools and universities. Today, every country faces serious competitive threats because jobs can be done wherever people are educated and skilled. We must invest more in research and development and promote access to higher quality education in science and technology.

Kunio Nakamura

Kunio Nakamura said that global constraints on economic activity are highlighted by energy and environmental problems, which pose a special challenge to Japan, a country poor in natural resources. Japan also faces structural changes imposed by an aging population. Japan's highest priority is increased innovation,

especially scientific research to generate new products for society. This advanced technology can also help other nations meet environmental challenges.


Mosibudi Mangena

Mosibudi Mangena suggested that human capital development promotes innovation and contributes to the growth of the knowledge sector. He emphasized the need for collaboration between North and South in science and technology. A common resource pool for developing countries would allow an exchange of students, researchers and scientists. We need infrastructure for high-end science and technology in the developing as well as the developed world. Finally, we should build upon our deliberations at this forum at other important platforms, such as the next G8 Summit.

13:20 – 14:30 Plenary Session

"Energy Solutions for the Sustainable Environment"

Chair: King, David, Chief Scientific Advisor and Head of the Office of Science, Department for Innovation, Universities and Skills, United Kingdom Government, UK

Speakers:

- **Chu**, Steven, Director, Lawrence Berkeley National Laboratory, US
- **Helal**, Hany M., Minister of Higher Education and Scientific Research, EG
- **Holliday, Jr.**, Charles O., Chairman and Chief Executive Officer, DuPont (E.I. du Pont de Nemours and Company); Chairman, Council on Competitiveness, US
- **Lauvergeon**, Anne, Chief Executive Officer, AREVA, FR
- **Tanaka**, Nobuo, Executive Director, International Energy Agency (IEA), JP
- **van der Eijk**, Johan M., Group Chief Technology Officer, Royal Dutch Shell plc, NL


David King

David King suggested that by focusing on how to stimulate low-carbon-emission energy technologies and how to develop public and private sector partnerships we can reverse the collapse of research due to privatization of energy industries. Global cooperation in translating research from institutions to the marketplace, and applying these technologies in both developed and developing countries is crucial. Realizing a proposed 50% reduction in greenhouse gas emissions by 2050 – the Cool Earth 50 goal – will require collaboration, ingenuity and hard work.


Hany Helal

Hany Helal said that our world has become a global village as we are all using the same resources and we are all equally affected by tendencies of production. In order to support sustainable economic growth, we must implement environment-friendly solutions and harness the expertise of developed nations. International collaboration has to be strengthened to deal with the urgency of global climate change. The burden of these investments must be shared between governments, societies and users. Egypt has already committed itself to a sustainable future by acceding to the 2020 plan.


Charles Holliday, Jr.

Charles Holliday, Jr., discussed the steps needed to achieve Cool Earth 50 from a business standpoint. First, we must set rules of progress and take a comprehensive, global view, as was previously employed to achieve CFC reduction. Second, we need to develop *multiple* solutions to the energy problem, including wind, solar and nuclear power and biofuels and also strong conservation policies. For biofuels to be viable we need to increase the global productivity of agriculture, to better utilize cellulose, and to find new fuels like bio-butanol. Finally, we need to define a clear and positive destination.


Anne Lauvergeon

Anne Lauvergeon explained that the challenges posed by demographics and climate change have sparked a third energy revolution. Its goals: energy efficiency and savings, development of energy without CO^2 emissions and investment in R&D. She underlined the fact that nuclear is part of the solution, as it's competitive and offers security of supply with no CO^2 emissions. As Areva has found, internationalization is also a part of the key to succeed. Finally, she insisted that we need to be very pragmatic, leaving ideology behind.


Johan van der Eijk

Johan van der Eijk stated that a transition towards renewable energy will require development of new technologies, inspired leadership and radical changes in consumer behavior. The problem of meeting continually increasing energy demands is compounded by the need to limit CO^2 generation. We need to explore all

promising energy sources, promote private investment (for example, Shell Company's investment in biofuels), and shorten the gap between demonstration and deployment. As a short-term solution, governments should provide economic incentives for companies' participation in carbon capture and storage.


Steven Chu

Steven Chu insisted that we truly have to maximize energy efficiency. A way to reach this goal would be to access the free markets, but governments' help will also be essential. Free market incentives for companies and populations should be balanced by rules serving as reference. To ensure efficiency, these procedures and regulations need to be stable. It obviously takes time to define them but once it is done, loopholes have to be avoided even when governments change.


Nobuo Tanaka

Nobuo Tanaka underlined the role of the International Energy Agency (IEA) in increasing energy efficiency. This is important for energy security and reduction of CO^2 emissions, but it is hampered by inefficient regulations and market barriers. Higher energy prices may be one solution. To encourage energy conservation policies, such as phasing out incandescent bulbs, the IEA has developed standards to measure the efficiency practices of member nations. Governments should fund private research and address carbon pricing plans. International cooperation for development and deployment is imperative and should involve developing countries like India and China.

14:30 – 15:45 Plenary Session

"Setting the Tone"

Chair: Bréchignac, Catherine, President, French National Center for Scientific Research (CNRS), FR

Speakers:

[Track A] **Hockfield**, Susan, President, Massachusetts Institute of Technology (MIT), US

[Track B] **Zerhouni**, Elias A., Director, U.S. National Institutes of Health (NIH), US

[Track C] **Baujard**, Olivier, Chief Technology Officer, Alcatel-Lucent, FR

[Track D] **Lee**, Yuan T., President Emeritus, Distinguished Research Fellow, Institute of Atomic and Molecular Sciences, Academia Sinica, Chinese Taipei

[Track E] **Wiesel**, Torsten N., Secretary General, Human Frontier Science Program Organization (HFSPO), US

[Track F] **Ernst**, Richard R., Professor Emeritus, Laboratory of Physical Chemistry, Swiss Federal Institute of Technology (ETH) Zurich, CH

[Track G] **Thumann**, Jürgen R., President, Federation of German Industries (BDI), DE


Catherine Bréchignac

Catherine Bréchignac introduced the seven tracks by dividing them into three categories -- harmony with nature, biological questions, and new frontiers.


Susan Hockfield

Susan Hockfield explained that although there will be no immediate end to reliance on oil and coal, in the next few decades the energy sector will change due to increased demand, needs for energy security, and the development of new, cleaner fuels on a sufficient scale. She foresees more efficient energy use and more advanced technology consumption methods. Solar and wind technologies are promising, affordable and reliable, but we need breakthroughs for them to be achievable. We need major investment, policy support and leadership, because innovation alone cannot solve our energy problems.


Elias Zerhouni

Elias Zerhouni emphasized population increase in developing countries with adverse environments as a vector for new infectious diseases. Life sciences face challenges of enormous increases in amount and speed of information, as well as changes in emphasis from study of components (hardware) to dynamic synergy and regulation of those components (software). It is important to develop sustainable models for both intervention in epidemics and preventive measures. It is essential to address issues of bioethics, GMO regulations and the very transformation of medicine and global health care in the interest of humanity's future health.


Olivier Baujard

Olivier Baujard stressed the contributions of the information and communication industry. For example, video-teleconferencing can save the need to fly long distances for meetings, while ICT in medicine can help provide distant populations with remote diagnosis and treatment. We can bridge the digital divide in the developing world to create more jobs, improve education and relieve pressure for job-based migration. ICT can deploy intelligence everywhere and network intelligent services at lower cost.


Yuan Lee

Yuan Lee introduced the concept of "Brain circulation" which he feels should supersede the previous "Brain drain/brain gain" model. Students went to the US after WWII in order to escape poverty, oppressive regimes and other limitations. In the 1980s and 90s, many US-trained technicians and scientists returned to their countries to help them compete effectively in the world. Brain drain is thus not necessarily negative. Developed countries should encourage "Brain circulation" to make the most of global human capital.


Torsten Wiesel

Torsten Wiesel identified science and technology as being at the heart of most global issues. He pointed to the Human Frontier Science Program, which is funded by Japan and 12 other member countries, as an example of a program promoting global collaboration among scientists. In this program, teams of life science scientists promote initiatives in life sciences. The program funds grants to international, interdisciplinary teams of young and senior investigators, and offers an international fellowship program in the life sciences to nurture the development of young scientists who train outside their home countries.


Richard Ernst

Richard Ernst addressed the importance of integration and cross-disciplinary communication in academia to build a healthy relationship between science and society. The responsibilities of academia are teaching (which includes inspiration), research (serving society) and innovation (finding new solutions to global problems). Academicians are in an ideal position to provide honest and unbiased foresight and inspiration in addressing global problems.


Jürgen Thumann

Jürgen Thumann discussed society, science, industry and innovation. He praised the public support in Japan for innovation, contrasting it with a reluctance to accept innovation in other countries, where the public fears the social and economic disruptions that result or implied disparities in the application of innovative technologies. He stressed the need for commitment by government and efforts to encourage start-ups and pioneering initiatives.

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

A1: "Harmony with Nature – Energy"

Chair: Feneuille, Serge, Chairman, High Council for Science and Technology, FR

Speakers:

- **Chambert-Loir**, Jacques, Chief Representative for North-East Asia, Total, FR
- **Foss**, Michelle M., Chief Energy Economist and Head, Center for Energy Economics, Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, US
- **Ong,** Soon Hock, President, Malaysia Invention and Design Society, MY
- **Ikeda**, Kaname, Director General Nominee of the ITER Organization, ITER International Team, JP
- **Jiang**, Mianheng, Vice President, Chinese Academy of Sciences, CN
- **MacNaughton**, Joan, Senior Vice President, Power and Environmental Policies, Alstom Power Systems, UK
- **Mochizuki**, Harufumi, Director-General, Agency for Natural Resources and Energy, JP

The world faces two major, interlinked challenges – energy security and climate change. We require clean, safe and stable energy sources to meet growing demand, as well as greater energy efficiency. Although energy is a global issue, no one energy solution is likely to satisfy these needs on a global basis. National and geopolitical considerations will play a major role in selecting an appropriate local portfolio of viable energy sources.

The developing world seeks a standard of living consistent with that of developed countries, but this requires untenably high levels of energy consumption. Can new energy sources or greater efficiency be sufficient to satisfy growing energy demand? What is the responsibility of the industrialized world for helping developing nations like

China achieve greater energy efficiency and lower greenhouse gas emissions, given that export industries are major energy users in China? Many participants wondered if we should allow developing nations to make the same mistakes of overconsumption and waste of resources as the developed (or overdeveloped) nations have along the path to industrialization.

Although many new energy sources, such as solar, nuclear fusion, nuclear fission, hydrogen and plug-in hybrid electric vehicle energy offer promise, it was largely agreed that fossil fuels will remain the main energy source for the foreseeable future. Production of conventional liquid fuels should plateau by 2020, but their ease of storage, low cost and safety will ensure their continuing dominance over other energy sources. Large-scale, multinational initiatives such as the ITER nuclear fusion project, which span several decades and cost billions of dollars, offer tantalizing promise, but we should also develop other, more localized undertakings that will help us reduce greenhouse gas emissions and lower fuel costs by focusing on energy conservation.

Some promising energies raise troubling implications. For example, the current enthusiasm for biofuels belies broad concerns about associated water and air pollution, deforestation and declines in food production. Two other alternatives, wind power and LNG, have met with public resistance to siting of power generation plants. At the same time, previously maligned energy sources such as coal and nuclear power are gaining renewed currency due to zero-emission and carbon capture and sequestration advances, for coal, and safer and more efficient nuclear technologies.

Renewable energies will assume increasing importance, and it was suggested that less technology-intensive native resources like oil palms, which don't compete with food crops, might become a highly efficient alternative energy source for tropical countries.

While there was some sentiment for a permanent international mechanism to evaluate the promise and costs of various energy sources, the complexity of energy choices and rapid change in prices and viability was seen as a deterrent to universal decisions. We must consider the economies of scale, security, safety, reliability and environmental impact of an energy source as it applies to each nation's situation. We need to provide the correct terms of trade for energies so they can be used effectively and to boost spending on research and development overall.

B1: "Biomedical Discovery and Development in the Genome Era"

Chair: Tan, Chris Y.H., Chairman/CEO, Calidris Therapeutics Inc., San Francisco, Vancouver, Tokyo, CA

Speakers:

- **Chetsanga**, Christopher J., President, Zimbabwe Academy of Sciences (ZAS), ZW
- **Harris**, Timothy, Director, Advanced Technology, SAIC-NCI-Frederick, US
- **Hayashizaki**, Yoshihide, Project Director and Chief Scientist, Genome Exploration Research Group, Genomic Sciences Center, RIKEN, JP
- **McConnell**, David J., Co-Vice Chairman, EAGLES (European Action on Global Life Sciences), European Federation of Biotechnology, IE
- **Trust**, Trevor J., Vice President, Infection Discovery Research, AstraZeneca Pharmaceuticals LP, CA

This session addressed major issues presented by the unique character of DNA information and advances in DNA sequencing.

The amount of data available from whole genome sequencing has led to over-optimism for quick new cures, but we need to encourage development of analysis, interpretation and theory and study the systems of disease in order to effectively progress. Session participants voiced concerns about the speed of sample preparation, data correlation techniques and the robustness of data, and they stressed the need for new theories and quantitative models. An analogy was made to the intelligence community, which draws key conclusions from hordes of data. However, the consensus stood that, in the biomedical field, even when supercomputing and data storage resources are available, the scarcity of human resources is critical. We need more cellular and molecular biologists and specialists in information processing. We should positively encourage cross-disciplinary training, possibly through grants.

Participants also addressed effects on healthcare costs, especially with the advent of fast and portable technologies needed to realize personal sequencing. On one hand, a lack of proper regulation and privacy could lead to inequitable health insurance policies. However, bedside diagnostics and individual profiles could individualize drug treatments, limiting expensive treatments to exactly those cases in

which it is necessary, thus saving and justifying costs. Precedent implies that even 'tailored drugs' can be lucrative for manufacturers. Unfortunately, however, drugs already branded as ineffective or dangerous may never be reanalyzed.

Even once sequencing is achieved, the roles of large portions of DNA remain unknown, and scientists must now study susceptibility alleles, look beyond individual markers, and analyze full profiles. Participants brought up several examples of companies successfully investing in development of cell-based imaging, assays, screening and diagnostics.

Accordingly, new sequencing and imaging technologies are being coupled with microbiology, and recent advances in transciptome sequencing and particularly RNA analysis have led to changes in research styles. Other targets of genome sequencing mentioned in this session included profiling of cancer genomes (utilizing comparisons of host and tumor DNA), and applications to infectious diseases.

For reasons of ethics and global security, participants expressed deep concern that, although infectious diseases can originate anywhere, the benefits of genomics will bypass the poor in both developing and developed countries. For example, in Africa, where talk of medicine is overshadowed by HIV, pricing will determine the impact of diagnostic techniques and vaccines derived from genomics. At the same time, large potential returns and the preservation of intellectual property are crucial for development. Participants expressed hope in the invention of 'infectious technologies' – technologies so universally beneficial as to spread quickly and globally – which will apply to the developing world. The idea of a 'global healthcare system' was also mentioned.

Finally, participants expressed the need to support research in developing countries. One reason is that proper analyses of local traditional medicines have not taken place. Another reason is that, in order to understand infectious diseases, we need to study them in context (for example, studies of innate immunity). A new discipline, *genomic geographic medicine,* has large and powerful potential, but to realize this potential, we should think of developing countries as 'sources of solutions.' Perhaps due to lack of funding and first class laboratories, research in developing nations is critically lacking in manpower. Even when facilities exist, international exchange between laboratories needs more promotion.

C1: "New Frontiers of Science and Technology – Nanotechnology"

Chair: Moskovits, Martin, Chief Technology Officer, API Nanotronics Corporation, CA

Speakers:

- **Kaiserswerth**, Matthias, Director, IBM Zurich Research Laboratory, DE
- **Kishi**, Teruo, President, National Institute for Materials Science, JP
- **Kitazawa**, Koichi, President, Japan Science and Technology Agency (JST), JP
- **Oliver**, Raymond, Director, Science & Innovation, Cenamps, UK
- **Sallin**, Aymeric, Founder and Managing Director, NanoDimension AG, CH

Nanotechnology refers to the fact that materials have special properties at nanometer-length scales.

There is a convergence today between systems that work from the ground up, such as chemistry, and systems that work from the top down, such as semiconductor fabrication. Growth up to now in the much-hyped nanotechnology industry has been evolutionary, but we are on the cusp of a revolution. Nanotechnology is predicted to be a 23 trillion yen industry by 2015. It can be seen as an innovation toolkit which will allow new convergence of diverse fields such as biology, information science and cognitive science, resulting in epochal developments.

Limits of conventional semiconductor fabrication technology will be reached in about a decade, and nanoscale printing of wires and circuits represents one method for continued transistor miniaturization. Life sciences and medicine will also be transformed by nanotechnology: 'Printing' of biological markers will allow personalized medicine through rapid detection of genetic disease markers and risk factors.

Other technologies that will benefit from nanotechnology include solar energy and water purification. Nanotechnology can be used to produce solar cells based on polymers (plastic) rather than silicon, resulting in order of magnitude cost reduction. There is strong government funding for nano-solar technology. Such solar cells could

be printed in a reel to reel fashion, which should lead to a ten-time decrease in cost.

Further in the future is the possibility of water filters incorporating nanotechnology. Eighty percent of infectious diseases are spread by unclean drinking water, and cheaper, better filters would help by simplifying desalinization and improving access to clean water.

Nanotechnology is being used in existing products as well. High temperature super-conducting wire has been developed which has 100 times better electrical conductivity per unit area than copper. There is a Japanese proposal to use this wire as superconducting cables to make a global network of solar energy stations, which will solve the issues of day-night and summer-winter energy fluctuations, without necessitating new electrical storage technologies.

Access to nanotechnology is a concern. Depending on what is considered as nanotechnology, cosmetics may be said to be the biggest nanotechnology business, and it exists mostly for the developed world. This pattern of consumption begs the question, how will the developing world gain access to nanotechnology?

Later in the session questions were addressed to the floor, with various participants lending their expertise. When asked why many companies are developing industrial production of nanotubes on the ton scale, it was noted that nanotubes are compelling materials that will be used widely as soon as the price is low enough. The price is expected to fall in connection with increased supply.

When asked how far we are from achieving single molecule switching, some members felt that it will take from five to 20 years to develop practical systems. Another asked about uncertainty in access to nanotechnology: what are the long term environmental consequences? It was felt that more studies are needed on toxicology and product lifecycles of products incorporating nanotechnology. Standards are currently in development in the EU but they do not go far enough.

Finally, participants were asked to provide more examples of nanotechnology in commercial products. A respondent noted that, in computing, spin-based RAM products are currently in development by startup companies, with 1 MB on the horizon for next year. All computer hard drives with capacities above 100 GB make use of nanotechnology. In addition, diagnostics chips that allow rapid patient DNA analysis are now on the market.

D1: "Science Literacy for All"

Chair: Fortier, Suzanne, President, Natural Science and Engineering Research Council of Canada (NSERC), CA

Speakers:

- **Arima**, Akito, Chairman, Japan Science Foundation, JP
- **Bartz**, Carol A., Executive Chairman, Autodesk Inc., US
- **Benmokhtar Benabdellah**, Rachid, President, Al Akhawayn University, MA
- **Massingue**, Venâncio S., Minister of Science and Technology, MZ
- **Osterwalder**, Konrad, Rector, United Nations University, CH

Acquiring a basic knowledge of science and technology is part of the education of most members of society. However, even as the world is becoming increasingly complex, many people still don't seem to understand the importance of science and technology in allowing us to meet tomorrow's challenges on the national and international levels.

It is thus crucial to be able to attract future generations to be the discoverers and innovators of tomorrow and to bring science to the general public in a way that corresponds to their needs. Young people are part of a truly global culture which offers opportunities that did not exist before and these opportunities could help to enhance science literacy worldwide.

The participants proposed different solutions in order to tackle the general lack of interest in science among young people and members of society at large:

- It is essential to teach young people how to solve problems and to give them an understanding of how scientists proceed in research and inquiry. This is particularly true in Japan, where students typically exhibit outstanding performance in science until high school, but then their achievements rapidly deteriorate.
- Inspiring our children is crucial. They should not be discouraged. Science should be taught in a rather "fun" way.
- New technologies should be shared with senior citizens so that they can help inspire younger generations.

- The quality of teachers is key to increasing science literacy and to motivate students. Teachers' education has to be rethought, especially in primary schools.
- Learning outside the classroom: Observation of nature should not be underestimated.
- Good story tellers are needed. Indeed, science and technology can solve problems but it can also create new problems, as regarding food security and health issues, hence contributing to make people feel suspicious or even threatened by scientific advances.
- The global environment should be more science-oriented. There are too many obstacles to enhancing scientific literacy such as local traditions, religion, or even societies that place greatest value on high-income professions, encouraging young people to study law and economics rather than engineering.
- International collaboration to enhance scientific culture worldwide can be implemented through the creation of joint programs.

The panel also discussed the role of women in science. There are still too few women who choose scientific careers, particularly careers in engineering. One speaker suggested that we should share with the public information about what science is really about and how it can contribute to meeting the world's challenges.

E1: "Establishing International Collaboration in Science and Technology"

Chair: Alberts, Bruce M., Professor, Department of Biochemistry and Biophysics, University of California, San Francisco (UCSF), US

Speakers:

- **Anand**, Rakesh, Director, R&D Genetics, AstraZeneca Pharmaceuticals, UK
- **Huettl**, Reinhard F., Scientific Executive Director, GeoForschungsZentrum Potsdam, DE
- **Komiyama**, Hiroshi, President, The University of Tokyo, JP
- **Rubinstein**, Ellis, President and Chief Executive Officer, The New York Academy of Sciences, US
- **Watkins**, Alfred, Science and Technology Program Coordinator, World Bank, US

Many questions were raised in this session regarding the best way to ensure more synergies from our current system for greater efficiency in protecting our future.

Many of the participants identified the necessity of building a real network as the key action that should be taken. These actions must result from strong international collaboration, but it is not always easy to achieve. Indeed, even in our own countries or within our own institutions, it can sometimes be difficult to know who is working on what project, and as a result too many opportunities go unexploited.

In recent years, however, the scientific community has undertaken several initiatives to ensure the creation of networks. As an example, the "Scientists Without Borders" project will soon be launched by The New York Academy of Sciences, while the United Nations Millennium Project aims at increasing the impact of every project's efforts through international collaboration. A web portal and a database will allow all the actors to access details of other projects, thus creating a new channel of communication and collaboration. Communication was also the most important factor identified by participants when asked how we can ensure that the built networks are efficient. Top-down decisions may not accurately reflect the needs of countries, as they are often effected only when something becomes an urgent matter.

The specific needs of developing countries were mentioned by several participants. They face a range of endemic limitations and problems. First of all, some governments of developing nations try to prevent transparency of information to the international community, making effective cooperation more difficult. Moreover, even when projects for sustainable development are decided, funding often becomes a major problem. The World Bank is involved in investing in and supporting different kinds of initiatives, but funding remains a constraining factor.

After these issues were raised, the participants turned to a discussion of the solutions and the directions that could be taken to help developing countries. The main conclusion was that more investment should be realized for capacity building. International cooperation between the North and the South has to be done through effective training of people. It is counterproductive to only give money, medicine or resources to developing countries when compared to the benefits that accrue from training people. Some developing countries possess abundant natural resources but often they are unable to sufficiently exploit them, and this is an important issue. Thus, one of the roles of industrialized countries is to train people who will be able to lead projects in their own countries. Investing in human resources for capacity building is the solution.

Finally, participants asked each other about the role of universities. International collaboration between and among universities should be strengthened, allowing more transfers of scientists and professors as well as students. Germany, where about 30% of the students are foreign students from all over the world, is an example in opening its frontiers to permit international exchanges and collaboration. In addition to the efforts made in the

economic field regarding funding, such topics as capacity building investment, science and technology development and international cooperation are now rising to the top of the agenda at many government ministries, which is definitely a sign of progress and growing awareness.

F1: "Engaging Policy Makers in Scientific and Technological Issues"

Chair: Lim, Chuan Poh, Chairman, A*STAR (Agency for Science, Technology and Research), SG

Speakers:

- **Busquin**, Philippe, Chairman, Scientific and Technology Options Assessment (STOA), Member of the European Parliament, BE
- **Hara**, George, Group Chairman and Chief Executive Officer, DEFTA Partners; Ambassador to the UN Economic and Social Council, JP
- **Hošek**, Chaviva, President and Chief Executive Officer, Canadian Institute for Advanced Research (CIFAR), CA
- **Huber**, Bernd, President, Ludwig Maximilians University, Munich, DE

This session devoted much of the discussion to dialogue between scientists and policy makers regarding the issue of climate change. It opened with comments by the Chair about the relative advisability of placing developed and developing countries under the same policy umbrella, bearing in mind their different industrial and economic circumstances in matters such as emissions reduction.

It was agreed that in addition to scientists and policy makers, the democratic process dictates that the general public should be involved in any decisions confronting the climate change issue, as their lives would be directly affected by policies such as carbon trading.

Many setbacks to progress in scientific and political networking became apparent. Viewpoints, priorities, incentives and levels of understanding were seen to be very different at the individual, national and global levels. While more collaboration is desirable, questions of short-term versus long-term solutions, incentive-based versus morality-based approaches, and economic versus environmental priorities constitute obstacles to mutual understanding. Specifically, short-term considerations of politicians, such as the need to gain or preserve electoral mandates by answering the immediate needs of constituents, override the long-term necessity for establishing policy to address projected problems of 50 years in the future.

While most people act on moral grounds as individuals (out of a desire to do right), the systems they work in are uniformly incentive-based (operating on human desire for profit and benefit). These conflicting interests often result in policy implementation being difficult or impossible.

The hierarchy of human concerns on the public level ranges from top priority emergency needs to security and economics, with environmental concerns as the lowest priority. This means that environmental issues are addressed in periods of economic prosperity, but they become endangered during economic downturns. Similarly, developing countries with precarious economic situations may find it difficult to engage in discussions of environmental policy.

There is also the issue of knowledge. The general public is inclined to regard scientists and technology experts as authorities yet, at the same time, resent them for possessing esoteric knowledge. Also, policy makers often find themselves unable to understand the technical pronouncements of science. Thus, it is necessary for scientists to use laymen's terms with policy makers and the public. Scientific knowledge itself may be erroneous or dated, declining in value, especially over the long term. The core technology of a culture itself also has a shelf life, being superseded by a new type every 40 years or so. Given that IT was first established in the 1970s, it may be time to begin addressing the question of post-computer technology as a base in the near future.

Climate change is a problem that cannot be solved solely by science. Economic, political and humanistic issues must be considered. This is the first time that humanity as a whole has had to address a single pressing problem, and we must resist national tendencies to put the problem off onto others, and take responsibility as a global family. The need for a global political framework to deal with this and other new issues was stressed.

Other discussion streams included the question of new environmental standards and building retrofitting on a local level; the need or desirability of involving the private sector in the policy-making dialogue; the lack of short-term return on investment in technological fields discouraging investment; and the advantages of small countries in having more opportunities for interdisciplinary discussion than larger countries.

Although the problems identified were manifold, the discussion closed on an optimistic note when it was pointed out how far engagement in these issues, by all parties, has progressed in recent years.

G1: "Science and Innovation"

Chair: Friedman, Jerome I., Institute Professor and Professor of Physics Emeritus, Physics Department, Massachusetts Institute of Technology (MIT), US

Speakers:

- **Bettermann**, Peter, Speaker of the Board, Freudenberg & Co. KG, DE
- **Luty**, Tadeusz, Rector, Wroclaw University of Technology, PL
- **Markides**, Karin E., President, Chalmers University of Technology, SE
- **Noyori**, Ryoji, President, RIKEN, JP
- **Peccei**, Roberto D., Vice Chancellor for Research, University of California, Los Angeles (UCLA), US
- **Vitarana**, Tissa, Minister of Science and Technology, LK

Basic research is an endangered activity. Markets have become so competitive that industry finds research dangerous because innovations take a long time. Instead of doing research, industries have turned to doing "searches" while universities and laboratories struggling with budget problems cut basic research and short-term-minded political leaders remain reluctant to support long-term projects. However, we need more information about how nature works. The past has shown that the most revolutionary innovations have been based on a foundation of strong basic research and are all a result of understanding nature better. Knowledge of physics, chemistry, mathematics and biology is fundamental for the discovery process as well as for fostering science and technology, and investment in basic sciences has served as a multiplying factor over the years.

Jerome I. Friedman
Institute Professor and Professor of Physics Emeritus,
Physics Dep., Massachusetts Institute of Technology (MIT), US

Unfortunately, industry finds this type of research too risky. Its results are not guaranteed, and any possible applications take a very long time. Instead of creating a divide between academia and industry, the participants emphasized the necessity to take risks together and share them among the members of the respective projects.

Developed and developing countries tend to adopt differing perspectives when it comes to science and innovation. For example, third world countries need to play an important role in basic research, but today that research is primarily done only in developed countries. The third world is of necessity most concerned about basic economic challenges and thus the emphasis of science and technology shifts to applied research and development research.

However, leaving basic research to the industrialized nations is a controversial issue, and some opposing views were voiced. It was felt by some that developing countries can indeed emerge by doing basic research and that basic research should under no circumstances be neglected by developing nations, as this would make the existing gap with the industrialized world even wider. All three pillars of the research – education – innovation triangle need to be developed, and education is based to a large extent on basic research. The panel agreed that technology and knowledge transfers are important in ensuring that basic research is not only conducted in the industrialized world.

In a world where basic research is in large part left to government to support, universities face challenges in changing their curricula such that students will acquire a deep knowledge of natural sciences and in incorporating science and innovation into their structure in order to become more interdisciplinary entities. The establishment of Institutes of Technology was cited as a means of facing these challenges.

Another issue raised was the question of how technical universities can go from excellence to relevance in their scientific leadership and contribute to the well-being and growth of society by building trust in technology. The media plays a crucial role in making science attractive; it should be used more widely to promote a positive image.

19:30 – 21:00
Official Dinner followed by Nightcap

Introducer: Tsukamoto, Hiroshi, Former President, Japan External Trade Organization (JETRO), JP

Speakers:

- **Cicerone**, Ralph J., President, National Academy of Sciences (NAS), US
- **Tokai**, Kisaburo, Minister of Education, Culture, Sports, Science and Technology, JP

Hiroshi Tsukamoto suggested that science and technology efforts must include implementation, innovation and international collaboration. First, we should pursue active

implementation of science and technology-based efforts to fight climate change by government and business. In terms of public acceptance, gradual but determined change would be better than rapid action. Promotion of innovation by academia, business and government is critical. Governments, particularly those from developed and developing nations, should also work together to share the fruits of these innovations.

Kisaburo Tokai praised the temples and other historical monuments of Kyoto that have been recognized as world cultural heritage sites. In contrast, he criticized recently constructed buildings in Japan that have been found to be low in earthquake resistance, causing the public to lose trust in architects and engineers. Free competition may be intensifying personal gain at the cost of proper ethics, so we need to strengthen education from the lowest levels. Science and technology education of the next generation must be promoted to ensure high level human resources.

Today children lack interest in science and math, and the climate in universities is restricting to research and innovation. Japan needs more collaboration between universities and industry and more opportunities for women and young people. Science and technology should be more accessible to people.

Ralph Cicerone discussed sustainable development, which he defined as providing for the current generation while not reducing options for later generations. These are admirable intentions, but they leave some questions unanswered: What do we sustain, and what do we develop? How many generations are included? Human beings want to satisfy more than minimal needs; we seek variety in the food we eat, travel, cultural choices. We also want employment, education, entertainment.

We need to provide for all human needs as well as set aside some land for nature on a fixed per capita allotment of land that is constantly declining as the population grows. We depend on trade and technology to maintain our living standards, and we need innovation to continue to progress.

October 8, 2007, Monday

08:30 – 09:30 Plenary Session:
"Dialogue between Political Leaders and Scientists"

Chair: Vest, Charles M., President, National Academy of Engineering (NAE), US

Speakers:

- **Amari**, Akira, Minister of Economy, Trade and Industry, JP
- **Harbour**, Malcolm, Member of the European Parliament for the West Midlands, UK
- **Krieger**, Eduardo M., Former President, Brazilian Academy of Sciences, BR
- **Moratti**, Letizia B.A., Mayor of Milano, IT
- **Suh**, Nam Pyo, President, Korea Advanced Institute of Science and Technology (KAIST), US

Charles Vest

Charles Vest explained that there must be a balance between cooperation and competition in science. Science flourishes in an open environment, and expensive tools necessitate international cooperation. Conversely, competition drives excellence and efficiency. Jobs follow from expertise and innovation. Thus it is necessary to balance cooperation and competition. Young people are driven by curiosity, researchers are driven by the need to solve complex problems, parliaments are driven by the need to create jobs and corporations are driven by profits. We need to balance resource allocation and participation in fundamental and applied science to satisfy these diverse motivations.

Akira Amari

Akira Amari focused on three challenges that science and technology should address to ensure society's sustainability. Science and technology should be managed so as to maximize social and public benefits, and we should seek to provide information and explanations to gain public acceptance for scientific advances and to overcome public apprehension. The third challenge, he said, is the vital task of creating a cross-border framework for dialogue between political leaders and scientists.

Eduardo Krieger

Eduardo Krieger proposed overcoming differences between scientists and politicians to alleviate poverty and solve the new problems facing our societies. Leaders need better information to invest effectively in science. Scientists must be more pragmatic, understand society's needs, and use institutional channels such as national academies. He also insisted on nations choosing cooperation over competition in scientific and technological developments. Finally, he rued the fact that developing countries have not yet benefited from science and technology advances. They deserve more technology transfer and corporate investment, he said, especially since for-profit organizations account for more than 60 percent of today's R&D.

Letizia Moratti

Letizia Moratti underlined the needs and characteristics of the dialogue between political leaders and the scientific community. Science, while maintaining its independence, needs the support of policy makers to face the new challenges brought by science and technology. Political leaders must secure appropriate funding and create the best conditions for science cooperation, enabling benefits to be shared with developing countries as well. Ms. Moratti concluded her remarks by stating that science cooperation could act as a sort of new diplomacy as some challenges are difficult to solve exclusively at the political level.

Malcolm Harbour

Malcolm Harbour identified a new EU framework for increased science funding, especially frontier research, attracting foreign and domestic researchers. Science has replaced agriculture as the EU's best-funded area. The government supports priorities through projects to optimize the use of resources. The task of politicians is not to interfere with the details of science, but to examine the environment for science. Are existing institutions for science effective? Career paths should be examined to ensure that European PhDs prefer Europe over the US.

Nam Pyo Suh said that scientists must engage the public through civil servants and the press to make science a priority. Relying on leaders who understand science is not enough. Regarding cooperation and competition, he said that cooperation enhances synergy, stimulates creative processes and makes science borderless. Korea has an Energy Environment Water Sustainability research institute to promote international cooperation. Competition rewards the best, encourages fresh results and creates an exciting research environment. Competition can lead to cooperation.

Nam Pyo Suh

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

A2: "Harmony with Nature – Climate Change"

Chair: Morishima, Akio, Chair of the Board of Directors, Japan Climate Policy Center (JCPC), JP

Speakers:

- **Batterham**, Robin J., President, Australian Academy of Technological Sciences and Engineering (ATSE), AU
- **Guinot**, François, President, National Academy of Technologies of France (NATF), FR
- **Mattila**, Markku K., President, Academy of Finland, FI
- **McBean**, Gordon A., Chair of Board and Executive Chief Officer, Canadian Foundation for Climate and Atmospheric Sciences, CA
- **Nobre**, Carlos A., Researcher, National Institute for Space Research (INPE), BR
- **Rowland**, F. Sherwood, Donald Bren Research Professor of Chemistry and Earth System Science, School of Physical Sciences, University of California, Irvine (UCI), US

Climate change -- widely acknowledged as having been caused by human activity and modern technology – can only be forestalled by similarly dynamic human behavior. Yet to respond to this unprecedented challenge we must first answer the following questions:

1. Can science elucidate the causes and mechanisms of climate change and predict future impacts?
2. Can technology mitigate greenhouse gas emissions or improve our adaptation to climate change?
3. How does society accept scientific results and promote needed technological innovations? How can funding be effected?

The consensus among participants was that, although many questions remain, current scientific research is reliable and high quality. It suggests a need for immediate action to overcome institutional inertia.

The signs are unmistakable: PPM concentration has increased, as absorption of CO2 by the land and oceans reaches its maximum level. Air and sea temperatures are rising and extreme weather – hurricanes, flooding, drought

-- has become more common around the world. Today there is an average of one weather-related disaster per day around the world; their effects are exacerbated due to more people living along coastlines or in other vulnerable spots.

We have not yet developed a way to overcome emissions of the most prevalent greenhouse gas, CO^2. Methane, the second largest source of greenhouse emissions, offers more promise for reduction, especially since it has a relatively short lifetime in the atmosphere.

Serge Feneuille
Chairman, High Council for Science and Technology, FR

There may be rapid and abrupt climate change at some point, such as rapid rises in sea level due to ice sheets melting and sliding into the ocean. This might lead to a disastrous loss in biodiversity. The tipping points are not predictable, so we need better observation systems around the globe.

Ethical considerations were also an important part of the discussion. The most disadvantaged people may be those most affected by climate change, but funds are limited, so we may have to decide at the local level whether to invest in mitigation or adaptation. We should consider how to adequately compensate developing countries like Brazil that have made strenuous efforts in recent years to reduce the rate of deforestation, an important contributor to climate change.

We also need to rethink current models of development: only 20% of humanity has benefited from them, but we all suffer from negative impacts. As more people improve their standards of living the adverse effects on the environment will worsen.

Climate change may have unexpected effects, such as destabilizing efforts to store carbon in deep-ocean hydrates or permafrost. We need more study of local impacts of climate change such as flooding, disease and adaptation of agriculture. What would it mean for a particular village if the mean temperature were to rise by 2 degrees? We lack a mechanism now for international cooperation on adaptation.

The public must push policy makers to take steps, since the private sector is not yet ready to invest in climate change-mitigating technologies. The government role is thus critical, but politics operates by a short-term approach inconsistent with the nature of this long-term problem.

We need stable government economic policies to drive long-term behavior, including taxes and subsidies. We need to educate the public about the need for behavior change, including the need to sacrifice for the greater good. Our message on climate change must be accessible to all, and the involvement of social scientists is critical.

B2: "Bioethics: Stem Cell Controversy"

Chair: Desmarescaux, Philippe, Chairman, Scientific Foundation of Lyon, FR

Speakers:

- **Atkinson**, George, Former Science and Technology Adviser to Secretary of State, University of Arizona, US
- **Caulfield**, Timothy, Canada Research Chair in Health Law and Policy, Health Law Institute, University of Alberta, CA
- **Finneran**, Kevin, Editor-in-Chief, Issues in Sciences and Technology, U.S. National Academy of Sciences (NAS), US
- **Imura**, Hiroo, President, Foundation for Biomedical Research and Innovation (FBRI), JP
- **Yamanaka**, Shinya, Professor, Institute for Frontier Medical Sciences, Kyoto University, JP

The stem cell controversy may be representative of the process of introducing and resolving bioethical issues, and this session's participants accordingly stressed the importance of addressing this issue in a timely and appropriate fashion in order to set proper precedents for future issues as well. On one hand, international competition has hitherto worked to drive research, and on the other international collaboration is needed to develop acceptable guidelines for research. Participants gave examples of political and legal concerns as well as ethical concerns and illustrated the variety of policies with which individual countries have responded to stem cell research. Many expressed the desire to achieve the most global standards possible, in contrast to the present situation.

The International Society on Stem Cell Research has defined three categories of stem cell research: Non-permissible research such as reproductive cloning, research which is permissible under currently mandated review, and research which is permissible only with an added level of oversight. These are aimed at addressing the

various ethical issues concerning stem cells, which include somatic stem cells, which have limited differentiating properties, and pleuripotent stem cells, which include embryonic stem (ES) cells and induced pleuripotent stem (iPS) cells. IPS cells – which, except for the fact that they are derived from adults rather than embryos are virtually identical to ES cells – avoid many of the ethical problems associated with ES cells, and successful human trials may occur before long.

The participants generally agreed that universal consensus on ethics and policy is impossible, but existing and seemingly insurmountable regulations in countries such as the US, Canada and Japan are excessive and overly hindering to research. The restrictions on scientific activity and the revered right of scientific research were themselves described as an important ethical issue. On the other extreme, participants pointed out, some areas such as iPS cells *lack* regulations, and their emergence is sure to present new ethical issues. We need new guidelines, and these guidelines should distinguish between scientific and clinical regulations. Creation of a short term forum was proposed to encourage communication of researchers and bioethicists and, while concentrating on current issues, articulate the justifications for funding, with the eventual goal of creating acceptable guidelines. Session members expressed the belief that it is scientists' duty to make an effort to communicate with the public and in their own interest to make decisions in collaboration with the public.

One of the biggest problems addressed in this session was the failure of stem cell research to gain popular support. Stem cell research has been oversold to various extents in different countries, and since the promised cures of regenerative medicine and therapeutic and toxicological applications have not yet arrived, the public understandably shirks backing additional research with more government money. Participants decided that, in order to promote public understanding, we should take a pragmatic approach, promoting basic research and open communication and addressing both opportunities and risks. If we better understood stem cell differentiation, for example, perhaps we could better articulate the opportunities and arguments.

C2: "New Frontiers of Science and Technology – ICT"

Chair: Fayyad, Usama, Chief Data Officer and Executive Vice President, Research and Strategic Data Solutions, Yahoo! Incorporated, US

Speakers:

- **Bjerring**, Andrew K., President and Chief Executive Officer, CANARIE Inc., CA
- **Chu**, Paul C.-W., President, Hong Kong University of Science and Technology, US
- **Huang**, Frank C.J., Chairman, Powerchip Semiconductor Corporation, Chinese Taipei
- **Iga**, Kenichi, Professor Emeritus, Tokyo Institute of Technology, JP
- **Jain**, J.K., President, Jain TV Group, IN
- **Kim**, Young Kyun, Senior Vice President, Global Standards & Research, Samsung Electronics, Co. Ltd., US

Researchers have begun collaborating on the massive datasets produced by advanced computer simulations in genomics, atmospheric studies, finance, brain and cognitive science, and astronomy. Evaluation of these datasets is challenging due to their huge size, and requires development of better modeling techniques. There is also a need for better collaboration platforms. The importance of search to the public has created new fields such as search ethics, which are currently not being adequately studied. Search rankings have a tremendous power to affect human behavior. Similarly, there is a need for research on microeconomics of the Internet, and what causes online communities to grow. What is trust online? Why do some sites inspire us to give out our personal information?

Digital search is giving way to *physical search* (using the Internet to find live information from the real world, rather than text pages). Information technology and cheap sensors, combined with ubiquitous terminals, will allow coordinated response to disasters. Reliance on ICT in emergencies highlights the importance of networks which are not dependent on vulnerable base stations. Satellite-based networks represent a possible robust network solution. It was recognized that there is a need for scientific software design. Large software systems are currently based on past experience and guesswork, which is not an acceptable basis for safety-critical systems. Rigorous software design for large systems will result in faster, more reliable networked environments.

Physical search capabilities will in turn create new privacy and ethical issues. With people uploading all kinds of information about themselves online for their friends to see, what ethical issues are involved? Interactive media and advertising has entered a new period of targetability and progress. Systems to share personal information with hundreds of millions of users are growing in ways that no one expected. There is an immense backlog of scientific data, reflecting the fact that our ability to produce data is outpacing our ability to analyze it. Similarly, the Internet is better indexed than scientific papers, an example of the market responding to the people. Researchers need better tools for literature review and data analysis.

The evolution of computing is leading to more capable mobile devices and more mobile computing devices. More highly connected environments are coming, but it is an open question whether these connected environments will come from increased integration of computers into our environment, or from increasingly capable mobile phones. A wireless-networked subnotebook computer with voice-over IP software and a 4th generation mobile phone have many of the same features but which one represents the future?

There is a convergence of television, broadband and fixed wireless communication hubs in the developed world. A challenge is extending this convergence to the developing world. Also, there is a need for evolution of optical interconnects which support increased transmission requirements of new content demand. ICT has the potential to improve the lives of the poor, but the developing world must not be left out of future networks, or this potential will not be realized. Education and healthcare, made available in ubiquitous terminals, would allow better utilization of highly educated people and better public services in all nations, and especially developing countries. Healthcare will be available anywhere and anytime.

Finally, in a forum which addresses the future development of such fast-changing fields such as software, it is essential that young people be included in the discussion. It was noted during Q&A that no one in the room belonged to the new generation of Internet users who publish everything they do online and prefer blogging, text and instant messaging to phone calls and email.

D2: "Collaboration between Universities / Research Institutes / Industries"

Chair: **Hertel**, Ingolf V., Director, Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, DE

Speakers:

- **Hayashi**, Yoshimasa, Member of the House of Councillors, JP
- **Irandoust**, Said, President, Asian Institute of Technology (AIT), SE
- **Kutzler**, Kurt R., President, Berlin University of Technology (TUB), DE
- **Macmillan**, William D., Vice-Chancellor, University of East Anglia (UEA), UK
- **Sahin**, Kenan E., CEO and Founder, TIAX LLC, US
- **Shirai**, Katsuhiko, President, Waseda University, JP

Collaboration between universities and industries was a taboo issue four decades ago. The situation has changed over the past 15-20 years, as efforts have been made to bring both entities closer to each other. The university-industry relationship today varies from one country to another; it also varies from one industrial sector to another. For example, government policies in Japan and the U.K. have acted to encourage strong cooperation between universities and companies. In Japan, over 1,000 new ventures were created in a three-year period from 2001. Furthermore, there appear to be more good examples of successful joint projects with large companies, meaning that universities have to rethink the best means of dealing with small and medium-sized enterprises.

Because research universities generate innovations and companies implement them, it is widely accepted that the interface between university and industry should be more effective. Although the relationship is complementary, in that universities excel at starting new things and industries at completing them in industrial terms, it was noted that "academic and industrial entities hold different values and are motivated by different incentives."

Compared to industries, many elite universities have outstanding reputations but a small core staff. Differences in perception are also important. As one participant said, on the one hand, "academics view themselves as selfless workers at the service of humankind, while viewing business/industry as the contaminated world." On the other hand, "industry holds similar negative views of academia, believing it to be populated by people who are disconnected from reality and hold irrelevant or even dangerous ideas."

To face up to the challenge of connecting distrusting entities, a better understanding and respect of the differences is crucial. It was emphasized that this university-industry link should be a two-way bridge, with universities transferring technology to industries and universities learning from industries. Moreover, appropriate intermediaries may be crucial to brokering future joint projects.

Participants highlighted the significant role of universities' research training capacity. It was argued that to ensure an effective supply of human resources for industry, basic research should be given greater importance.

E2: "Science and Technology for/in Developing Countries"

Chair: Carty, Arthur J., National Science Advisor to the Government of Canada, Industry Canada, CA

Speakers:

- **Berkley**, Seth F., President and CEO, International AIDS Vaccine Initiative (IAVI), US
- **Haseltine**, William A., President, William A. Haseltine Foundation for Medical Sciences and the Arts; Chairman and Chief Executive Officer, Haseltine Associates, Ltd., US
- **Murenzi**, Romain, Minister of Science, Technology and Scientific Research, RW
- **Phissamay**, Bountiem, Minister to the Prime Minister's Office, Chairman, Science, Technology and Environment Agency (STEA), LA
- **Rubinstein**, Joanna, Chief of Staff to Jeffrey D. Sachs, Director of Strategic Programs and Director of the Center for Global Health and Economic Development (CGHED), The Earth Institute at Columbia University, SE
- **Saeed**, Abdelrahman, Minister, Ministry of Science and Technology, SD

Science, technology and innovation (STI) are key to a nation's capacity for economic development to reduce poverty, increase health care, eradicate disease and achieve sustainability. It was first stated that it is commonly agreed that the Millennium Development Goals will only be achieved by building a framework in science, technology and innovation. In this session the participants focused on the issues which must be addressed to achieve this objective in the most effective way.

First of all, we should keep in mind that partnerships are crucial. Projects in STI should be interdisciplinary, gathering people of various fields, including ecologists, economists and agriculturists as well as policy makers, to respond to the needs of society. Governance should be improved for more effective development of STI. The funding agencies should thus work together with the helping agencies. Indeed, a common language should be found for all the active members. Organizations should work more closely together. The task and role of scientists is to help agencies and to fight to improve inadequate programs.

It was noted that these partnerships must embody the above characteristics to ensure efficiency and meet the local needs of developing countries. A participant presented a highly informative example regarding the creation of a new collaborative network on the occasion of the Millennium Village Project. In this project, 15 countries worked together to apply science and technology to create local villages in Africa to meet local needs.

As shown in the previous example, STI have to be long-term-oriented and stable. There is no point to establish projects that are not sustainable. It is obvious that long-term commitment is the solution and working with local partners is an important component of this solution.

Participants stressed the importance of focusing on education and knowledge transfer. In this field, many positive signs and steps have been taken in developing countries. Rwanda was offered as a successful example, for many reasons. First of all, the case of Rwanda underscores the fact that for the development of STI to occur, you must have development of educational opportunities. Rwanda has tried to rebuild the country after the genocide, focused on promoting science in the field of education. Today, Rwanda is working with the Massachusetts Institute of Technology to develop access to technological means and to promote the involvement of foreign scientists but also to establish R&D units in local industries. The point is really to develop and promote knowledge transfer to reduce brain drain, which exacerbates local difficulties.

Indeed, engaging local scientists has multiple benefits. In Africa, there are now 18 laboratories with huge research capacities and the newest technologies, allowing them to gain accreditation. In addition, the fact that some African countries are gaining international recognition in development of STI acts to encourage other developing countries. Still, it is true that STI initiatives in developing countries continue to lack funding. Foreign direct investment might be part of the solution. As an example, the efficiency of Japan in accelerating innovation and providing transfers of technology was underlined.

Finally, the participants insisted on the fact that nowadays there is a new drive for technological achievements. Demographic changes are so important that action cannot be postponed. The relevant problems are known, and now practical solutions have to be taken.

F2: "Interface and Dialogue between Humanities and Natural Sciences"

Chair: Waldvogel, Francis A., Director of the Executive Board, World Knowledge Dialogue Foundation, CH

Speakers:

- **Bassi**, Davide, Rector, University of Trento, IT
- **Bosredon**, Bernard, President, Sorbonne Nouvelle University, Paris III, FR
- **Desai**, Vishakha N., President, Asia Society, IN
- **Hill**, Richard S., Chairman of the Board and Chief Executive Officer, Novellus Systems Incorporated, US
- **Minami**, Masago, Senior Writer, Yomiuri Shimbun, JP

Sciences and humanities have long had different approaches to their disciplines. Science is observational

and perceptive, while the humanities are introspective and testimony-based. Although natural scientists often use their discipline as a springboard for philosophical speculation, social scientists feel their insufficient knowledge disqualifies them to comment on natural science.

Generation gaps also exist, with older people's deeper experience and younger people's freshness of approach contrasting with the more hidebound discipline of middle-aged people. Fruitful dialogue between science and humanities requires a holistic approach, with honest admission of interdependence and requests for help by each side. There is a need for a toolbox approach to problems with input from many different disciplines available to all. This is a goal of the World Knowledge Dialogue instituted last year.

Flexibility and broadmindedness in academia emerged as an important factor. Academic education naturally moves toward greater specialization, but there is a need for specialists to broaden their fields of general interest, respect each other's ways of communicating and learn other's languages to facilitate dialogue. Also, there is the question of the perceived hierarchy of prestige of various disciplines.

The media faces a conflict between the responsibility to tell the truth and the need to market publications competitively. The media custom of presenting pro and con sides of an issue like climate change might result in a lagging scientific consensus and inhibit accurate reportage which would alert the public to real concerns. Training journalists to communicate in the language of science would be helpful.

A historical perspective shows us that the Enlightenment, which spurred the Industrial Revolution some 250 years ago, was based on unilateral consumption of nature for industry, but this paradigm now needs to be changed. The world order is poised to shift to include more superpowers, probably in Asia. It may now be appropriate to look at the ancient cultures of Asia. Some of these cultures may provide interesting perspectives on modern problems. There is also a need for science to become more culturally sensitive, which might be met by embedding culturally trained personnel into science, public policy and global problem-solving.

The problems facing humanity at present are less those of production than of fair allocation and distribution of energy, technology and related goods. If it is the responsibility of science to provide solutions, it is the role of the humanities to find ways to carry out this allocation, keeping basic morality in mind.

Finally, all agreed that education, including primary education, is a major key to increased awareness of global issues. Reorganization of knowledge along new parameters is one possibility. Instead of organizing both science and humanities into ever more specialized disciplines, an issue-based approach, incorporating the most useful elements of all relevant disciplines, might lead to more and better solutions.

G2: "Measures to Accelerate Innovation"

Chair: Kurokawa, Kiyoshi, Science Advisor to the Cabinet; Professor, National Graduate Institute for Policy Studies, JP

Speakers:

- **Cronin**, Martin, Chief Executive, Forfás, IE
- **Eriksson**, Per, Director General, VINNOVA (Swedish Agency for Innovation Systems), SE
- **Hane**, Gerald J., Managing Director, Q-Paradigm, US
- **Hasse Ferreira**, Joel, Member of the European Parliament, PT
- **Pontin**, Jason, Editor-in-Chief and Publisher, Technology Review, UK

Innovation comes from understanding market needs, creating a need that did not previously exist, and seeing value that is currently not there.

Kiyoshi Kurokawa
Science Advisor to the Cabinet;
Professor, National Graduate Institute for Policy Studies, JP

Innovation in a globalized world means, among other things, investing in human capital rather than human resources, nurturing entrepreneurship and striving to protect our differences. We need to recognize our weaknesses and turn them into strengths by finding collaborators. Most importantly, the catchphrase "Think globally and act locally" is now reversed: We should "Think locally and act globally."

When it comes to globalization of networks of venture innovation, parallel expansion of companies in national and international markets offers a new approach to tapping global potential at an early stage and to accelerating growth.

In order to gain value from this process, there is a need for policy measures to consider the full innovation process, especially downstream, in order to create a nurturing environment for venture innovation. On a broad scale, lessons that can be learned from case studies include the notion that society has to be willing to support discovery-based research, that there has to be a system for technology transfer and IT ownership, and that there should be more of a tolerance for failure. The latter point applies to the U.S. attitude in particular, but this ability is also underdeveloped in Europe and Japan.

Public-Private University Partnerships are a means of strengthening the linkage between academia, business and politics. One case study yielded useful suggestions to accelerate innovation. These included setting up financial centers, technology transfers, a scheme for innovation vouchers where small amounts of money act as positive incentives, and encouraging T-shaped profiles, i.e. both deep and broad-based interdisciplinary education.

Social sciences are not to be left out of the discussion. Innovation is usually technology and market-based. However, social acceptance has to be taken into account, too. Social sciences help and support innovative activities. The Massachusetts Institute of Technology (MIT) was cited as a place where departments talk to end-users first, not to companies, in order to find out more about their real needs. Hence, while technology-based innovations are important, we must also foster non-technology-based innovations on the service side. Furthermore, in order to foster innovation, forming interdisciplinary teams characterized by plurality and different backgrounds and careers is recommended.

The discussion closed with the remarks that innovation requires the cooperation of all actors involved.

12:00 – 13:45 Working Lunch: "Innovation"

Chair: Wince-Smith, Deborah L., President, Council on Competitiveness, US

Speakers:

- **Cho**, Fujio, Chairman, Toyota Motor Corporation, JP
- **Little**, Mark M., Senior Vice President and Director, GE Global Research, General Electric Company, US

Deborah Wince-Smith identified innovation to be the driving force of the 21st century, requiring new strategies for every industry. She outlined 8 great transformations innovation has brought about:

Deborah Wince-Smith

1. The digital revolution. The diffusion of knowledge happens at a mind-boggling speed. Talent flows across borders and employees and consumers can be reached globally.
2. The rapid advance of emerging economies. By 2020, 80% of all consumers will live outside the first world.
3. International trade. Today, trade leaves a global geographic footprint with complex global supply chains.
4. The globalization of talent and workforce. Emerging economies are entering the global economy, while European countries and Japan face a decreasing population. Global trade in tasks and global labor arbitrage are key to tackling these issues.
5. The relentless pace of S&T change. The speed of science and technology changes has a tremendous impact on the whole world and entails profound and disruptive effects. This transformation is immensely complex, necessitating new tools and high performance.
6. Nature and the process of innovation itself. Twenty years ago, the concept of innovation revolved around S&T. Today, half of all innovation processes come from intangible assets.
7. The global ecosystem. Innovation is multi-disciplinary and requires cooperation, which brings people with diverse backgrounds together and creates a network across the globe.
8. The intersection between demand and need. Dealing with global issues such as climate change will result in the development of new technologies aiming at resolving pressing problems.

She closed her speech by pointing out that the future holds new forms of values and transformative innovation.

Fujio Cho described the nature of Toyota's winning philosophy, a success story that goes beyond innovation in product design and equipment technologies to innovation in the manufacturing system. To set the tone, he first described an increasingly global economy and society, which implies rapid movement across political borders and consequent international competition, intensified competition in technologies driven by the virtually infinite resources of knowledge and innovation, and the rise of environmental and resource issues such as climate change

and the consequences of expansion. We can expect revolutionary – and simultaneous -- innovations in all areas of research.

Fujio Cho

Underlying Toyota's success is its unwavering belief in the development of human resources, including parts suppliers and employees, through traditional Japanese styles of on-the-job training, innovation through teamwork, and kaizen, or daily continuous improvement. Another factor is Toyota's unique production system. This has led to unprecedented elimination of waste, mainly addressed by two operational schemes: 1.) The Just-in-Time scheme ensures that no more product is made than is needed by the customer, and no more is made at any step of the assembly line than is needed by the next step. 2.) The Jidoka scheme works to stop machines and assembly lines immediately when a problem is found, thus preventing unnecessary production of defective items. This applies even today, when assembly lines have become fully automated and workers need only intervene when machines have to be stopped.

Mark Little

Mark Little explained that innovation lies at the very core of operations at the General Electric Company (GE), the directive for business being technological innovation. He outlined how GE connects innovation and business needs, namely by delivering core technology, discovering new technologies, spreading technology across GE companies, developing world-class talent and connecting with the world's technology. GE's innovation process further includes a technology council to evaluate new potential as well as the formal Session T process whereby external customers visit the company to share projections of their future technology needs and to brainstorm. In order to ensure that all ideas are heard, GE funds an idea generation process. Moreover, GE reaches out to the venture capital world, an important source for ideas, to invest in start-up corporations.

14:00 – 16:00
Third Series of Concurrent Sessions

A3: "Harmony with Nature – Water"

Chair: Catley-Carlson, Margaret, Chairperson, Steering Committee, Global Water Partnership/UN SecGen Water Advisory Board, CA

Speakers:

- **Moody**, James B., General Manager, International Development, CSIRO, AU
- **Rijsberman**, Frank R., Director, Water and Climate Adaptation Initiatives, Google, NL
- **Szöllösi-Nagy**, András, Deputy Assistant Director-General, Natural Sciences Sector, UNESCO, HU
- **Tundisi**, José G., Honorary President, International Institute of Ecology, BR

Are we running out of water? The amount of water is fixed but the increasing population, which is forecast to peak at 8.5 billion, along with greater meat consumption and higher living standards, has dramatically increased total water consumption and decreased the amount available to each of us. As a result, there is competition for water for food, feed, fuel, biofuels and fiber. With climate change we have more episodes of drought as well as more flooding than ever before. In fact, some areas experience both drought and flooding during different seasons of the year. Climate change has also wrought a seeming acceleration of the hydrological cycle, making our past predictive tools less effective.

The problem with water isn't scarcity as much as governance. Access to drinking water is a political and budgetary choice. We don't pay much for water, so it doesn't generate enough revenues to cover the price of building infrastructure to transport it or efficiently irrigate fields, or for drinking and sanitation.

Science can't solve the water scarcity problem alone, although membranes, flushing systems and other new technologies can help improve water use efficiency. A sustained water crisis, as experienced in recent years by countries like Australia, causes economic decline and dislocation, litigation and crime. At the same time, it contributes to growing public awareness of this vital natural resource, spurring greater public investment and regulation, increased commercial interests and heightened community involvement.

There are some steps we can take to reduce demand, such as conservation-minded pricing policies and efforts to reduce waste in agricultural irrigation or waste of treated drinking water due to degraded pipelines. Decentralization of watersheds and privatization of water supplies and waste water treatment may make management more efficient, but we also need management communities to work together to share expertise.

Data on ground and surface water and the influence of climate change on water supplies is insufficient, and there is often insufficient access to data or models due to governments' proprietary control of information. A global hydrological observation system and satellite-based information gathering would help here. More scientific research and development on ways to reduce water use, especially in agriculture, would also be beneficial. Many efforts to solve water problems may stop at national borders, but international cooperation with shared watersheds and in preparing seasonal forecasts or long-term outlooks is desirable.

It was suggested that we improve the means of economic analysis of the shadow price of water for smarter allocation and regulation. Forming teams of managers from various disciplines to discuss water issues will result in better decisions.

Gender and equity issues affecting water should not be neglected. For example, many women in Africa spend hours a day obtaining water for household use, reducing opportunities for education and employment. Access to water should be affordable for lower income groups, with progressive pricing schemes meriting consideration.

Water quality and storage are other crucial areas. Degraded water demands more chemicals so costs increase. Flooding can cause sedimentation and degradation of stored water. We must increase storage capacity in reservoirs and ground water. Capacity-building in developing countries is especially needed.

Finally, many participants suggested that an understanding of water must also consider energy issues, since both areas are closely interrelated.

B3: "New Opportunities opened by GMOs"

Chair: Fedoroff, Nina V., Science and Technology Adviser to the Secretary of State, U.S. Department of State; Evan Pugh Professor of Biology and Willaman Professor of Life Sciences, The Huck Institute of the Life Sciences, Pennsylvania State University, US

Speakers:

- **Beachy**, Roger N., President, Donald Danforth Plant Science Center, US
- **Fischhoff**, David, Vice President, Technology Strategy and Development, Monsanto Company, US
- **Fyrwald**, J. Erik, Group Vice President, DuPont Agriculture & Nutrition, US
- **Madkour**, Magdy A., Head of Biotechnology, Arid Lands Agricultural Research Institute (ALARI), Ain Shams University, EG
- **Moloney**, Maurice M., Founder and Chief Scientific Officer, SemBioSys Genetics Inc., IE
- **Van Montagu**, Marc, Founder and Chairman, Institute of Plant Biotechnology for Developing Countries (IPBO), Ghent University, BE

Genetic engineering and genetically modified crops have both improved the quantity and quality of agricultural production and decreased the negative impact of agriculture on the environment, and yet, paradoxically, they face widespread prohibitions and tough regulations.

There are many arguments in favor of GM crops. Increases in population along with greater demand for meat and low-carbon emissions mean an increase in demand for grain which can only be met with GM technologies. These technologies can yield higher productivity through drought, insect and herbicide resistance. They have enabled us to develop plants with enhanced nutrition and added nutrients; plants with material properties better suited to forest product or biofuels applications; and plants that create needed proteins like insulin. Traits that were once fantasized about, such as increased nitrogen usage efficiency and cold tolerance, and plants with modified oils are now being developed and may be ready for commercialization within ten years.

Despite these benefits, the barriers to commercialization are daunting. Costs are one issue, but the main problem is regulation and associated liability concerns of GM crop companies. Commercial GM crops are grown in over a dozen countries, but are limited to only a handful of varieties taking advantage of just a few traits, such as herbicide tolerance and insecticide. Regulations have grown out of the public's overblown fears concerning health effects and morality, the impact on the organic farming business, and the possibility that GMO trade will allow control of global agriculture by a few nations.

The most effective solution would be to provide people with crops which promise great direct benefits (a comparison was made to Botox, which, despite being a potent toxin, was quickly embraced by the public for cosmetic uses). Transgenic plants geared towards biofuels could be used as a sort of gateway transition towards transgenic food crops, since there is money in the biofuels area and the maize used for fuel presumably has many commonalities with maize used for food. Though efforts have been futile to date, dissemination of information is still crucial, especially as relates to the benefits, safety and need for biotech crops. Looking back, better preparedness of the scientific community at the outset and an appeal for 'sunsetting' regulations – i.e. regulations with built-in time limits so that they could be rethought and changed every

few years as knowledge about the technology changes – could have been beneficial. It may be too late for such laws, but scientists should try to gain the support of various groups which could then work to lobby politicians and promote and convince others of the benefits of GM plants.

Another area addressed in this session was the issues hindering developing countries from embracing GM crops. One of the main concerns was that seeds bought from foreign GM companies would make farmers vulnerable to price changes. These concerns could be overcome with the use of GM sorghum – modified to improve digestion – which is a native staple. Work is being done to introduce such sorghum and build a platform to deliver the seeds to small-scale farmers as well. As in developed countries, public forums are needed to answer questions and concerns and bring policy makers as well as farmers on board with the scientists. Many countries do not have regulatory systems in place, and it is especially important to make sure these nations are aware of their options. Also, the people in developing nations are not likely to be convinced of the safety and benefits of GM crops until the people in developed nations are first convinced.

C3: "How Computational Capabilities are Changing Science and Research"

Chair: Anzai, Yuichiro, President, Keio University, JP

Speakers:

- **Bolsens**, Ivo, Chief Technology Officer and Vice President, Xilinx, Incorporated, BE
- **Crounse**, William E., Worldwide Health Director, Microsoft Corporation, US
- **Havlíček**, Václav, Rector, Czech Technical University in Prague (CTU), CZ
- **Markram**, Henry, Professor, Swiss Federal Institute of Technology, Lausanne (EPFL), IL
- **Sprekels**, Jürgen, Director, Weierstrass Institute for Applied Analysis and Stochastics in Forschungsverbund Berlin e.V., DE
- **Yamada**, Keiji, General Manager, C&C Innovation Research Laboratories, NEC Corporation, JP

Japan's Earth Simulator was an important milestone in scientific computing, both for the simulations it made possible and for the impetus it provided to trigger further supercomputer research in the rest of the world. Genetics, biochemistry, weather forecasting, climate change research and computational neuroscience are some of the fields that have developed directly from the capability for massive computer simulations.

Though people worry about how long lithography technology can support faster chips, improving computer architectures enables a 1000x increase in performance without changing current chip manufacturing processes. Thus non-standard architectures offer performance improvements without investing in new chip fabrication facilities.

The vast data output of supercomputers has created a need for modeling tools for complex data. 'More' and 'faster' alone will not lead to breakthrough results. It is important in computational methods to find the right mathematical models and to use the models efficiently in order to perform effective simulations. We must invest in mathematics, as it provides for abstraction, abstraction allows flexibility, and flexibility leads to innovation. Thus effective use of mathematical toolkits will result in new scientific discoveries and products.

High speed networks and collaborative portals are enabling international cooperation, and have already been used to speed up drug development by allowing collaboration between disparate laboratories. The infrastructure for education and R&D has been enhanced. Consequently, new possibilities such as virtual health systems will allow expansion of healthcare to areas experiencing severe physicians' shortages.

We are entering a supercomputer race. Japan plans to build a 10 petaflop general purpose supercomputer in 2012 which will allow new possibilities for simulation, particularly in climate change. With such enormous computing power, the amount of data required for initialization and validation of simulations increases, driving the need for low cost sensors to provide such data. Also, the data generated is enormous in volume, which leads to another challenge for researchers.

It is becoming impossible for one person to read all the papers produced in a year in a given field, so that even experts know only a fraction of the accumulated knowledge in their fields. Computers can help with data analysis, as well as searching literature from a database to draw a portfolio of relevant research activities. Computers should facilitate the intellectual activity of researchers.

The new computing capabilities are causing some ethical dilemmas. It is important to perform thorough validation of models and to know their limitations. Also, implications of statements to the public and the press must be considered.

A 10,000-cell portion of the human brain was successfully simulated after two years of research at ETH, and a follow-up program has begun to make a computer that can simulate the human brain by 2015. The human brain simulation will trigger a revolution in computing, as the mechanisms of the computing efficiency of the brain are

understood and utilized to make computers with better performance per watt of orders of magnitude. What is more, we will know how we think.

D3: "Brain Drain and Brain Gain"

Chair: Kumar, Ashok, Chair, Parliamentary Office of Science and Technology (POST), Houses of Parliament, UK

Speakers:

- **Bhumiratana**, Sadkarindr, President, National Science and Technology Development Agency (NSTDA), TH
- **Campbell**, Donald W., Senior Strategy Advisor, Davis LLP, CA
- **Kinnear**, Judith F., Vice-Chancellor, Massey University, NZ
- **Schütte**, Georg B., Secretary General, Alexander von Humboldt Foundation, DE

The Brain Drain issue - and its counterpart the Brain Gain - is a phenomenon which is partly reflective of mankind itself. It is indeed a type of human migration. Talents are not bound to nations: highly skilled people are among the most mobile of humans.

The Brain Drain issue first became a significant concern in the 1970s and 1980s, when experts moved from developing countries to developed countries, especially in North America and Western Europe. Movement between developed countries is not to be forgotten, however, as people with valued skills move from the U.K. and Canada, for instance, to the U.S., or from New Zealand to Australia. The brain drain debate is still relevant today, although the scale of the phenomenon may be smaller.

As one of the speakers noted, "The brain drain debate oscillates between the intrinsic freedom of academia and national interests." From the point of view of the individuals involved, the phenomenon is a dividend, whereas from the view point of states, it is an acute challenge, though not irremediable.

The phenomenon boasts several favorable aspects. Skilled people who move to work overseas gain valuable experience and build research networks that in the long-run will benefit their homelands, while the developed countries maintain their workforce and, at the same time, extend their networks and business. In this regard, brain drain should not be regarded as a threat, since "brains" may return to their home countries if appropriate measures are taken.

For example, Thailand has faced a shortage of skilled personnel in science and technology for more than two decades. It has nevertheless been successful in drawing back native Thais after setting up a "reverse brain drain project," a short-term measure aimed at increasing manpower, especially in science and technology. However, even if qualified people are coming back, it is still important to regard the overall outlook with some caution, as many developing countries don't produce sufficient educational resources.

"Optimistic" is the word which may best describe how most people currently perceive the phenomenon. Some countries undergo brain drain and brain gain at the same time (inflow/outflow) and net results are often positive. This is the case with New Zealand, a country shaped by immigration, where more workers are entering the country than leaving it, thus contributing to promote cultural diversity and build research networks.

The session placed particular emphasis on "brain circulation," a complex multilateral interaction of flows of students (due to exchange programs or double degrees) and qualified researchers. It has been suggested that the expansion of higher education and research systems worldwide might herald a new geography of researcher mobility, thus helping career structures to converge.

The question of how to attract skilled people was addressed by several participants. Policy makers offer a wide range of gambits, including flexible reward structures, selective investments to elevate individual research universities, and subsidies to advanced higher education and research systems.

E3: "International Harmonization of Intellectual Property Rights"

Chair: Roach, Allan, Director, World Intellectual Property Organization (WIPO), Japan Office, AU

Speakers:

- **Akimoto**, Hiroshi, Managing Director, Member of the Board, Takeda Pharmaceutical Company Limited, JP
- **Rader**, Randall R., Circuit Judge, U.S. Court of Appeals for the Federal Circuit, US
- **Stein**, Christian A., Chief Executive Officer, Ascenion GmbH, DE
- **Sweeney**, Tom, Co-founder and Managing Director, Garage Technology Ventures, CA

Intellectual property refers to legal entitlements to copyrights, patents, trademarks, trade secrets and other expressions of ideas or information. Maintenance of intellectual property rights is seen as vital in protecting and facilitating technological advances, yet due to differing national IP systems, inventors find it difficult to protect their inventions worldwide. This stymies innovation, new investment and technology transfer.

The 100-year-old IP framework no longer suits the increasingly globalized and rapidly evolving nature of science and technology. Some participants felt that strict IP protection in Europe and other developed nations may constitute barriers to entry for start-ups and other small and medium-sized companies in particular, due to the expense involved and the need to devise a sophisticated IP strategy. Although government-level bilateral IP agreements are increasingly common, there is a need for harmonization of legal protection through national and international mechanisms with common measures of success.

Two issues of particular focus in this session were the lack of IP protection in the academic community and the need for affordable, simplified IP coverage in developing countries. Universities have become research-based institutions responsible for fostering innovation and technology transfer, but the academic imperative for publishing new research and the commercial need to protect it can cause conflicts. Knowledge and information are not being shared as much as before, and legal and incentive mechanisms are often poorly applied. Universities and affiliated research centers must address conflicting demands for social responsibility and ownership by implementing clear rules and schedules for licensing and royalties.

Development efforts must be profitable to be sustainable, while developing countries need to have more incentives to invest in IP. A participant noted that affordable, harmonized IP protection could allow developing countries to benefit from their inherent competitive advantages, such as lower-cost manpower and infrastructure, plentiful raw materials and high levels of biodiversity. This would enable them to attract investment by multinational companies in research and development. Differential pricing for medicine might be one way to ensure that developing countries can afford the drugs they need, and a fast track for certain types of patents might help such products reach their markets more quickly.

It was suggested that current proposals, like the World Trade Organization's TRIPS scheme, may face legal problems in implementation. Global action is needed at the political level to reform the current IP system and improve its applications within the research community. This problem should be on the agenda at the next G8 summit meeting.

F3: "Critical Science and Technology Agendas for the Media"

Chair: Campbell, Philip, Editor-in-Chief, Nature, UK

Speakers:

- **Apsell**, Paula S., Senior Executive Producer, Director WGBH Science Unit, WGBH NOVA SERIES, US
- **Bly**, Adam, Founder and Editor-in-Chief, Seed Magazine, CA
- **Cerrell**, Joe, Director, Global Health Advocacy, Bill & Melinda Gates Foundation, US
- **Coyaud**, Sylvie, Science Reporter, Il Sole 24 Ore, FR
- **Fujisawa**, Hidetoshi, Executive Controller General, NHK Japan Broadcasting Corporation, JP
- **Ghosh**, Pallab K., Science Correspondent, BBC News; President, World Federation of Science Journalists, UK
- **Standage**, Tom, Business Editor, The Economist, UK

The media is of essential importance in interpreting the scientific community, policy makers and the general public to each other. How should the media promote science to the public, and to what degree should the public accept manipulation by the media in science reportage? How should the media deal with controversial issues relating to science? Should the media contribute to the preservation of scientific integrity and help to protect "whistle-blowers" who step forward to call attention to lack of integrity?

Sylvie Coyaud
Science Reporter, Il Sole 24 Ore, FR

The promotion of science to the general public is a major task of the media. The popularity of science TV programs, magazines and the Internet shows the public's desire for information. The media has a responsibility to avoid negative stereotypes of science. The problem for the media is how to present science realistically as a process without cheerleading for science. In modern society, the differing viewpoints of science are often seen as a kind of debate wherein consumers can choose the facts that suit them, which may not be an appropriate response to some issues

whose scientific results point unequivocally to inconvenient but vital truths.

On the other hand, quick turnover in scientific results are seen by the public as a weakness, rather than as a fundamental attribute of science. There are also the well-organized and well-publicized "anti-science" attitudes promulgated in the US and elsewhere by religious groups, which create difficulties for media seeking to represent science fairly and objectively. Different levels of sophistication in media serving different intellectual and social levels of the public must also be considered. Many sources have no checking mechanisms; distorted or mistaken science – which is very difficult to correct -- may easily make its way into the public consciousness.

Encouraging developments in media promotion of science can be found in the new media, such as online Internet magazines, science blogs, etc. These have the advantages of reaching younger audiences from many different spheres, encouraging the pursuit of science in the next generation, promoting transparency by allowing scientists to communicate directly with the public, and spurring global intercourse. There is also the art/science interface, which is garnering increasing interest. Health issues, too, may find advocates in the media, alerting the public, investors and policy makers to vital issues of global need.

The media is responsible for making the public aware of controversial scientific issues. Reportage which is not well-founded, simplistic, biased, or even untrue can distort the objective truths provided by science. The media needs to zoom in on scientific processes by providing insights for increased public understanding, making sure scientific findings are not oversimplified or skewed. At the same time, the media needs to zoom out on social patterns, especially remembering that much technology was initially regarded with suspicion which later turned out to be unfounded. Complex issues combined with ill-informed or biased journalism produce inaccurate stories and a confused and ignorant public.

The media is also responsible for preserving integrity. There is a perceived lack of critically-minded science reporting. If science needs to be ethical, and government needs to be transparent, the media needs to be as clear a conduit as possible. In addition, scientific and academic "whistle blowers" who are committed to public accountability of institutions suffer persecution by both their institutions and the media. An atmosphere in which these courageous people can come forward with reduced risk is necessary to maintain the integrity of institutions.

In conclusion, there is a need for more media to accurately portray science-related issues, and for more financial resources to be allocated to this end.

G3: "Innovation and Business"

Chair: Clark, Megan E., Vice President Technology, BHP Billiton Ltd., AU

Speakers:

- **Feczko**, Joseph M., Senior Vice President and Chief Medical Officer, Pfizer Inc., US
- **Gregory**, Mike, Head of Division, Institute for Manufacturing, University of Cambridge, UK
- **Hirata**, Ikuo, Editorial Page Editor, The Nihon Keizai Shimbun, JP
- **Jourquin**, Christian F., CEO, Solvay S.A., BE
- **Nicholson**, Peter J., President and Chief Executive Officer, Council of Canadian Academies, CA
- **Patel**, Ketan, CEO, Greater Pacific Capital, UK

This session debated the good practices and challenges involved in turning technical progress into revenues and flourishing businesses.

Enormous challenges are facing us regarding innovation, be it in the field of energy and resources or in the rise of economies such as China and India. Comparative cost advantage can be tackled with participation in these markets, while deep understanding of the nature of this competition is required in view of powerful China and India's unstoppable transformation.

Further, there is a new breed of entrepreneurs with Asian characteristics, people from poor countries who have fought their way up, so that survival of the fittest is a reality in the business environment. Another challenge is to find the right policy-makers to support innovation. However, the dialogue between industry and authority is difficult, due to the policy maker's pursuit of short-term goals in light of the next elections. While the time-frame for politics is years, and that of the media only days, it is centuries when speaking about population and decades when it comes to business. We must remember that the media, however, has a powerful influence on innovation, insofar as reporting can raise public awareness and eventually can result in heightened demand for cleaner technologies and more efficient tools to fight global warming and other problems.

Creativity is a crucial factor to accelerate innovation, complemented by an interdisciplinary approach and interaction between institutions of higher education. Furthermore, we should not underestimate the importance of the soft skills of innovation, such as being able to learn as a team and work as part of a team.

Innovation means doing something new and not just having a great idea, as is the case with invention. Business then turns ideas into realistic opportunities. However, the accelerating trend towards specialization is posing some significant new hurdles to innovation. Although there is nothing inherently wrong with universities becoming more and more specialized and science becoming deeper and deeper in its purview, at the same time, science can be regarded as becoming smaller and smaller. Universities lack follow-up institutions that ensure the integration of ideas, as is the case in the business world. Universities should thus follow the model of industrial innovation, as there is a real pressing external need for them to be more closely linked.

Universities and research can play a vital role, as innovation challenges faced by business can be viewed as healthy reality checks for universities. On the other hand, the downsides of the relationship between universities and the business world include the differences in values and the priority placed on protection of the use of knowledge in the business world.

A participant emphasized the importance of Public-Private Partnerships as a means to engage more broadly with different stakeholders and find collaborators. The key point is that we cannot do it alone. This view reflects the fact that the action of one actor in a country can affect another member of society due to the interdependencies existing in today's globalized world. Having an international perspective becomes indispensable.

16:30 – 17:30 Plenary Sessions in Parallel

A: "Global Solutions for Infectious Diseases"

Chair: McKinnell, Jr., Henry A., Former Chairman & CEO, Pfizer Inc; Chairman, Academic Alliance Foundation, US

Speakers:

- **Feinberg**, Mark B., Vice President, Policy, Public Health and Medical Affairs, Merck Vaccine Division, US
- **Herrling**, Paul L., Head of Corporate Research, Novartis International AG, CH
- **Makgoba**, Malegapuru W., Vice-Chancellor, University of KwaZulu-Natal, ZA
- **Masuzoe**, Yoichi, Minister of Health, Labour and Welfare, JP
- **Muchena**, Olivia N., Minister of Science and Technology Development, ZW
- **Nakatani**, Hiroki, Assistant Director-General, HIV/AIDS, Tuberculosis and Malaria, World Health Organization (WHO), JP

Henry McKinnell, Jr.

Henry McKinnell, Jr., noted that today one in two people in developing countries and one in seven in developed countries die from infectious diseases, making the fight against it a moral imperative. The problems of the developed and developing world are interrelated. The diseases of developed countries are mutating into resistant strains, threat of a pandemic is overdue, and vigilance will be necessary to keep populations safe. In developing countries, HIV now affects 30 million people, with substantial increases projected in the future.

Yoichi Masuzoe

Yoichi Masuzoe explained that to fight such diseases as pandemic flu, HIV and STDS, Japan has developed the Directly Observed Treatment Short-course program, focusing on high-risk populations such as the old, young city dwellers and the urban homeless population. Young people are also being inoculated in a bid to eliminate measles. In addition, Japan is helping to fight avian flu on a regional level by offering international aid, stockpiling anti-viral drugs and focusing on human security.

Malegapuru Makgoba

Malegapuru Makgoba stated that HIV has increased geometrically in South Africa, with its transmission exacerbated by migrant labor flows, poor living standards and low education levels. The major diseases impact on each other – from STD to HIV to TB. Deaths of young people from HIV impact society as a whole by putting pressure on agriculture and family life. Problem-solving strategies include education encouraging lifestyle choices and sexual responsibility, investigating various treatments, identifying resistant strains of HIV and TB, and transferring resources to reduce equity disparities.

Olivia Muchena

Olivia Muchena said that Zimbabwe has mobilized internal resources to meet the AIDS challenge. The goals of the anti-AIDS campaign are to remove the stigma of having AIDS, to rehabilitate people, and to get people to talk about AIDS and to make their status public. As a result, AIDS incidence decreased 9% from 2000 to

2005. Zimbabwe has used its minimal resources to fight AIDS, malaria and TB, by focusing on low-cost technologies, sanitation and clean water, with positive results.


Hiroki Nakatani

Hiroki Nakatani identified the role of infectious disease as a barrier to sustainable development. Although smallpox and polio are greatly reduced globally, the disease cluster of HIV-TB-malaria remains a major threat. WHO is working for universal access to treatment of HIV, but more financial help is needed for distribution. TB is a global health issue, but some decrease has been seen. Malaria especially affects children; WHO focuses on state-of-the-art technical assistance. The changing landscape of international cooperation will hopefully promote technical guidance, national pathways for distribution, and access to existing drug supplies.


Mark Feinberg

Mark Feinberg explained that 2 million children die in developing countries from preventable diseases every year. Merck provides resources for institutions, partners with government scientists to make real drugs, manufactures drugs that address high and low-income countries' needs, and has no-profit pricing for low-income countries. From external sources, Merck needs increased awareness, advocacy and prioritization of vaccines, and funding. Merck has helped China boost hepatitis B vaccinations for children from 10% to 60% of the population, developed a vaccination for rotavirus, started HPV vaccination programs in Peru and India, and is pursuing an HIV vaccine.


Paul Herrling

Paul Herrling of Novartis International focused on drug discovery for tropical and other diseases that have been neglected due to lack of commercial returns. The NITD, set up jointly by Novartis and the Singapore government, pinpoints TB, dengue fever and lately, malaria. The institute provides access to technical information, generates its own basic data, holds scientific meetings offering firsthand interaction with patients, promotes local training, carries out networking between government and science, and makes drugs and vaccines available at no profit.

B: "The Role of Universities in the 21st Century"

Chair: Sykes, Richard, Rector, Imperial College London, UK

Speakers:

- **Fox**, Marye Anne, Chancellor, University of California, San Diego (UCSD), US
- **Seweryński**, Michał, Minister of Science and Higher Education, PL
- **Shih**, Choon Fong, President, National University of Singapore, SG
- **Wintermantel**, Margret, President, German Rectors' Conference, DE
- **Yuthavong**, Yongyuth, Minister of Science and Technology, TH


Richard Sykes

Richard Sykes noted that universities contribute to wealth generation, help to tackle social inequalities and improve quality of life, and foster better understanding between cultures. Solving the complex global problems that will be faced by new generations requires teams working across disciplines and global brainpower. To be global, universities will have to draw its members internationally. This will lead to intellectual, social and cultural benefits. "Universities in the 21st century must take on a leadership role," he concluded.


Marye Anne Fox

Marye Anne Fox explained the role of research-intensive universities as advancing knowledge, educating knowledge workers and using this knowledge to further society. The approach rests on a foundation of innovation, interdisciplinary studies and an international curriculum. Secondary schools provide universities with the raw material of future leaders, but too few children in the United States are finishing high school, and of those who do, many choose not to attend university. We need to inspire students at lower levels, particularly women and minorities, to develop an interest in science and technology and we must clarify the rewards of careers in S&T.

Choon Fong Shih presented science and technology as a double-edged sword, bringing people closer together but also amplifying cultural differences and socio-cultural


Choon Fong Shih

divides. He stressed out that today's global conflicts may be due to the fact that "the pace of technological change far exceeds the pace of social and cultural adaptation." Universities can play a vital role in contributing to innovation and building bridges across different cultures. Global alliances of universities can be powerful forces for building mutual respect and dialogue among diverse cultures and civilizations.


Margret Wintermantel

Margret Wintermantel proposed seven roles for universities to play in the 21st century. They must hand down existing knowledge and generate new knowledge, particularly in the sciences, and they must be competitive and prepared for new challenges. Universities are agents of change, even as they are themselves changing dramatically. They must offer a diverse spectrum of academic subjects and be innovative and entrepreneurial. They must be socially responsible in seeking social equity and broader access to education, and they must be international, able to compete for students and faculty worldwide through strategic alliances. Finally, they must serve as creative workshops for the future, able to contribute to development and investigate important issues.


Yongyuth Yuthavong

Yongyuth Yuthavong believes that universities in the 21st century must seek a new paradigm. In the knowledge economy, knowledge increases but also becomes rapidly obsolete, thus making "learner-centered education" an important concept. This implies the need for tomorrow's universities to constantly refresh teachers' knowledge and provide an environment for active research. Universities of the future could become more accessible, due to new and powerful educational tools, as well as less accessible, if the underprivileged cannot meet entry costs.

Michał Seweryński discussed the history of universities in Europe, which date from the middle ages. Universities created the intellectual elite of the time and shaped the development of Europe, and their example of creation, development and diffusion of knowledge spread worldwide. At that time, university education was based on respect for truth and human values. Ethical training was eventually


Michał Seweryński

supplanted by pluralistic values and diversified material culture, and the main mission of the university became education and basic research. This factor has stimulated positive social changes, but it also lowers the quality of academic life. Universities should serve the economy but they also need to be concerned with cultural formation and reflect on mankind's eternal questions.

18:00 – 20:00 Special Buffet at Chion-in Temple

October 9, 2007, Tuesday

08:00 – 09:45 Plenary Session:
Summaries from Concurrent Sessions

Chair: Serageldin, Ismail, Director, Library of Alexandria, EG

Speakers:

[Track A] **Cohon**, Jared L., President, Carnegie Mellon University, US
[Track B] **Kanazawa**, Ichiro, President, Science Council of Japan (SCJ), JP
[Track C] **Samarasekera**, Indira V., President and Vice-Chancellor, University of Alberta, CA
[Track D] **Brown**, Gavin, Vice-Chancellor and Principal, University of Sydney, AU
[Track E] **Goldin**, Daniel S., Chairman & CEO, Intellisis Corporation, US
[Track F] **Yeo**, Philip, Senior Science and Technology Advisor, Ministry of Trade and Industry, SG
[Track G] **Zehnder**, Alexander J.B., President of the ETH Board, Swiss Federal Institute of Technology (ETH), CH


Ismail Serageldin

Ismail Serageldin lauded the discussions in each topic, emphasizing the necessity of a major effort in science and technology to solve the urgent problems of the environment and humanity in a sustainable way. He was optimistic about the power of innovation to transform, stating that we are witnessing a new scientific revolution: "It is important to embrace cooperation and to nurture data into information into knowledge into wisdom."

Jared Cohon noted that climate change is an urgent issue. Three subthemes of the discussion were the sources of greenhouse gases, whether we can mitigate their effects,


Jared Cohon

and adaptation to their consequences for human society. Energy is a major driver of climate change, but promising alternative energies are not yet close to commercial scale. We need government leadership to provide massive R&D investment, "paradigm-busting," and a road map in policy making to lessen risk. Water problems are also aggravated by climate change. Changes in management schemes and better global data on water and climate change are called for.


Ichiro Kanazawa

Ichiro Kanazawa described advances in genomic research and hopes for new drugs. International cooperation will be necessary to extend benefits and research to developing nations. Regarding stem cell research, we must bring together knowledge and contrasting opinions to globally harmonize widely varying guidelines on the use of embryonic stem cells and to create regulations regarding induced pleuripotent stem cells. He also reported agreement on the necessity of biotechnology to solve environmental issues and world hunger. High costs present barriers to developing countries, while the public remains unconvinced about safety. Communication through websites and political campaigning is important.


Indira Samarasekera

Indira Samarasekera said the nanotechnology field is experiencing revolutionary growth. Applications in medicine, agriculture and other fields are driving the development of intelligent materials with unseen properties. However, ethical, environmental and legal concerns still need to be addressed. She discussed three recent ICT trends: 1. Collaborative networks, in which our challenge is to create platforms for sharing data. 2. Digital searches of our physical environment 3. Interactive media, including new platforms like Linux and Wikipedia. Computational capabilities are changing science and research. We need mass cooperation for work on 3D models, expert systems and virtual reality.

Gavin Brown reported support for human movement as a means of cross-cultural stimulation and optimism that communication can growingly take the place of physical movement. Government funds and diversity within universities were deemed important for the future of basic


Gavin Brown

research. The university-industry interface should be a two-way bridge. Discussion on scientific literacy and the urgent need to attract students back to core sciences stirred much controversy, he said. However, all agreed on the fundamental importance of the quality of teachers.


Daniel Goldin

Daniel Goldin noted a consensus among session participants that a bottoms-up approach to problem solving creates the greatest dividend, and that implementing functional national and international frameworks with common measures of success will enhance the emergence of new technologies in both developing and developed nations. Developing nations must establish their own needs before accepting aid, and development efforts must be profitable to be sustainable. He called on global action to tackle inefficiencies in intellectual property protection and to foster more technology transfer by building capacity for global IP mechanisms in the research community and reforming global patent systems.


Philip Yeo

Philip Yeo reported concern that policy makers – who often value security issues over the environment and have a short-term orientation – were not taking more action concerning climate change, partly because of disagreements within the scientific community itself. Dialogue is needed between the humanities, social sciences and natural sciences in the handling of climate change. He mentioned the need for diversity and fundamental changes in university education systems, for more communication between the science community and the public, and for responses to declining interest in science, as well as the role of the Internet in advancing communication among scientists.


Alexander Zehnder

Alexander Zehnder explained that innovation is a thread throughout all the sessions, but we don't know how to make innovations happen. Innovations are investments that gain value from their application. We can only foster innovations by cultivating an entrepreneurial spirit and a willingness to take risk.

Innovations for the developing world must be specific to their needs, in areas like health. They must be cultivated with new thinking, integration and communication. The craziest ideas lead to the most radical discoveries.

10:15 – 11:15 Plenary Session:
"Development across the World with Sustainability"

Chair: Colwell, Rita R., Distinguished University Professor, Center for Bioinformatics and Computational Biology, University of Maryland and Johns Hopkins University, US

Speakers:

- **Albanese**, Tom, Chief Executive, Rio Tinto Plc, US
- **Grosvenor**, Gilbert M., Chairman, Board of Trustees, National Geographic Society; Chairman, Education Foundation, US
- **Jones**, Monty P., Executive Director, Forum for Agricultural Research in Africa (FARA), SL
- **Sasaki**, Hajime, Chairman of the Board, NEC Corporation, JP

Rita Colwell

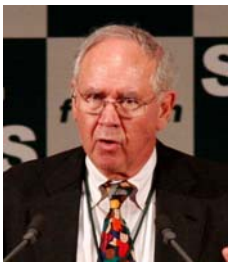
Rita Colwell suggested that discoveries happen in convergent zones. A systems approach spans disciplines, and allows one to see common problems and solutions. Scientific questions have planetary dimensions, and climate and health care are global problems. A new framework is needed to study connections between diverse fields. By blending boundaries, advances in one field can be applied in another one. Preventing infectious diseases, for example, can be as simple as a piece of sari cloth used to filter water. We should seek effective simple solutions, and remember that development and sustainability need not be in conflict.

Hajime Sasaki

Hajime Sasaki of NEC reported on the status of energy conservation and reduction of emissions projects in Japan. Many Japanese and international organizations have begun to address the global warming issue in proactive ways. Supercomputers have contributed to more accurate climate system tracking. A satellite to record greenhouse gases is expected to be launched in 2008. Industry also has made many contributions, with 36 major Japanese industries joining an action plan for emission reduction. However, an interim report shows that the Protocol target of 6% reductions in emissions by 2010 from the 1990 level will not be reached. Since commercial and residential sectors consume large amounts of energy, changing the structure of commercial enterprises, including the use of IT to make work styles more efficient, will contribute to reduced energy consumption. Finally, increased education, awareness and commitment to lifestyle change will be necessary for large-scale improvement.

Monty Jones

Monty Jones pointed out that Africa has the largest number of internally displaced persons and the brain drain represents economic aid to developed nations of several billion dollars annually. Sub-Saharan Africa has a quickly growing population, of which 70% work in agriculture. Further, croplands and pastures are degraded, so increasing yields is crucial for decreasing imports and increasing domestic stability. Africa can increase its yields by developing high-yield crop varieties. One example of this was a rice variety developed by an African-led team with international support that offers 50% increases in yields. Similar efforts are needed for cassava and maize production, so Africa can become a net exporter of food and improve its quality of life.



Gilbert Grosvenor

Gilbert Grosvenor stressed the need to enhance the public's geographical literacy. An emphasis on the interrelatedness and global relevance of facts will make geography more interesting and more useful in problem-solving in the future. Geography touches on all aspects of human life studies, including transportation, conservation, sustainable growth, social welfare and studies of population movement. Teachers are of vital importance in raising the consciousness of future scientists, policy makers and media workers. Educators of every stripe are presently lobbying for better geography education, and museums and other educational institutions are networking to provide interesting, exciting and useful classroom materials. Schools must be brought up to date and teachers trained to use modern technological tools, both hardware and software, with familiarity and efficiency.

Tom Albanese said that the mining industry traditionally focused on optimizing cost and production at the expense of innovation, but he explained that this mindset is being challenged as raw material demand reaches unprecedented levels and the industry seeks to reduce pollution. Fortunately, wealth creation can be reconciled with sustainable development by promoting efficiency through


Tom Albanese

automation, while increasing underground mining to minimize surface impact. Rio Tinto has eliminated the coking process from steel production, which has attracted China's interest. Rio Tinto operates a hydrogen energy joint venture with BP to change coal to hydrogen while sequestering carbon dioxide, an example of the company's policy of adding value while minimizing its footprint.

11:15 – 12:00 Closing Plenary Session: "Returning to Harmony with Nature"

Chair: Yoshikawa, Hiroyuki, President, National Institute of Advanced Industrial Science and Technology (AIST), JP

Speakers:

- **Carty**, Arthur J., National Science Advisor to the Government of Canada, Industry Canada, Government of Canada, CA
- **Friedman**, Jerome I., Institute Professor and Professor of Physics Emeritus, Physics Department, Massachusetts Institute of Technology (MIT), US
- **Omi**, Koji, Member of the House of Representatives; Founder and Chairman, STS *forum*, JP
- **Taha**, Elzubeir B., Minister of Interior, SD


Hiroyuki Yoshikawa

Hiroyuki Yoshikawa discussed the need to return to harmony with nature, which is the most certain method to attain sustainable development. In each session, possible paths to a globally sustainable society were sought, reflecting the diverse backgrounds of the participants. The STS *forum* must promote communication and establish networks between the various actors.


Arthur Carty

Arthur Carty stated that the theme of harmony with nature implies returning to a state where human development no longer degrades the world. This is the challenge of sustainable development, a commitment to improve the quality of human life while living within the carrying capacity of ecosystems. It requires leadership and commitment from global institutions. On the question of climate change, there is consensus that it has been brought about by human activity. We need urgent action, including a commitment from countries for a post-Kyoto framework to reduce greenhouse gases, more efficiency, new technologies, and a new mandatory framework with rules of the road for industry that will stimulate investment. Knowledge is the new currency of development and the key to meeting New Millennium goals. The G8 countries must help fund and support science and technology research in the developing world.


Jerome Friedman

Jerome Friedman suggested that the problems we face, such as habitat destruction, topsoil loss, drinking water shortages and climate change, are symptoms of a larger truth: Human activities are threatening the natural processes of air, water and land. Science and technology cannot fix these problems on its own; public leaders must be engaged. Facts may not be enough to persuade the public, so the media must be included. The industrial nations should implement measures to prevent climate change and environmental destruction, and help the developing nations to do so. We share the air and the oceans; we all have a stake in the earth's future.


Koji Omi

Koji Omi thanked the participants for their insights into harmony with nature and innovation. He proposed continuing discussions on several issues:

- A new international framework to replace the Kyoto protocol that would include the US, China and India,
- higher energy efficiency and effective use of resources,
- a shared view of nanotechnology's potential to benefit humankind,
- mechanisms for vaccine development and distribution,
- encouragement of joint research between developed and developing countries,
- reconsideration of biofuels,
- development of such alternative energies as nuclear fission and nuclear fusion,
- considering allocation of a portion of national ODA budget for joint research in developing countries at the next G8 Summit.

We must engage in science to create new ideas, which are transferred from institutions to products that benefit society. Rather than seeking to control nature, we should seek harmony with it. The STS *forum*, he concluded, is not a conference but a movement to promote the survival of humankind.

Elzubeir Taha

Elzubeir Taha underlined the universality of the human quest for harmony with nature. It reflects an underlying desire for peace and dignity within and for equilibrium with our physical environment. Science and technology is contributing to advancing this quest, partly in an attempt to solve the very problems that it has helped to create. We need more wisdom to enable us to utilize technologies by protecting our natural and social well being. Climate science is about observations of ecosystems, assessing impacts, making precise predictions and raising alarms. Energy technology is about developing mitigating options. The public must make choices of these options.

12:00 – 13:00 Farewell Buffet Lunch

INDEX OF PLENARY SESSION SPEAKERS

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,* registered as a non-profit organization (NPO) since March 2006, holds an annual meeting starting on the first Sunday of October every year, in Kyoto, Japan. The meeting is aimed at 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 potential problems under proper control based on shared values, and to establish a common base for promoting science and technology.

Because international efforts as well as concerted efforts between different constituencies to address these problems are needed, the forum gathers every autumn top opinion leaders of various backgrounds – including policymakers, business executives, scientists, researchers and media - from all over the world.