

SESSION on DESIGN THINKING TO MOBILIZE SCIENCE, TECHNOLOGY AND INNOVATION FOR SOCIAL CHALLENGES

**Report on the outcome
of the AAAS 2011 session**

**Sunday, February 20, 2011 8:30 AM to 11:30 AM
Walter E. Washington Convention Center 159AB**



Japan Science and Technology Agency



Research Institute of Science and Technology for Society

DESIGN THINKING

SESSION on DESIGN THINKING
TO MOBILIZE SCIENCE,
TECHNOLOGY AND INNOVATION
FOR SOCIAL CHALLENGES

The aim of this symposium is to highlight the innovative approaches towards address social challenges.

There has been growing interest in promoting “social innovation” to imbed innovation in the wider economy by fostering opportunities for new actors, such as non-profit foundations, to steer research and collaborate with firms and entrepreneurs and to tackle social challenges. User and consumers are also relevant as they play an important role in demanding innovation for social goals but also as actors and suppliers of solutions.

Although the innovation process is now much more open and receptive to social influences, progress on social innovation will call for the greater involvement of stakeholders who can mobilize science, technology and innovation to address social challenges.

Thus, the session requires to be approached from holistic and multidisciplinary mind and needs to cover the issue from different aspects by seven international speakers.



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• **Dr. Yuko Harayama**, Deputy Director of the OECD's Directorate for Science, Technology and Industry (DSTI) (moderator) (5min)

8:35-9:20

• **Dr. Karabi Acharya**, Change Leader, Ashoka, USA(15min)
Systemic Change to Achieve Environmental Impact and Sustainability

• **Mr. Tateo Arimoto**, Director-General, Research Institute of Science and Technology for Society, Japan Science and Technology Agency (JST / RISTEX) (Co-organiser and Host), Japan (15min)
Design Thinking to Induce new paradigm for issue-driven approach

–Discussant (5min)

• **Dr. Hans-Liudger Diemel**, Director, The Centre for Technology and Society; CEO, Nexus Institute for Cooperation Management and Interdisciplinary Research, Germany (5min)

Discussion (10min)

9:20-10:20

• **Dr. Julia Lane**, Program Director, National Science Foundation, USA and **Dr. Stefano Bertuzzi**, Office of Science Policy Analysis, Office of the Director, National Institutes of Health (co-presentation) (25min)
Science of Science Assessment

• **Dr. Johan Evers instead of Mr. Roby Berloznik**, Project manager, Institute Society and Technology, (15min)
Governance in Science and Technology: citizen participation and social innovation

–Discussant (5min)

• **Dr. Hans-Liudger Diemel**, Director, The Centre for Technology and Society; CEO, Nexus Institute for Cooperation Management and Interdisciplinary Research, Germany (5min)

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• **Ms. Laura Bunt**, Policy Advisor, The National Endowment for Science, Technology and the Arts (NESTA), UK (15min)
Mass Localism: a way to help small communities solve big social challenges

• **Dr. Masayuki Horio**, Professor Emeritus, Tokyo University of Agriculture and Technology / Professor, Politics, Faculty of Law, Ryukoku University Area Director, R&D Focus Area "Community-Based Actions against / Global Warming and Environmental Degradation" JST / RISTEX Director, Japan (15min)
Socio-technical Routes Needed to Save Society from Energy and Environment Crises

–Discussant (5min)

• **Dr. Hans-Liudger Diemel**, Director, The Centre for Technology and Society; CEO, Nexus Institute for Cooperation Management and Interdisciplinary Research, Germany (5min)

Discussion (10min)

11:05-11:25

11:25-11:30

• **Dr. Yuko Harayama**, Deputy Director of the OECD's Directorate for Science, Technology and Industry (DSTI)(moderator)



Session Description

Design Thinking To Mobilize Science, Technology, and Innovation for Social Challenges

Sunday, February 20, 2011: 8:30 AM-11:30 AM
159AB (Washington Convention Center)

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Today, "innovation" is attracting the interest of policy-makers, not only as a driver of economic growth or a tool to overcome economic crisis, but as a means to solve social problems. In sum, this trend may induce a new paradigm of innovation, moving from the traditional linear perception of innovation into a more concerted way of conceiving innovation. Fostering innovation to address social challenges and mobilizing science, technology, and innovation calls for collaboration among multiple stakeholders, including universities, research institutes, private companies, government, and civil society and leads to the value creation for the society as a whole. Social challenges are the issue for everyone without a border. Thus, we need to look ahead and work to find solutions comprehensively. Motivated to gain more insights into the factors that determine success and failure in our efforts, this session will highlight elements and good practices that support a more systematic approach for policy implications, looking into barriers and incentives designed to address social challenges as well. Panelists will identify projects that gather social entrepreneurs and researchers to develop and demonstrate technologies and show the possibility of solving environmental issues by fostering the dissemination of wooden houses and forest revitalization. These co-evolutive approaches, which involve reciprocal adaptation, will also be discussed.

Organizer: *Tateo Arimoto, Japan Science and Technology Agency*

Co-organizers: *Yoko Nitta, Japan Science and Technology Agency and Suguru Ishiguro, Japan Science and Technology Agency*

Moderator: *Yuko Harayama, Organization for Economic Cooperation and Development*

Discussant: *Hans-Liudger Dienel, Technical University Berlin*

Speakers:

Laura Bunt, *National Endowment for Science, Technology, and Arts*
Mass Localism: A Way To Help Small Communities Solve Big Social Challenges

Masayuki Horio, *Japan Science and Technology Agency*
Sociotechnical Routes Needed to Save Society from Energy and Environment Crises

Julia Lane, *National Science Foundation*; **Stefano Bertuzzi**, *NIH*
The Science of Science Assessment

Johan Evers, *Institute Society and Technology*
Governance in Science and Technology: Citizens' Engagement for Social Innovation

Karabi Acharya, *Ashoka*
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Design thinking to induce new paradigm for issue-driven approach

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Introduction



Yuko Harayama

Ladies and Gentlemen. Welcome to our session on 'Design thinking to mobilize science, technology and innovation for social challenges'. We are happy to have all of you to join this discussion. I believe this session will be a really good and exciting one.

My name is Yuko Harayama from OECD, chairing this session: I think this discussion will be an exciting and good one.

At the beginning, I will explain what our intention to have this session.

STI has a long history long time ago (for long time) and not a new phenomenon. Also STI has so many impacts on the society by the past and the way of we are functioning and the way we are living having been influenced.

So, technological advancement helps us to have better life, but also to induce some negative ones, too.

Social challenge could be to reduce adverse consequence of innovation.

What is new now? We have policy discourse on innovation for economic growth

Yuko Harayama: Deputy Director of the OECD's Directorate for Science, Technology and Industry (DSTI)

When you have financial crisis, economic crisis - policy makers say ok what should be the next determinant and next driver for economic growth?

More than one countries focus on innovation but the trial of this session is not limited to the innovation for economic growth but is trying to foresee innovation as a mean to solve social problems

In this case, we have several questions arising:

1. Who does initiate?
2. Whom to mobilize?
3. How to orchestrate it?

Usually when we want to promote new technology -there are tools to invest in some specific area, and then we promote R&D and we see later on, probably we will have new product and then commercialize them. It is relatively simple compared to the challenge we have as social problems Because not only we take advantage of new technology, but at the same time we have to redesign social structures and we have to really in touch with the society . And it is difficult to touch with society comprehensively because we have diverse actors and stakeholders and it makes really complex more than usual.

The key is: What makes innovation different by targeting social objective?

That could be the topics of this discussion.

We should understand first the nature of the social innovation.

Actors are not only scientist, not only business people.

Also we should have engagement coming from social actor.

Plus, we used to have innovation entrepreneur on the scene but here we have to deal with social entrepreneurs for making change.

We should move from science driven into science based in terms of the role of ST and

we should move from technology driven to technology serving for the society.

In that sense, the challenge is which action we should design and how to

remold social institution.

That is the challenge.

How to improve our capacity to address social challenges?

There is no unique solution

We have passed through several experimentation trials.

For the first session,

We will put into practice and see some experimental ones.

For the second session 2, tasks are

How to Assessing and how to value STI

Because in our discussion, not only policy makers are on the scene but also we have several actors in the action on the topics.

At the same time we should measure mutual impact of the action.

For the third session, we will learn from the ground.

We have several experiences going and will share the experiences.

Welcome to the learning space here to you, everyone.

We are going to have exciting discussion.

Thank you.

Systematic Change to Achieve Environmental Impact and Sustainability



Karabi Acharya

Ashoka is a global association of the world's leading social entrepreneurs. It is the world's largest community of 2,500 leading social entrepreneurs across 70 countries working on every social issue. It helps them both get started and succeed over their long lifetimes causing large scale, very much needed pattern change. They address every area of human need - from human rights to the environment, from full economic citizenship to empowering young people. Small investments produce huge results. Five years after their start-up launch, between 49 and 60 percent have already changed national policy and around 90 percent have seen independent institutions copy their innovation. Working with these social entrepreneurs, Ashoka builds communities of innovators who work collectively to

Karabi Acharya: Change Leader, Ashoka, USA

transform society, and to design new ways for the social sector to become more productive, entrepreneurial and globally integrated. Ashoka champions transformational social change ideas and supports the entrepreneurs (and intrapreneurs) leading them and connects social and business sectors to build an "eco-system" of initiatives that support the fast-growing social needs of the world.

What characterizes a leading social entrepreneur? How does Ashoka decide which candidates to nominate and which to turn away?

Ashoka's selection process is anchored by our five criteria against which all Fellow candidates are evaluated:

A New Idea The first criterion is that a Fellow must have a new idea that will change the pattern in a field, be it human rights, the environment, or any other. It must change "the system"

• The Knockout Test: A New Idea

Ashoka cannot elect someone to the Fellowship unless he or she is possessed by a new idea-a new solution or approach to a social problem-that will change the pattern in a field, be it human rights, the environment, or any other. We evaluate the idea historically and against its contemporaries in the field, looking for innovation and real change potential.

• Creativity

Successful social entrepreneurs must be creative both as goal-setting visionaries and as problem solvers capable of engineering their visions into reality. Creativity is not a quality that suddenly appears-it is almost always apparent from youth onward. Among the questions we might ask: Does this individual have a vision of how he or she can meet some human need better than it has been met before? Does the candidate have a history of creating other new visions?

• Entrepreneurial Quality

Perhaps our most important criterion,

entrepreneurial quality is the defining characteristic of first class entrepreneurs. It defines leaders who see opportunities for change and innovation and devote themselves entirely to making that change happen. These leaders often have little interest in anything beyond their mission, and they are willing to spend the next ten to fifteen years making a historical development take place. This total absorption is critical to transforming a new idea into reality, and it is for this reason that Ashoka insists that candidates commit themselves full-time to their ideas during the launch phase.

Ashoka is looking for the Andrew Carnegies, Henry Fords, and Steve Jobses of the citizen sector.

• Social Impact of the Idea

This criterion focuses on the candidate's idea, not the candidate. Ashoka is only interested in ideas that it believes will change the field significantly and that will trigger nationwide impact or, for smaller countries, broader regional change. For example, Ashoka will not support the launch of a new school or clinic unless it is part of a broader strategy to reform the education or health system at the national level and beyond.

• Ethical Fiber

Social entrepreneurs introducing major structural changes to society have to ask a lot of people to change how they do things. If the entrepreneur is not trusted, the likelihood of success is significantly reduced. Ashoka asks every participant in the selection process to evaluate candidates for these qualities rigorously. To do so often requires one to resort to instinct and gut feelings, not just rational analysis. The essential question is: "Do you trust this person absolutely?" If there is any doubt, a candidate will not pass.

"Social entrepreneurs are not content just to give a fish, or teach how to fish. They will not rest until they have revolutionized the fishing industry."

- Bill Drayton, Ashoka Founder and CEO

The types of system changes are intended to be a simple way to describe the kinds of changes that Ashoka programs and Fellows implement. The five types of system changes are:

1. Changes in market dynamics and value chains: This type of change focuses on the interconnections or rules of the market system. This includes changes in the flow of market information, change in access to goods and services, or increased efficiency of the value chain. For example, Ashoka Fellow Adrian Mukhebe uses cell phones in Kenya to get market information directly to farmers that enables them to make more informed sales decisions.

2. Changes in public policy and industry norms and standards: Changes in public policy are critical system changes that signify societal commitment and institutionalization of specific changes; also a change in the interconnections of system elements. Many Fellows have contributed to changes in public policy, often at a national level. In addition, Fellows have brought about changes in industry norms and standards such as through certification standards.

3. Brought full inclusion to a disadvantaged group and fostered empathetic ethics: This type of change refers to achieving full inclusion of people who are disadvantaged due to gender, caste, religion, ethnicity, extreme poverty or disability. At first, this may seem to be a simple change in the elements of the broader social system, but of course we have found that when disadvantaged or marginalized voices are heard, this changes the both the interconnections and the purpose of the system; creating a system that is equitable and inclusive for all people.

4. Achieved business-social congruence: This change refers to system changes that lead to a future where this is little distinction between social and business enterprises - where all enterprises achieve and document economic and social value (with a focus on the double or triple bottom line). In other words, this system change refers to a

recognition by businesses of their social purpose and a recognition by citizen sector groups of their economic purpose. Many Ashoka Fellows have for-profit elements which subsidize other aspects of their work. There is also a growing trend in the business sector to examine the social impact in addition to economic measures. The growing field of social venture funding is an example of this.

5. Enabled a global culture that values changemaking and social entrepreneurs: This kind of system changes speak directly to Ashoka's vision of Everyone A Changemaker. The type of change refers to cultural and social norms around changemaking and social entrepreneurs. Ashoka Fellows show the world that there are alternatives to the existing system and that each person has the power to make a difference. A culture of changemaking is also supported through the on-line Changemaker competitions where anyone can submit an entry, comment on entries and vote for the winners. The last type of system change speaks directly to our overall purpose as a society - that our purpose is to ensure everyone has the capacity to solve problems to achieve social impact.

By 10 years after election, 83% of Fellows have changed a system in at least one way.

Ishita Khanna

Ishita Khanna is building a green economy in the remote villages of India's high Himalayas. In response to the region's growing environmental degradation and threatened cultural preservation, Ishita has developed a collection of new income-generating and ecotourism opportunities designed to improve environmental management and promote the pursuit of more sustainable livelihoods. These efforts have merged the region's most marginalized communities with the market-based economy and created an incentive to conserve the region's dwindling resources. The local community thus retains primary ownership over their nat-

ural resource base, further reducing their dependency on government subsidies and hand-outs.

The New Idea

Ishita has introduced a unique set of market-based incentives to improve environmental management in the isolated villages of India's high Himalayas, instilling a new sense of pride to communities long mired in dependency. By developing a range of products and marketing outlets for the region's fast disappearing indigenous plants, she is both reviving sustainable farming practices and restoring local ownership to a region which has for years relied almost wholly on heavy government hand-outs. This signifies a major shift from previous development schemes in the region: Whereas such attempts have relied on cash crops and devastating resource extraction, Ishita uses the growing demand for eco-friendly products to create what she calls "seabuckthorn entrepreneurs". These local groups are trained to cultivate and produce native crops, including seabuckthorn, the region's declining "Wonder Berry," as well as traditional handicrafts and other eco-friendly enterprises.

The first movement of its kind in the Indian subcontinent, Ishita's organization, Spiticosphere, has given rise to significant collaborations with other organizations in the state of Himachal and elsewhere along the Trans-Himalayan belt of India. As these inaccessible regions have historically remained outside the purview of targeted and informed government and non-governmental support, Ishita aims to create a development model that can be implemented across the entire Himalayan range. She is in the process of developing a consistent and replicable brand for seabuckthorn products, which, due to her efforts, are now produced in other ecologically similar states across India. Most importantly, she is paving the way for the region's most isolated communities to retake control of their resources, proving that better environmental management can be a profound source of economic growth.

Joseph Adelagan

The Cows to Kilowatts Partnership, based in Nigera, provides an unusual example. It was founded by Joseph Adelagan, a Nigerian engineer, who was concerned about the impact on local rivers of effluent from the Bodija Market abattoir in Ibadan. As well as the polluting the water supply of several nearby villages, the effluent carried animal diseases that could be passed to humans. Dr Adelagan proposed setting up an effluent-treatment plant.

He discovered, however, that although treating the effluent would reduce water pollution, the process would produce carbon-dioxide and methane emissions that contribute to climate change. So he began to look for ways to capture these gases and make use of them. Researching the subject online, he found that a research institution in Thailand, the Centre for Waste Utilisation and Management at King Mongkut University of Technology Thonburi, had developed anaerobic reactors that could transform agro-industrial waste into biogas. He made contact with the Thai researchers, and together they developed a version of the technology suitable for use in Nigeria that turns the abattoir waste into clean household cooking gas and organic fertiliser, thus reducing the need for expensive chemical fertiliser. The same approach could be applied across Africa, Dr Adelagan believes. The Cows to Kilowatts project illustrates the global nature of modern innovation, facilitated by the free movement of both ideas and people. Thanks to the internet, people in one part of the world can easily make contact with people trying to solve similar problems elsewhere.

Dr. Willie Smits

Dr. Willie Smits is a rainforest inventor who has revolutionized reforestation techniques and policies worldwide and is also the world's most prominent protector of orangutans and their natural habitat. As founder of the Borneo Orangutan Survival Foundation and the Masarang Foundation, he has consis-

tently worked to address the root causes of deforestation by addressing the relationship between the animal world, our planet, and humankind.

The New Idea

To rebuild orangutan populations, Dr. Smits believes it is crucial to both rebuild their forest habitat, as well as address the social causes of deforestation and orangutan habitat loss by empowering local workers to find alternatives to harvesting forests. Dr. Smits started his efforts with a team of 100 local workers to restore the Samboja Lestari which had been completely devastated by clear cutting. Covering approximately 5,000 acres in Borneo, this healthy man-made rainforest - a first of its kind - is now home to the hundreds of rehabilitated orangutans.

In rebuilding these forests, Dr. Smits attempted to recreate the extreme complexity of nature, impacting even the local microclimate. To grow, protect, and preserve the forest land itself, his solution is simple: he offers local migrants free land to plant crops in the forest. In return for both the land and farming income, the villagers must protect the rainforest and the animals that live there. By improving around 3,000 villagers' quality of life and building trust throughout the community, Dr. Smits has provided powerful incentives for both long-term ecological and economic restoration.

Key to his model's success is the use of newly developed and sustained rainforest as a new source for fresh water, by both increasing and retaining more rainfall in the area. This is not only improved the protection from forest fires but also a increased the supply of clean drinking water to more than 30,000 people in surrounding cities. Dr. Smits has also created a water supply company with the local government to improve access to clean drinking water, with the profits being used exclusively to sustain the Samboja Lestari rainforest.

Dr. Smits' Borneo Orangutan Survival Foundation has not only saved hundreds of homeless and mistreated orangutans, it has also provided them a

new long-term habitat in the wild. His palm sugar factory has been pledged by the government to be a national project and will be replicated in eight provinces in Indonesia. By providing alternatives and proper incentives for the local community - through the extensive efforts of his Masarang Foundation - he has also achieved both economic and political legitimacy, and has established a model for restoring forest habitats worldwide.

Albina Ruiz

Waste Collection through Community Empowerment and Relationship Building

What I love about Ashoka Fellow and social entrepreneur Albina Ruiz and her Ciudad Saludable (Healthy City) initiative is that she refuses to accept that anyone should live surrounded by garbage, filth and potential disease. Albina has made it her mission to help communities clean up their own neighborhoods in Peru, especially in the poorest areas where people rummage through the trash and try to resell items to support their families. Interestingly, Albina doesn't just work to clean up the trash. She recognized that taking away the trash, while it would improve living conditions, also meant taking away vital income that these communities needed to survive. So, she worked directly with people in the community and gave them jobs going door to door to collect trash. Instead of just taking away the garbage, she gave people access to income and dignified work that bettered their communities and their families.

"Ciudad Saludable develops efficient solid waste management systems that generate employment and contribute to better quality-of-life and cleaner cities. Ruiz created the organization because government-run garbage collection in Peru had not been effective and illegal dumping was causing environmental deterioration and ground water contamination. The garbage crisis arose partly because municipalities failed to collect the funds necessary to maintain the infrastructure. Because the system wasn't working, people didn't pay their

monthly fees, making the garbage problem worse. Ruiz set out to break that cycle. In addition to taking care of the garbage problem, her micro-enterprise model provides self-employment opportunities to local residents in neighborhoods where unemployment rates are high. The businesses are often run by women who go door to door collecting garbage and fees, and educating people about respecting and protecting their environment. Some women have even built profitable businesses by creating products like organic fertilizer out of the trash they collect. By generating income for local residents and involving them in the process of improving their neighborhood, Ruiz has succeeded in obtaining pay rates of up to 98 percent. The government collection pay rates sunk as low as 40 percent. Ruiz's simple idea has become a successful business and community-organizing model that benefits large numbers of people and has worldwide potential."

Rob Hopkins

Providing solutions to the twin challenges of climate change and Peak Oil, supporting communities to build resilient, re-localised paths away from their dependence on oil.

The New Idea

Through the model of Transition Towns, Rob has created a way to engage people en masse to tackle climate change practically through a solutions-based and action-oriented approach leading away from oil dependency. A Transition Initiative is a community working together to assess what it needs in order to sustain itself and thrive, and then to identify how to increase resilience and drastically reduce carbon emissions. The process Rob employs is a collection of tools and approaches that communities can use to maximise their chances of success across each aspect of local life. Community building processes utilised by the Transition process lead to an Energy Descent Action Plan which, in turn, is the starting point for a whole range of activities designed to lead

away from oil dependency and towards a more sustainable, lower carbon community. Multiple groups are formed within each community which tackle a different aspect of local life, from agriculture and energy to the economy and housing. Through the Transition Network groups receive practical tools and training as well as inspiration, support and encouragement. Key to this approach is Transition Towns' role in developing communities. Through stimulating a sense of belonging, citizens are able to see the consequence of their actions on the people and places that are closest to them. By addressing climate change at a community level Rob has succeeded in making it relevant to everyday life and the daily choices of everyday people and not just the environmentally concerned few.

Impact

The Transition Network comprises 100 formal Transition communities with over 1,000 more at an earlier stage of development. Additional groups in a number of countries around the world are looking to the Transition Network for possible replication. Early successes of the Transition movement have been the setting up of energy service companies, the establishment of alternative currencies and the development of local food growing businesses. These combined efforts are beginning to result in policy change as local councils begin to sign themselves up as Transition Authorities.

If our goal is to change the fishing industry (or any other industry), how will we know we have succeeded? We define impact as system changes resulting from the social entrepreneurs, ideas and networks we support that affect (or have the potential to affect) large numbers of people. Our Fellows change systems in five different ways: redefining interconnections in market systems (market dynamics and value chains), changing the rules that govern our societies (public policy and industry norms), transforming the meaning of private vs. citizen sector (business social congruence), fully integrating marginalized populations (full citizenship and

empathetic ethics) and increasing the number of people who are social problem solvers (culture of changemaking and social entrepreneurship). The results on the opposite page reflect the percentage of Fellows surveyed who have changed these systems at a national level within 10 years of election. 83% of Fellows (76% five years post election) have changed systems at a national level in at least one way. On average, Fellows change systems in three different ways.

Design Thinking to Induce New paradigm for Issue-driven Approach



Tateo Arimoto

As Prof. Harayama mentioned in the opening that "Innovation for what for 21st century?", traditionally Innovation has been discussed and led by business administration in many places in the context of for profit for companies, for competitiveness, for economic growth and for employment at national levels in the last century. However, since the definition of innovation has been expanded rapidly, new innovation should be replaced by the system for social value, for quality of life, for security & social cohesion and for sustainability at global levels to cope with social problems. In the light of the new situation, we need change of mind. Traditional concept of "science and technology policy" is now being transformed into a new concept of "science based innovation policy". We, therefore,

Tateo Arimoto: Director General, RISTEX-JST

need to reshape innovation systems in order to bridge science and society, to fill the gap in between.

Similarly, science and scientific policy are changing dynamically, the activity of science system have to be reshaped as modern scientific enterprise including funding system, university system and evaluation system so far. In addition, we have to nurture young scientists and practitioners in the field. Then, the other question comes up that how we can measure the values of states in 21st century not only by hard power, but also by soft and smart power such as quality of life, environment, education, and connectivity etc... We are in a transition process from industrial society to knowledge-based society as compared to intangible assets, brains, R&D, brand design, and network & connectivity.

Currently each country and private companies are focusing on innovation policy and innovation strategy. In last May, OECD published comprehensive new Innovation Strategy (IS) 2010, which will be one of the indicatives for us. It stressed better match between supply side input and demand side. They pointed out that an importance of global policy post innovation beyond science and technology, education and trainings to empower the people. Not only amongst upstream of academic R&D area, but also in wider scopes, there is a need to foster diffusion and application of knowledge for innovation through well-functioning networks and markets the role of government in creating new platforms for innovation will be particularly more important.

Traditional Japanese Funding System

When I take examples of traditional governmental funding system in Japan, we can see three major different research funding agencies, called JSPS (Japan Society for the Promotion of Science), JST (Japan Science and Technology Agency), and NEDO (New Energy and Industrial Technology Development Organization). JSPS sup-

ports curiosity driven research, so called bottom-up research, JST supports mission oriented basic research and NEDO support s 'Exit' oriented R&D prototypes which attached to Ministry of Economy and Trade. The Institution RISTEX (Research Institute of Science and Technology for Society), as one of the research institutions of JST, has engaged in problem setting and creating social and public values through funding as its mission. It was established based upon the principle of Budapest declaration in 1999, 'Science in Society, Science for Society.

Funding system for science is featured as such institutional funding which is based national innovation system in Japan. In my opinion, for all three institutions need to be reshaped for problem solving or problem-driven issues at stake approaches.

Principles and Methodology of RISTEX's activities

• When I was assigned to RISTEX as a general director, I drastically changed the management system in R&D funding. Features of the funding system in RISTEX are described as below

- 1) problem(issue)-oriented R&D projects
- 2) multidisciplinary approaches
- 3) application both of technological and social innovation
- 4) social experimentation
- 5) collaboration among practitioners and researchers
- 6) mutual communication between management side and research project side

• Even in small science, we need social experiment at community level or local level to implement the projects for society. Our managestaff intensively involve and commit themselves to the work of R&D projects in the early stages, not just watch them several years after funding agency select the theme of the project.

Adding to ongoing R&D focus area

programs, such as "Community-Based Actions against Global Warming and Environmental Degradation", "Science Technology and Humanity", "Protecting Children from Crime", "Service Science, Solutions and Foundation Integrated Research Program", this year we established new program called "Redesigning Communities for Aged Society" since Japan is the world most rapid ageing society. Also 'Science of Science and Innovation Policy' will be launched in no distant future.

Regarding to the methodology, at first, we have to identify or grip the social problems to be funded despite of the difficulty under limited sources, budget and technical staffs. Next, we establish R&D focus area and start calling for the application of the proposals from research communities, practitioners, local community, NPO, and to government sectors. Normally one R&D area selects ten to twelve proposals, which will undertake the project at least for 3 years. Within each projects, researchers analyze and hypothesize a new measure and propose a solution of the social problems and we make them take social experiments based on their hypothesis. Finally, we hope each of them is going to be synthesized and to make prototypes in order to diffuse the adoption of the results to society. To make this procedure successfully, collaboration with multiple stake folders, hands-on approaching, collaboration with natural scientists and social scientists, and pursuit PDCA cycle are crucial in the process. Finally, we hope government or local government takes over this method of solution in implementing to society.

I would like to refer to the management guide line based on the metaphase of PDCA cycle as suggested by Prof. Yoshikawa, we can see a basic loop for sustainable evolution. Scientists analyze condition and problems and they suggest future solutions of issues and next phase is design scientists who synthesize social and technological problems. Design scientists, who are very important, make a design

of science or design thinking, so-called synthesizing, and integrate existing knowledge, technology to communities and they will make a new solution.

New perspectives for science and innovation policy are that we need a bridge for science and society, ensuring Innovation beyond the boundaries of traditional disciplines, funding, organization, academic system, and science sector. We need to reshape science and innovation system and values. In this end, Japanese government recently stress issue driven S&I policy beyond traditional discipline oriented issue. Discipline oriented issue means nano-technology, bio-science and information technology etc. Beyond discipline oriented issue, Japanese government has been trying to figure issue oriented problems.

At the time of 1970's, science policy in the world mainly has focused on Center of Excellence (COE) research though, we are now focusing on Network of Excellences (NOE) research with each sector.

Those social innovations should be gained by not only developed countries but also by developing countries such as Asian countries at Pacific region level and BRICS, which are increasing knowledge capacities and expanding their markets. How we can collaborate with them? We need to share each region's knowledge and good practices which could make international collaborations. As we have various different supporting systems, we now need a system of system collecting knowledge and good practices from local communities to government

Science of Science Assessment



Julia Lane¹ & Stefano Bertuzzi²

Historically, federally funded basic and applied scientific research has promoted scientific knowledge, innovation, economic growth, and social well-being. However, there is increasing pressure to document the results of these research investments in a scientific manner (1, 2) and to quantify how

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The intent is to leverage revolutionary digital technology to capture the broad scientific, social, economic, and workforce impacts of science investments.

much of the work is linked to innovation (3).

Is it possible to create a system in which the effects of scientific research can be described? If so, what would be the inputs, outputs, and structure of the system? What scientific disciplines should inform the formulation of such a model? Creating a system in which the effects of scientific research can be described on an ongoing basis- without increasing the burden on research institutions and principal investigators- is difficult.

The current scientific data infrastructure is based on identifying, funding, and managing high-quality science, not on understanding its impact. The main sources of data on research and development in the United States-the Survey of Federal Funds for Research and Development (the federal funds survey) and the Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions-were designed to describe the types and levels of science investments, not their impact or effects (4). There are systems available to capture outcomes (for example, various health and economic information systems) but they do not link inputs with outputs and outcomes. Historically, there have been limited resources devoted to rigorous evaluations of science investments (5). Indeed, the roadmap published by the National Science and Technology Council (NSTC) Science of Science Policy Interagency group in 2008, found that "current science and technology investment decisions are based on analyses that lack a strong theoretical and empirical basis" (6).

The challenge is not limited to the United States; other countries have been developing systematic ways of

describing the results of science investments. Since 1986, the Higher Education Funding Councils in England has assessed research with its Research Assessment Exercises (now a Research Assessment Framework) intended to assess the quality, impact, and vitality of funded research. Their lessons are salutary: Although the exercises did help to improve research quality, the process of producing the data was burdensome and complex (7). In 2009, the European Union EUFORDIA conference, which examined the impact of the Framework Programme (FP) 6, included, as a major recommendation, of building a database of project results for future FPs, noting that "getting robust data on the FPs in terms of participation and results is the foundation for any evaluation" (8). In 2011, the Japanese government is creating a program to advance the science of science and innovation.

A high-quality system should be based on describing the activities of scientists and clusters of scientists. Of course, the direct output of research is knowledge, which includes even research "failures," and is difficult to measure. Despite this, the system should include proximal measures of scientific output (such as publications, citations, and patents) and go well beyond simple publication counts to the identification of emerging and interdisciplinary areas. It should also include broader outcomes, such as better health, clean energy and environment, the training of an analytically oriented workforce, and increased competitiveness. It should be structured to compare differences in outcomes and outputs of the recipients of science funding relative to a comparable control group that did not receive funding.

The development and analysis of such a system will not be easy—there are multiple feedback loops and long lags—and it is important to go beyond an accounting exercise. However, there are useful precedents in other fields of policy in the United States. The Institute for Education Sciences has had a major impact on the quality of education policy. It has funded high-quality evaluations and brought together experts in economics, education, and other fields to provide evidence about the effects of education investments (9). The Center for Evidence-Based Policy has identified high-quality evaluations in a variety of policy areas, ranging from crime to health care to labor markets (10).

Developing such a system and the associated data infrastructure will require financial and intellectual resources. Other efforts to put together a data infrastructure describing the outcomes of research and development (R&D) investments, both by the private and the public sectors, no longer function for a variety of reasons (11). The new focus on accountability, combined with new technology and the broad-based commitment of key stakeholders, may result in a better outcome.

Currently, key data elements are dispersed across federal agencies and research institutions or are in third-party databases. For example, information about what science is being funded is often neither in structured format nor systematically shared across agencies; administrative information about the students supported by federal funding is housed at research institutions, but not by the agencies; and the universe of data on patents, publications, and citations is typically maintained by such third-party sources as the U.S. Patent and Trademark Office and the Web of Science. Similarly, research institutions, rather than federal agencies, typically have better access to data on subawards, vendors, and overhead expenditures, and these are not typically available in a way that can be mined and studied analytically. Reported outputs

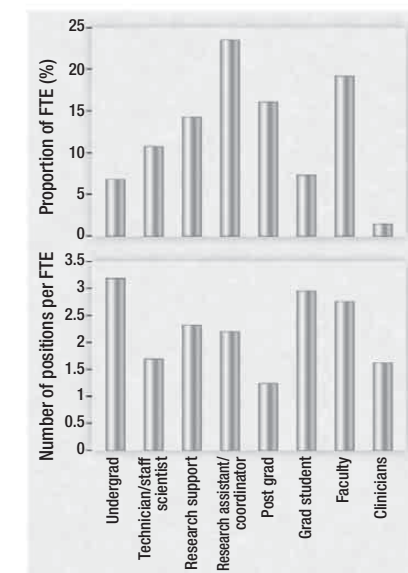
are only captured during the funding period (typically 3 to 5 years), often manually and in an unstructured format. The reporting burden is very high: The Federal Demonstration Partnership has estimated that some 42% of principal investigators' time is spent on administrative tasks (12).

It is important to address these deficiencies; otherwise, impact estimates will be biased or unachievable. Numerous case studies estimate that the full outcomes are often felt more than a decade after the research is initiated. Capturing activities of students is similarly critical; they not only form the workforce of the future but generate scientific, social, and economic activity. Characterizing the funding and outcomes of interdisciplinary research within and across federal agencies will require being able to describe the structure of proposals, awards, and publications (4) and building information systems that link outputs to inputs or infrastructure investments. Estimating impact not only requires capturing data and comparing the outputs and outcomes of the activities of both funded and unfunded scientists but thinking carefully about appropriate counterfactuals. It is important to be clear about the policy question of interest and to develop a full cost-benefit analysis (9).

The STAR METRICS (Science and Technology for America's Reinvestment: Measuring the Effects of Research on Innovation, Competitiveness, and Science) is an attempt to focus both financial and intellectual resources to address some of these challenges in the United States. The program is being developed by a consortium consisting of the National Institutes of Health (NIH) and the National Science Foundation (NSF) under the auspices of the White House Office of Science Technology and Policy (OSTP). The Department of Energy and the Environmental Protection Agency are joining that consortium. The goal is to work collaboratively with research institutions to build a scientific data

infrastructure that brings together inputs, outputs, and outcomes from a variety of sources in an open a fashion as possible. A major functional aim is to reduce, as much as possible, manual reporting by research institutions and principal investigators. The use of such automated tools as CiteSeerX, which facilitates the capture of outputs produced by principal investigators, offers great promise in fulfilling this aim. Such an approach should simultaneously reduce the reporting burden and increase the period over which outputs can be measured. Similarly, text-mining tools and topic-modeling approaches can be used to represent the information within proposals and scientific documents to describe the nature of scientific investments. The design is intended to permit scientists to provide input into the way in which knowledge is created and transmitted in their disciplines, as well as to engage social and behavioral scientists for modeling the impact of interventions.

STAR METRICS began as a small pilot with seven institutions in July of 2009 in cooperation with the Federal Demonstration Partnership. By May of 2010, a Memorandum of Understanding had been signed with the participating



Individuals in occupations supported by science funding. (Top) The distribution of FTEs in occupations directly supported by science funding. (Bottom) The number of distinct individuals per FTE directly supported by science funding per FTE. [Source: STAR METRICS data for 45 institutions, third quarter 2010.]

agencies; Office of Management and Budget approval was received in July 2010 to expand the program. Since then, more than 60 institutions have signed participation agreements and at least 50 more have indicated interest in participating.

In practical terms, STAR METRICS is structured in two phases. The first phase ascertains the immediate effect of science spending on employment. It uses administrative records within participating institutions to document how many scientists (including graduate students, undergraduate students, and research staff) are supported by federal science funding, as well as to capture information on subawards and subcontracts. Only 14 data elements are required (13); STAR METRICS is now capturing that information electronically from institutional financial records (without personal identifiers) without burden for the scientists. This process, described in detail at <https://www.star-metrics.nih.gov>, has enabled generation of tables and maps of jobs and positions immediately traceable to science funding at each institution. Federal agencies use the same reports, aggregated from multiple institutions. Source data can be generated with minimal burden and cost—the typical institution requires less than 20 hours of staff time to generate the initial report. Subsequent reports are automated.

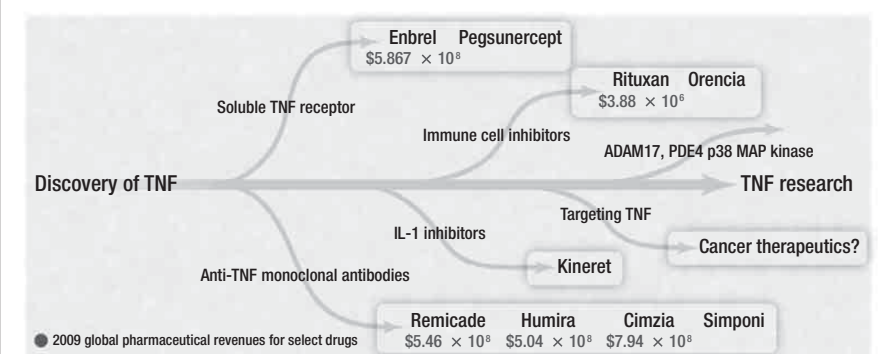
A graphic visualization of the type of report generated for each university is shown in the first figure. Science funding supports a wide range of occupations (top), and the nature of research means that science funding supports more individuals than are conveyed by simple counts of full-time equivalent (FTE) workers or students (bottom).

Phase I also provides estimates of how many additional jobs are created that are directly attributable to firms whose goods and services result from the spending of research institutions. These institutions, unlike federal agencies, have data that can be used to

derive the industry and geographic location of their vendors and subcontractors. In combination with publicly available data from the Economics Directorate of the Census Bureau, we can estimate the payroll associated with payments and, hence, the number of jobs.

Phase II is designed to capture outputs and outcomes beyond the initial employment effects captured by phase I. The intent is to leverage revolutionary digital technology to capture the broad scientific, social, economic, and workforce results of science investments. Almost all scientific activity is eventually captured in electronic form. At least initially, this means we need to develop ways in which scientists' activities can be automatically, rather than manually, reported to science agencies. Phase II is likely to take at least 5 years to achieve the intermediate goals we have laid out here. Research institutions are developing structured information architectures to capture current and more accurate information about scientists' interests, activities, and accomplishments, including, for example, the VIVO Project (<http://vivoweb.org>), the Harvard Profiles System, and others. Brazilian science agencies have developed a system (Lattes Platform) for researchers and scientists to register and build curricula vitae and to capture scientific outcomes. The STAR METRICS team is beginning to consult with the scientific community to identify viable approaches.

An initial consultation meeting with



An example of research investments. Linking the discovery of TNF and its related properties to NIH investments in research grants.

and scientific connections to trace the path from the initial discovery of tumor necrosis factor (TNF) to successful biotech drugs. We also plan to expand the use of the existing patent database to provide automated visualizations of technologies supported by NIH- and NSF-funded research, as well as the firms using them.

We began by asking what scientific disciplines would inform the development of the system. There are many possibilities. For example, knowledge organization systems theory may inform the conceptual approach, which requires the maintenance of a set of relations between different areas of scientific knowledge and the maintenance of continuity between past, current, and emerging ways of describing science (17). The fact that science is becoming increasingly team-oriented may necessitate drawing on the advances in network analysis and graph theory to describe the complex and changing nature of scientific collaboration. Even something as seemingly straightforward as describing what science is being done, which is beyond the current reporting capacity of many science agencies, may draw on recent advances in topic modeling (18).

There are interesting questions to be answered with the restructured data. For example, what types of funding are most successful? Preliminary evidence suggests that the structure and type of multiuniversity and multidisciplinary collaborations matter (19). How important are institutions, like biological resource centers, in stimulating research? What evidence supports the notion that it is better (or worse) to fund junior versus senior researchers? What are the employment and earnings outcomes for students trained in science? An open and transparent approach, as well as full scientific engagement, is necessary. Federal agencies typically do not have resources to build complex models and develop analytical techniques necessary to tease out the marginal and average impact of interventions in different

areas.

In addition to the financial resources that have been made available, we will also need to attract the intellectual resources of the research community. We believe the scientific challenge is compelling: The way in which scientists create, disseminate, and adopt knowledge in cyberspace is changing in new and exciting ways, and scientists should be fully engaged in describing and studying these changes. Collaborations between computer scientists and social scientists can capture these activities by means of new digital technologies and statistical techniques. We believe that the data being generated will attract new researchers and students to the field. Finally, we hope that the active engagement of the federal science policy community through STAR METRICS will help ensure that the scientific advances in science measurement move the data available for science policy to the same analytical level as the data available for the study of education, labor, and health-care policy.

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Governance in Science and Technology

Citizens' engagement for social innovation ?



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degree in Bioscience Engineering (Katholieke Universiteit Leuven, Belgium). As a PhD researcher he has been involved in the project 'Nanotechnologies for Tomorrow's Society', a four year academic TA study on exploring pathways to integrate societal considerations into nanotechnology research. He has also postgraduate qualifications in Science & Technology Communication.

Robby Berloznik is the director of the Institute Society and Technology. He holds a degree in political science of the Free University of Brussels. After a research career in Technology Assessment he entered the Flemish Institute for Technological Research in Mol in 1991 where he became the advisor for Technology Assessment to the managing director. In 1997 he became research manager in the fields of Technology Assessment, technology foresight and sustainable development. In December 2001 he was appointed by the Flemish Parliament as the first director of the Institute Society and Technology. Robby Berloznik is an expert and advisor in Technology Assessment methodology and foresight. He was assistant to the Chair of the EU High-Level Expert Group on Foresight for Europe and member of the High Level Expert Group on Blueprints for Regional Foresight. Recently he was asked by the Organization for Economic Co-operation and Development (OECD) as an expert in working groups on Public Participation in Science and on Social Innovation.

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Introduction

The significant increase in science and technology (S&T) developments in the course of the twentieth century has laid the basis for S&T governance to become a pressing and important policy activity. Actors involved in the management of science, technology and society have been confronted with the complex, unpredictable and even troublesome

impact relation between research and society. Such innovation actors require information about the exploration and assessment of possible and worthwhile scientific and technological developments and about policy options that may foster innovation. As governance means making systematic use of the richness of societal diversity, (re)ordering it, and defining its boundaries in iterative governing interactions (Kooiman, 2003: 196²), over time policy support instruments have been developed that seek to enable the 'strategic' management of S&T developments. This variety of approaches is the result of

- the numerous domains in which S&T governance is relevant,
- the variety of actors involved such as policy makers, think thank groups, spokesmen of civil society, citizens, scientists, engineers, and entrepreneurs,
- the different governance levels ranging from an individual laboratory or company to global initiatives,
- various economic, ethical and legal perspectives and motivations,
- and the many challenges having to be addressed, including the identification and/or prediction of possible and likely R&D trajectories, the evaluation of (potential) (in)direct positive and negative impacts, the exploration of different and new forms of public participation or S&T regulation, and the recognition of the expert role in a mediated society and politics (Evers, 2009: 143-144³).

² Kooiman, J. (2003). *Governing as governance*. SAGE Publishing Ltd, London, United Kingdom, 264p.
³ Evers, J. (2009). *Small things matter. On technoscientific mediation and human agency*. Doctoral thesis nr. 873, Faculty of Bioscience Engineering, Katholieke Universiteit Leuven, Leuven, Belgium, 272p.

More recently, there is growing attention to social innovation governance, which can be broadly defined as governing activities that see the 'social' as a key modifier and enabler for value creation from which society should benefit. The 'social' generally refers to social needs, social problems and social values that are to be taken into account in order to favor society. Social gover-

nance creates value when it results in a more sustainable, more efficient, more effective and/or more just social situation than without the governing activities.

In the context of science and technology, the turn to social innovation can be highlighted in various ways. The first interpretation highlights that S&T applications are means to create new solutions to pressing social needs including issues in environment, climate change, housing, transportation, health care, viability of (local) communities, and education. Hence it maximizes the potential of S&T for social innovation. As virtually every society on this planet hopes for societal improvement through scientific and technological progress, there is indeed a significant trust in science and technology to deliver answers to local and global challenges. The second interpretation of social innovation relates to the incorporation and institutionalization of various knowledge sources besides the traditional scientific expertise. It focuses more on the democratization of S&T governance. The number, type and relative weight of aspects and interests that are taken into account in the decision-making process have changed over the last decades. The third interpretation of social innovation is grounded in the understanding that if interactions between different innovation actors including the broader public, take place in an early-stage, broadened, constructive and enriched fashion, the social robustness of these developments can be improved and such actors are better equipped to steer them. To overcome the strict separation between innovation design and innovation impact, between research and public and between policy and public, the 'upstreaming' principle has emerged. According to this principle, one has to move governance activities related to the impact, which normally occur often too late to be fully effective, forward in time. From an upstreaming perspective, reflections on the course of new developments and societal transitions can be brought anywhere along the trajectory, but preferably in the early stages.

On the one hand, this article argues and illustrates that citizen participation, as it is implemented in the Flemish parliamentary Technology Assessment institute, is a useful instrument to tackle the huge challenges that lie in front of us to make social innovation the new cornerstone of thinking about future innovation and science and technology policy. On the other hand it raises some critical consideration as to how quality criteria about participation can be defined and put into practice.

Technology Assessment as a source for social innovation governance

Initiatives aiming at S&T governance of contemporary societies traditionally focus on (potentially) positive, negative and ambivalent public and political responses related to the impact of technological developments. Such responses are often assessed through analyzing ethical, legal, economic and social implications, and health and safety risk aspects of science and technology developments. Technology assessment or TA is an umbrella term that refers to such exploration and assessment of new socio-technical developments in order to provide governance support. Contemporary TA, particularly in the context of policy making, includes participatory activities as dialogue and deliberation means for promoters of S&T (e.g. scientists, engineers and innovation agencies), and for S&T demanders (e.g. regulative agencies, pressure groups, citizens, and consumers). Their ideas, concerns and resources serve to incite responsible (social) innovation. Moreover, the processes in a participatory TA format are seen as "arenas for social policy-making" (Klüver et al., 2000: 23⁴), meaning that they provide opportunities to contribute to the social dimension of more sustainable and more socially robust S&T developments and hence contribute to foster social innovation.

Technology assessment can be understood as 'a scientific, interactive and communicative process that aims

to contribute to the formation of public and political opinion on societal aspects of science and technology' (Decker & Ladikas, 2004: 14⁵). TA is oriented towards assessing the intended and unintended consequences of technological developments and applications for society and strives to formulate policy advice to govern these consequences in a socially robust way (Kastenhofer, 2010: 39⁶). The overall philosophy of TA can be summarized as the "commitment to reduce human costs of trial and error learning in society's handling of new technologies. In order to reduce these costs, general or specific potential impacts are anticipated and these insights are fed back into actors' decision making strategies" (Schot & Rip, 1997: 251⁷).

Over the last decades, TA has evolved significantly and it has become an umbrella concept for a variety of approaches and practices. Broadly, it can be summarized that the outcomes of a TA endeavor aim at being a strategic and inspiring source for broader discussion to empower policy makers and other relevant stakeholders in the complex process of decision-making. There is, however, no standard 'recipe' for doing TA because each TA practice has its unique set of objectives, starting situation and process.

⁴ Klüver, L. et al. (2000). European Participatory Technology Assessment (EUROPTA). The Danish Board of Technology, Copenhagen, Denmark, 186p.
⁵ Decker, M. & M. Ladikas (2004). Bridges between science, society and policy: technology assessment - methods and impacts. Springer Science & Business, Berlin, Germany, 250p.
⁶ Kastenhofer, K. (2010). Do we need a specific kind of technoscience assessment? Taking convergence of science and technology seriously. *Poiesis & Praxis*, 7(1&2), 37-54.
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From its inception to the present, TA has fostered the sharing of information between relevant actors with diverse backgrounds in different interactions: scientist-scientist, scientist-politician, scientist-public, politician-public, public-public or a combination of all actors. Past emerging technologies such as

nuclear energy and biotechnology have illustrated that the transfer of accurate and consistent information, and swift communication on the state-of-the-art of S&T developments and policies for future directions between all these actors are significant bottlenecks.

The analytical approaches used in TA activities may vary significantly and depend, amongst others, on the institutional context, the problem-driven issue(s) at stake, the available scientific and technological knowledge and the nature of the societal and or political controversy. Even though TA practices use scientific analysis procedures, TA is not hard science; rather TA practices may be influenced by a variety of analytical approaches and policy tools including social sciences, science communication, Foresight studies, Ethical, Legal, and Social Issues (ELSI) approaches, and Science and Technology Studies (STS).

Parliamentary Technology Assessment

The first, largest and best-known TA-institute (the Office of Technology Assessment or OTA) was established in 1972 in the United States of America and functioned until 1996 (Vig & Paschen, 2000: 4). It had an analytical approach with the aim of supporting decision-makers with knowledge and political options. The early ambitions of TA were to provide comprehensive knowledge and to realize early warning capabilities by recruiting natural scientists and engineers in the policy process. This 'expertocratic' model in which experts, often restricted to natural scientists, engineers and economists, were summoned to widen knowledge pools, gradually evolved into various TA models with a common emphasis on participation, co-construction and co-operative learning of a variety of actors (Hronszky, 2001: 97; 104⁸). In the 1980s, five European countries - United Kingdom, Denmark, France, Germany and The Netherlands - founded Technology Assessment agencies modeled after OTA. In the 1990's and 2000's, the number of countries in

Europe that established TA institutions linked to governments gradually increased. Technology Assessment activities that are taken up by institutions specializing in advising parliamentary bodies in Europe are called 'parliamentary Technology Assessment' institutions. At present, Europe has a network of 13 parliamentary TA institutions, i.e. European Parliamentary Technology Assessment or EPTA⁹.

⁸ Hronszky, I. (2001). Toward "lay" participation and co-operative learning in TA, technology policy and construction of technologies. In: *Interdisciplinarity in technology assessment. Implementation and its chances ad limits. Ethics of Science and Technology assessment*. Decker, M. (Ed.). Springer-Verlag Berlin, Heidelberg, Germany: 95-122.
⁹ EPTA has two regional parliamentary TA institutions (Catalonia, Spain and Flanders, Belgium) and eleven national parliamentary TA institutions (Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Sweden, Switzerland and United Kingdom).

Despite institutional and operational differences, practices of parliamentary TA institutions share some common characteristics. First, parliamentary TA institutions have their respective parliament as their first and foremost client and therefore try as much as possible to gear their activities to the needs of this parliament and its constituting parliamentary committees. Secondly, they frame their activities from a problem-driven perspective rather than a technology-driven perspective. Hence, their analyses do not merely start from the demands and expectations of traditional innovation actors such as scientists, engineers and entrepreneurs who are promoting science and technology developments. Rather, they start from concerns and hopes of (potentially) affected stakeholders and users, including citizens, policy makers, NGOs and regulators of the applications of new technologies. Thirdly, the exploration and assessment of (new) socio-technical developments in order to provide decision support have become one of the main functions and thus motivations to initiate a parliamentary TA practice. Moreover, they adopt a constructivist logic, rather than determinist or acceptance logic. The constructivist logic refutes the traditional and deeply rooted

image that science and technology have an inevitable, determined way of evolving. Furthermore it contests that science and technology realizations are merely tools or instruments through which humans satisfy their needs and reach their goals. On the one hand, construction implies that there is 'de-construction' and 're-construction' leaving room for alterations, alternatives and multiple trajectories. On the other hand, construction is grounded in the understanding that S&T and society jointly impact each other. Finally, the nature of analyses is prospective rather than evaluative. Hence, through independent research and communication the focus is on performing anticipatory assessments, inciting deliberative processes, and providing recommendations to S&T decision makers rather than delivering evaluation reports on existing innovation policies and governance.

Parliamentary Technology Assessment in Flanders (Belgium)

The Flemish¹⁰ parliamentary TA institution, 'Institute Society and Technology (IST)'¹¹ was founded by a Flemish decree in 2000 and is still one of youngest members of the EPTA network. IST is an autonomous organization joined to the Flemish parliament that makes recommendations to the members of the Flemish parliament on science and technology matters and that informs relevant stakeholders and the general public. Technology assessment, as performed by IST, rests on three pillars: mapping out knowledge that is relevant for the policy-making process, starting a constructive dialogue between the involved parties (experts, stakeholders, public, and politicians), and supporting the policy-making by supplying information and policy recommendations on science and technology.

As a parliamentary TA organization, IST supports the decision-making process of the Flemish representatives, with regard to science and technology policy. Nevertheless, IST is not directly

involved in the actual decision-making, neither in its implementation. Those areas belong to the exclusive responsibility of the members of parliament and the competent ministers. But it does contribute to the policy-making process by supplying knowledge about the underlying scientific foundations and by studying the social acceptance of new technologies. It makes recommendations on what can be done, rather than on what should be done. Hence, IST is characterized by cooperation with the Flemish parliament and with external independent research institutes.

In practice, the Institute Society and Technology achieves its goals by:

- making brief preliminary evaluations;
- outsourcing longer and more comprehensive evaluations to national or international experts or research teams;
- organizing a constructive, suitable and properly-scaled dialogue among the stakeholders;
- drawing up recommendations for the Flemish parliament;
- getting back to the regional, national and international organizations that are involved in the scientific and technological decisions;
- making a yearly analysis of the current societal and political needs, and S&T trends.

Since its foundation, IST has dealt with quite a variety of technologies, from biotechnologies, through mobility technologies, energy technologies, information and communication technologies and nanotechnologies, and fertility technologies. For that purpose, it applied a broad range of analytical and participatory methods and approaches: explorative survey studies, parliamentary hearings, theatre plays, essays, interviews with experts and stakeholders, retrospective trend analyses, consensus conferences, public forums, citizen conventions, technology festivals, didactical packages for scholars, etcetera. In 2005, IST published the publication named 'Participatory Methods Toolkit. A practitioner's manual'¹², a joint publication with the King Baudouin foundation. The first part of this manual is an intro-

duction to participatory methods and contains general guidelines and tips for participatory methods. The second part is a detailed description of 13 participatory methods. The last part is a brief description of 50 participatory methods and techniques for easy reference.

The Institute Society and Technology tries as much as possible to gear its activities to the needs of the Flemish parliament and to thematically follow the current scientific and technological trends, which are relevant for Flanders. Therefore, IST carries out regular 'trend watche'¹³, to make an inventory of the current trends in the development of science and technology. Especially themes with a clear societal impact on Flemish areas of responsibility are taken into consideration. The trend watch inventory is subsequently fine-tuned in consultation with other European TA institutions within the EPTA network, with the Flemish scientific and technological stakeholders, and with the responsible commissions within the Flemish parliament. On the basis of this inventory, IST defines its yearly work program.

¹⁰ Flanders is the northern federal state within the nation Belgium and has its own legislative and executive powers including broad and exclusive domestic and international responsibilities. Flanders is, amongst others, competent for science and innovation. At present (March 2011), there is no federal TA institution in Belgium and no regional TA body in Wallonia.

¹¹ The original name of IST was Flemish Institute for Science and Technology Assessment (viWTA). In 2008 viWTA was renamed into its current name, Institute Society and Technology. For readability reasons, the name IST will be used throughout the text.

¹² Steyaert, S. & H. Lisoir (2005). Participatory Methods Toolkit. A practitioner's manual. Belgian Advertising, 210 pages. The manual can be downloaded for free via www.samenlevingentechologie.be

¹³ The most recent trend watch of IST can be downloaded for free via www.samenlevingentechologie.be

The principle of (citizen) engagement in parliamentary TA

In the European Union, public access to information and participation in decision-making are basic human rights that have been incorporated in the Aarhus Convention (1998). This Convention

grants the public rights and imposes obligations to governments regarding their accountability, transparency and responsiveness (Stec & Casey-Lefkowitz, 2000: 1¹⁴). In the context of S&T governance, promoters of S&T innovation and other affected stakeholders such as interested and lay citizens are invited to participate and deliberate on technological and societal priorities for present or future research and formulate suggestions on how to innovate purposefully and constructively. The notions of information and participation acknowledge that - through the involvement of various stakeholders - the management of S&T developments can benefit from multiple perspectives. Stakeholders are valuable (i.e. interesting and relevant) sources of information for enriching these developments and policies, or valuable recipients for information and education concerning these developments and policies, or both.

Participation can be subdivided into consultation and active participation. The notion active participation refers to the highest level of public involvement. In TA approaches and democratic societies in general information, consultation and active participation are present. It might therefore be better to speak of different levels of 'engagement'.

Granting effective access to information, enhancing public understanding of S&T developments and policies, democratization, legitimization and social learning processes are major purposes for public engagement in governance. The issue of social learning is distinct from merely attempting to improve the public understanding of S&T (Genus, 2006: 15¹⁵). It refers to the process in which actors learn new perspectives, attitudes and skills by interacting with other actors. Social learning thus fosters the empowerment of each involved actor vis-à-vis existing, new and emerging socio-technical questions.

¹⁴ Stec, S. & S. Casey-Lefkowitz (2000). The Aarhus Convention: An implementation guide. Economic Commission for Europe, Geneva, Switzerland, 186p.

¹⁵ Genus, A. (2006). Rethinking constructive technology assessment as democratic, reflective, discourse. *Technological Forecasting and Social Change*, 73(1): 13-26.

Inspirational Flemish cases related to (citizen) participation

Although all parliamentary TA institutions play an intermediate role with regard to the three societal arenas (science, politics and the public sphere), IST operates more according to the interactive model, hereby focusing on the intersection between politics and the public sphere (Hennen & Ladikas, 2009: 46¹⁶). During its nearly 10 years of existence, IST has implemented and refined different participatory approaches that involved citizens. In these sections, three illustrations of past participatory approaches are described below. The focus is here on the flow of the participatory practices, and not on their substantive outcomes.

Public forum on genetically modified foods

The first example was the first project conducted by IST. In November 2002 a sample of randomly selected Flemish citizens received a letter from IST. On behalf of the Flemish parliament they were invited to participate in a public forum on genetically modified foods. None of them knew what a public forum entailed, and none of them were (or have become) experts in the field of genetically modified food. Fourteen citizens finally accepted the challenge. During two weekends they explored this complex theme and their own attitudes towards food. They then identified different controversial or vague topics, and chose reference persons for questioning. In May 2003 they met during two days in the Flemish parliament, looking for answers to their questions and arguing with the reference persons and the public. They then discussed the results of their experiences and drew up a list of recommendations. The final report presented an overview of activities and a list of the questions they had, the answers they found and the recommendations to the Flemish parliament on the topic of genetically modified food.

World Wide Views on Global Warming

In 2009 IST collaborated in the project 'World Wide Views on Global Warming' (WWViews), jointly organized by the Danish Board of Technology and the Danish Cultural Institute (Denmark). WWViews was a global project, in which citizens were asked about their views on global warming and climate policy. Its main objective was to give citizens around the world the possibility to contribute with their views on some of the key issues addressed at the United Nations Climate Change Conference 2009 (COP15) in Copenhagen (Denmark) on December 7-18, 2009, in order to influence the negotiations and the future of global climate policy. The overarching purpose was to demonstrate that political decision-making processes on a global scale were to benefit when everyday people participate. Around 100 citizens from each of the 38 participating countries met in their own countries to engage in a structured dialogue, which aimed at answering an identical set of questions. The dialogue was supported by well-balanced information material. Scientific experts, political decision makers and a diverse range of other stakeholders were invited to contribute to the formulation of both the questions and the information material. The face-to-face citizens consultations, the WWViews, were carried out in the participating countries almost simultaneously and a few months before the COP15. The results were gathered and presented continuously for comparison on a public homepage as the results from the different WWViews were reported¹⁷. The questions asked at the WWViews made statistical comparison of the answers in different countries possible, but citizens were also be given the opportunity to phrase their own recommendations for national and international political decision makers.

Technology festivals on nanotechnologies and digital technologies

The third example is the 'technology

festival' method that was implemented twice by IST. The first technology festival was organized in November 2007 on nanosciences and nanotechnologies, the second in November 2010 on information and communication technologies. In both cases it was a three-day event with a mixture of infotainment activities for a variety of experts, stakeholders and the broader public. In 2007, there was a one day event for scholars, while in 2010 there was a workshop day for civil servants. Both technology festivals had a public day, in which the Flemish parliament opened its doors for everybody to experience new science and technology developments and to debate on the societal impact. The infotainment activities included an exposition area (in which Flemish universities, research centers and companies demonstrated new insights, applications and services), a science theater¹⁸, a video cabin, an audio wall, art performances, debates, workshops and tutorials.

¹⁶ Hennen, L. & Ladikas, M. (2009). Embedding society in European science and technology policy advice. In: Ladikas, M. (Ed.): Embedding society in science and technology policy - European and Chinese perspectives. European Commission, Brussels, 39 - 63.

¹⁷ The report of WWViews can be consulted via www.wwviews.org

¹⁸ A science theater is a stage play performance followed by a discussion.

Some considerations regarding (citizen) participation in parliamentary TA

The explicit introduction of public participation in Technology Assessment procedures has not only improved the democratization of science and technology but also caused tensions concerning the validity and the legitimacy of the assessment and policy support role stemming from 'experts' and 'lay persons'. This tension is related to the question about who effectively provides information and advice to actors engaged in the political sphere.

Another critique often raised relates to the issue of representation. If TA practices involve citizens and present the results from citizen participation

activities, how do they respond to the expectation that these opinions represent the opinions and views of the community, to say for instance the Flemish population? This expectation of representation is often expressed by policy makers as a condition to maximize the validity of the results emerging from such participatory activities.

Citizen participation activities are often time-consuming as they requires an intense preparation period including design of the participatory script, selection of possible candidates, ensuring the actual presence of engaged citizens, analysis of substantive outcomes, linking the outcomes to policy context and providing feedback to the participants. This process may raise concerns in relation to the (social) return on investment and to the validation of anticipated impact.

Three types of arguments are frequently used in participatory TA formats to justify the involvement of stakeholders other than S&T experts: instrumental, normative and substantive arguments. These arguments are rationales of imperatives for the conceptualization and practice of participatory exercises and they are often linked to other salient notions such as legitimacy, accountability, responsiveness, responsibility, integrity, controllability and efficiency (Abels, 2007: 105-106¹⁹), but also to democracy, trust and responsible S&T governance. Such notions are often taken for granted or considered intrinsically desirable. While instrumental arguments (e.g. participation increases the legitimacy of and trust in decision-making) are more concerned with the outcomes of participation exercises, normative arguments (e.g. participation is about fostering the process of decision-making and about ensuring inclusion, equity, and empowerment of participants) refer to the process of participation. Like instrumental arguments, substantive arguments refer to outcomes rather than processes. However, substantive arguments emphasize for instance that involving citizens enriches the innovation discourse beyond the traditional economic preferences and

interests and thus enhances the social robustness of possible and worthwhile S&T policy options.

After several decades of TA practices and experiences, it is a continuous challenge to evaluate participatory practices, and thus to define and implement evaluation or quality criteria. The definition and implementation of such criteria are needed if TA analysts and practitioners want to be able to assess the impact of participatory activities and practices. Without making claim to be exhaustive and by means of stimulating further discussions, 6 different notions (inclusiveness, comprehensiveness, fairness, social learning, consensual decision-making and process design) are highlighted here as potential evaluation criteria. Further discussions are needed to assess whether they are useful in daily TA practices. The criterion of inclusiveness refers to the assessment whether all participants and their point of views have the opportunity to engage in the participatory process. The criterion of comprehensiveness relates to whether all interests are represented and/or all arguments can be heard. Whether all participants have equal chances for participation in TA practices is of concern in the fairness or respect criterion. The social learning criterion aims to determine whether the process of participation ensures building up reflexivity capacity amongst participants and empowers them to take further actions. Social learning is thus more than improving public understanding; it is about empowering the involved participants and the targeted audience. The criterion of consensual decision-making relates to the assessment whether all participants achieve a common opinion on an aspect of science and technology policy that is agreed upon by a group as a whole. In practice, however, not every participatory activity aspires or should aspire to a consensual outcome. Sometimes it suffices to collect diverse and conflicting views or to probe temporary closure of the debate. The criterion of process design, finally, relates to what extent TA analysts and practitioners are transpar-

ent about the methodologies used and the aims of the TA activity's outcomes, and are open for multiple discourses such as including art performances and philosophical contributions.

¹⁹ Abels, G. (2007). Citizen involvement in public policy-making: Does it improve democratic legitimacy and accountability? The case of pTA. *Interdisciplinary Information Sciences*, 13(1): 103-116.

Conclusions

When challenged to think about social innovation and more particular about how social innovation could be more firmly established in policy-making, every useful angle that brings extra knowledge needs to be explored. Mutual learning between communities that study and manage science, technology and innovation is needed. If we want to face the challenge of transforming traditional innovation thinking into one where societal needs and demands steer and enable the drivers for science and technology policy, innovation and economic growth, then the exchange of ideas, concepts and practices is vital. If societal values and preferences are integrated into policy-making, then Technology Assessment (TA) and particularly participatory TA can contribute to this learning process. TA practices in which citizen participation forms a part of producing knowledge about societal drivers of science, technology and innovation are useful as a source of inspiration to articulate and identify societal values and preferences and - eventually - develop social innovation. Citizen participation is a useful instrument to tackle the huge challenges that lie in front of us to make social innovation the new cornerstone of thinking about future innovation and science and technology policy. It remains, however, an ongoing endeavor to develop and implement quality criteria that may grasp the instrumental, substantive and normative rationales in the participation paradigm.

Mass Localism: a way to help small communities solve big social challenges



Laura Bunt

Engaging communities in innovation is important in tackling the complexity and interdependent nature of the many challenges we face globally. Communities can be effective actors in innovation if they are given the right kind of incentives and support, but we need new methods, new policies and approaches to facilitate this more effectively.

In this session, the panel explored the potential of community-led innovation in addressing social challenges. My contribution drew on our experience at the UK's National Endowment for Science, Technology and the Arts (NESTA) of running an innovation challenge prize for community-led responses to climate change. Running the challenge prize

Laura Bunt: JST RISTEX, Designing for Social Challenges workshop
AAAS Science without Borders, February 2011

showed us the potential for creative community solutions, and taught us some important lessons in how to support this to scale.

NESTA is an independent body with a mission to make the UK more innovative. We invest in early stage companies, inform government policy, and deliver practical programmes that inspire and support others to solve the major social and economic challenges of the future. Our work is based on a blend of practical experimentation, evaluation and research work, from which we draw lessons for government, policymakers and practitioners.¹

¹ For more information about NESTA, please visit www.nesta.org.uk

Why is community-led innovation important?

We collectively face real, pressing challenges in promoting physical health and wellbeing, responding to demographic shifts and supporting an ageing population, tackling global social environmental and economic challenges such as climate change, fighting disease, employment, access to clean water, drug misuse, loneliness, poor mental health and social isolation. Poverty reduction, social justice and environmental sustainability are major social issues that affect all of us.

We wanted to explore the potential for communities to engage in innovation in response to such challenges. These issues cannot be met by technological innovation alone. These are complex, social issues that are hugely diverse and affected by local conditions, human behaviour and socioeconomic circumstance. In climate change for example, it is also important that we all reduce our carbon consumption as it is that we invest in carbon capture or developing alternative energy sources.

This is why community-led innovation is so important, as we need innovation

in behaviours as well as in technologies. Our practical experience has shown that communities can be particularly effective at identifying and supporting ways to change behaviour, maximising local resources and building networks for change. Communities are critical actors in social innovation, where innovation is prompted by need and social purpose rather than invention.²

² For detailed analysis and description of social innovation in practice, see Robin Murray, Julie Caulier-Grice, Geoff Mulgan, *The Open Book of Social Innovation* (London: NESTA and the Young Foundation, 2010).

So this is where NESTA started to experiment, to develop our own method for driving community-led innovation that is prompted by a social issue.

Driving community-led innovation: NESTA's Big Green Challenge

Inspired by technological innovation prizes such as the X-Prize and InnoCentive, NESTA designed a social challenge prize model to engage a broad set of actors in the process of generating and scaling innovations - we called it the Big Green Challenge. This was an issue-led approach to incentive knowledge creation and enterprise, prompted by a social issue. In this case, climate change.

Launched in 2007, the Big Green Challenge was a £1 million social challenge prize for communities to design, develop and deliver responses to climate change. The challenge prize was carefully constructed to encourage widespread engagement - over 300 communities and over 1500 people got involved in developing innovations at a local level, working within their local area to reduce carbon emissions.³

³ For further discussion of NESTA's Big Green Challenge, see *Using Social Challenge Prizes to Support Social Innovation* (London: NESTA, 2011).

An open challenge prize model was (at the time) novel to the UK's social sector, so we set out to test its design

features to learn what could be applicable elsewhere. We identified three core features that made the challenge prize effective in leveraging and supporting community-led innovation:

- *An open access approach, with a very open set of criteria at the first stage:*

The Big Green Challenge prize intentionally set low barriers to entry to help find and mobilise new problem solvers beyond the usual suspects. Application criteria were loose and very broad, and NESTA explicitly invited proposals from any non-profit group whether formally constituted or not. This was coupled with a direct, extensive outreach strategy to encourage applications from those who may not have thought of themselves as innovators.

- *Setting and rewarding clear social or environmental outcomes, not just process:*

In order to generate momentum, the Big Green Challenge set one clear, measurable outcome - to reduce carbon emissions in a local area. The clarity of intention gave focus. Combined with a tight timetable, this generated urgency and momentum which was supported by credible information on progress. Specifying the outcome, but not the process, meant that imagination was not limited.

- *A staged process, with help for development of ideas and graduated rewards:*

As the challenge prize offered a staged process that was progressively more demanding of participants, all Big Green Challenge participants were actively encouraged to iterate, change and adapt their ideas as shifting circumstances required. Demands were met with reward, both in the form of financial support, and critical advice and challenge. In the final stage of the process, ten finalists progressed their ideas for a year with on-going mentoring and evaluation.

The staged process was also instrumental in helping both funders and competitors manage risk, while clear and transparent stages within the overall process helped them make informed choices as to how and whether to continue.

In the third stage, 10 finalists developed their projects for a whole year and were closely monitored and evaluated against their main objective - reducing carbon emissions in their communities. The 10 final projects were wonderfully varied, from urban farming and food projects to community energy investment, from an island going carbon neutral to a networked home energy service.

In 2010, we announced the four winners - a micro-hydro power generation scheme, a local Household Energy Service, a low carbon community trust and a carbon neutral island. All four achieved significant reductions in CO2 emissions of between 10 and 32% in a very short time period. But the success of the programme lies not just in the performance of the finalists, but in the spread of applicants who chose to progress their own projects despite not making it to the final stage.

Spotlight on success: the Green Valleys

One of the four winners of the Big Green Challenge was the Green Valleys, a community-owned micro hydro power scheme in the Brecon Beacons in Wales. The team wanted to create a local sustainable energy markets, supporting the community to reduce their own carbon emissions and explore the potential of alternative energy sources. By setting up community renewable energy schemes and reinvesting revenue in community-based carbon reduction projects, the team aims to make the region a net exporter of sustainable energy.

During the final year of the Big Green

Challenge, Green Valleys installed a number of community-owned, hydro electric power turbines, just one of which will generate over 80 per cent of the electricity needed by the local community. But rather than just introducing a new technology and assuming its uptake, the Green Valleys team led an intensive local education campaign around climate change to drum-up support for the project. They put on more than 60 public lectures to get people thinking and talking about climate change.

As a result of actions taken during the Big Green Challenge year, Green Valleys will reduce CO2 emissions in the area by between 370 and 435 tonnes per year, a reduction of 20-23 per cent.

This impact is set to increase; with 40 hydro schemes planned to be installed in the next four years, Green Valleys could reduce emissions by 1,670 to 2,000 tonnes per year - the equivalent of over 500 households successfully meeting government's 2020 target of a 34 per cent reduction in CO2 emissions many years early.

The Green Valleys is demonstrative of a hyper-local but networked approach to developing alternative energy sources. Led by a vivacious and enterprising team, not only did they ramp-up demand for alternative energy sources, but they built a coalition and community ownership around the project that was critical to its success. This is reflective of our in depth evaluation of other communities' success. We found that overall, locally-led schemes were particularly effective at instigating and sustaining behaviour change, and raising local public awareness of an issue.

Mass localism: realising the potential of community-led innovation

Something special happened here. The Big Green Challenge was successful on its own terms, but it also revealed valuable lessons about the potential of

leveraging and supporting community-led, social innovation. The communities who took part in the Big Green Challenge achieved significant carbon reductions, but we also discovered a way to join up distributed efforts towards a wider, collective goal. The Big Green Challenge taught us how to combine local innovation with national impact and scale-an approach we came to term "Mass Localism."⁴

⁴ Laura Bunt and Michael Harris, *Mass Localism: A way to help small communities solve big social challenges* (London: NESTA, 2010).

Mass localism is a way to achieve scale through local intervention, by connecting lots of community-led innovation to respond to a major social issue. This has a range of possible applications, most obviously in complex, behavioural challenges such as environmental sustainability, health promotion, and reducing re-offending. From our evaluation of the Big Green Challenge, NESTA outlined five key principles that indicate how governments can support this sort of approach:

- *Inspire challenge - promote a clear, measurable outcome*

The Big Green Challenge participants welcomed the emphasis on outcomes, allowing space for innovation in designing and delivering the most effective approach. This gave communities the licence to tailor solutions to local need, rather than prescribing the solution from the centre.

- *Presume community capacity to innovate*

Inherent in the design of the Big Green Challenge was a belief that communities could, with appropriate support, develop and deliver their own responses to big social challenges. Such a belief is not universally apparent in the design of many government initiatives, but it is the first and most fundamental step in giving communities real ownership of solutions

- *Support and finance - challenge and advice as valuable as cash*

Sometimes what communities need is access to advice, networks or institutional guidance rather than finance. This was an important lesson from the Big Green Challenge; that in supporting community-led innovation a mix of support is necessary rather than just providing cash up-front.

- *Remove barriers to participation*

The individual and shared experience of projects can help to illuminate the conditions necessary for community action, and identify existing barriers to designing and delivering local solutions of various kinds. The challenge prize process can in this light be seen as a useful tool for gathering intelligence, and could be used to inform future interventions in supporting local action and initiative.

- *Reward outcomes, not just activity*

Practically, this means rewarding achievement of the 'what' rather than the 'how' of community-led innovation, focusing on the impact of activity rather than the activity per se. This represents a shift away from traditional grant giving.

Supporting more community-led innovation implies a different approach to policymaking. Instead of assuming that the best solutions need to be led centrally or 'authorised' by policymakers, mass localism is about creating more opportunities for communities to develop their own solutions and to learn and adapt from each other. It is not as simple as removing bureaucracy and allowing 1000 flowers to bloom, but depends on more active support to remove barriers and value achievement.

Of course, the Big Green Challenge is just one method to incentivise and support community-led innovation, mobilising community and networked resources, and evaluating their impact. There are many others (including those

showcased in the panel at this workshop). NESTA is building on this research and practical experience with a range of new programmes, including the Neighbourhood Challenge - a larger, more ambitious version of the Big Green Challenge. Watch this space.

Laura Bunt, NESTA

Bio: Laura Bunt is an advisor on public and social innovation at the UK's National Endowment for Science, Technology and the Arts (NESTA). She has co-authored a number of publications on social innovation and public service reform. She previously worked for the Royal Society for the Arts, Manufacturing and Commerce (the RSA), and the leading public policy think tank Demos. She has a BA (Hons) in Classics from Oxford University.

Sociotechnical routes necessary for saving the society from energy/environment crises



Masayuki Horio

Targets for Green House Gases, Emission Reduction and Sociotechnical Innovation

We, in the developed countries, are now facing the heavy burden of reducing green house gases' emission 70 to 90% by 2050. This requires us a significant change in thinking on the future of the modern society. The five year R&D program 'Community-Based Actions against Global Warming and Environmental Degradation' of JST-RISTEX started in 2008 aims at initiating new actions to reform the present sociotechnical systems existing on the basis of fossil fuels.

Since the reform necessary to cope with the global environment issues is limited to a fixed period of some 40

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JST-RISTEX R&D Area Director

years, which is already too soon compared with the social and nature's inertias, our R&D program has been designed to aim at not incremental and merely technical actions but sociotechnical innovations. We have been stressing that such drastic reduction is not impossible by combining several innovative but by realistic methods.

Significance of Social Design Thinking and Approaches

There exists a strong social skepticism on global warming and a mood of denying environmental counter actions. It is understandable that citizens of United States, the leading country of the petroleum based modernization over 100 years, tend to think nostalgic to the power of petroleum. It is also understandable that the enormous socioeconomic changes required anywhere in the developed countries in the world induces a fear of big losses in businesses. Even in Japan, where tackling the global warming issue is well authorized at COP10, many of its R&D projects for GHG reduction have been adopting the idea as a far future target. To cope with such situations that are based on the social system structures developed with the plentiful supply of fossil fuels, we decided for our program to declare the need of tackling the social tendencies such as: 1) Less horizontal collaboration among sections and divisions both in government and academia, 2) Less equal partnership among local people, government, industry and academia, 3) Maniac technical challenges even in cases where social actions or appropriate technologies are effective or necessary, 4) Qualitative, ethical and enlightening approaches rather than practical and profitable ones, and 5) Sector-by-sector and region-by-region target settings rather than collaborative ones.

To develop new ways of solving the above issues by bringing ordinary people into the reform actions, we in this program have set its objective of working from a very fundamental viewpoint

of "reconstructing modernity" as fossil-fuel-free one. For instance, rural areas that have been losing their population for the last 50 years of post-WWII modernization have high potential of evolving into bases for renewable-energy based social reform. Once massive population transfer from urban areas to country sides is conducted together with agriculture, forestry and other industrial revitalization, the social aspects of the population transfer including new rule design and process designs for endogenous decision making can be some of the major R&D issues. What is crucial is to introduce design thinking/approaches into social processes.

Design Approaches should be as well effective in almost all aspects of sociotechnical innovation. Engineers and scientists should better design institutional systems together with their technical and scientific R&D efforts to realize the technical innovation they are aiming at. This is because the existing institutional systems are developed based on the present technology and tend to prohibit technology innovation. Academia, consultants, local government officials and NPO members should move from simple analytical and enlightenment approach to design approach for social actions collaborating with people. Local government officials need design thinking for green reconstruction of the local techno-social systems. Project planners need design thinking to integrate issues for comprehensive solutions. Distributors and consumer activists can work together through design thinking to make supply chains green in the existing market place.

How to Quantify Social Aspects and Drive the Whole Socio-technical Innovation

So far there has not been substantial effort concerning the design of social actions for reducing GHGs emission from the sociotechnical system except for purely social approaches such as

carbon trading, taxation etc. However, there exists quite a few social R&D issues necessary for realizing engineering scenarios that are just developed based on scientific mass and energy balances. Even the scenario of mass movement of people from urban area of high GHG emission to the country side living solely with natural energies should be classified to physical/engineering, not to social scenario, unless the detailed scenario of rule development and/or consensus building are not included. The latter should be the social scenario. In our program the applicants have been requested to present their R&D project plan by clearly separating and inter-relating the physical/engineering and social scenario. This approach is further developed to deal with work and industry development for country sides, forestry revitalization, supply chain transformation and city policy renovation.

Among the relevant issues, cognitive process has a significant role in activating local societies. Through recognizing their redefined historical positions in the time of global warming, local communities can change to survive. In the present R&D program the investigation on procedures for creating local sovereignty is pursued through newly introduced concepts of social experiment of the second kind, in which the investigators themselves are the object of investigation.

Comments



Hans-Liudger Dienel

The session focussed on new approaches in science and technology to address social challenges and to develop social innovations. It comprised of three sub-sessions with two papers each:

1. New concepts for Design Thinking as an approach to support science and technology to address social challenges
2. New structures of social impact measurement and accounting of science and technology and
3. New forms of community led social innovations

The workshop had two overarching foci: "Social Innovations" and "Innovations for Social Change". While the first focus (social innovations) tackled new types, forms and processes of innovation, the latter one (innovations for social challenges) addressed new themes, topics and goals for innovation. The talks oscillated between these two foci for good reasons. Innovations to address social problems require new

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forms and processes of innovation: in order to identify demands, to prioritise solutions (not only along technical efficiency, but along ecological benefits and social and societal acceptance) and not at least to secure support and funding. At the same time, some characteristics of social innovations have to keep traditional concepts, forms and strengths of innovation. The freedom of creativity, the radical thinking, and the classic incentives for researchers and innovations (money, positions, social status) should be kept. Social innovations should not be limited to politically correct (but boring) innovations.

Presentations and the discussion made very clear that these two foci belong together as mirror image twins. Processes and topics for and of social innovations are interrelated and dependent on each other. This was a first important result of a most stimulating and fruitful session on a fundamental change and challenge for change in science, technology and innovation, which in the word of German Sociologist Niklas Luhmann are "independent subsystems" with too little exchange with other societal subsystems. Self sufficiency of science and technology has substantially grown in the last 100 years. We have to come back to an issue driven understanding of science and technology research. In short: the session discussed nothing less than a fundamental change towards a new problem orientated transdisciplinary rearrangement of research and innovation.

The first sub-session about social innovations and innovations for social challenges presented two quite different support strategies

1. an NGO supporting social entrepreneurs (ASHOKA)
2. a governmental agency supporting research institutes (RISTEX)

By presenting and discussing the strategies of ASHOKA and RISTEX, the sub-session implicitly compared the role of private organisations (ASHOKA) with the role of governmental agencies and

finally the state (RISTEX) in this change of innovation strategy.

KARABI ASHARYA presented goals and strategies of ASHOKA, a wonderful organisation, a big support for social entrepreneurs and a testimony for the paradigm shift of new trust into entrepreneurs and independent inventors. In Joseph Schumpeters thinking, the "Gyro Gearloose" type of inventor and innovator was a key figure for creative destruction and innovation. After WW II and up to the 1980s, this independent inventor, however, became a man of the past, a strange and increasing ludicrous figure against anonymous big science and large technological systems. But, since the 1980s, we experience a new wave of admiration for the independent inventor, especially in new businesses as computers and the internet from Steve Jobs, over Bill Gates and Eric Schmidt to Marc Zuckerberg. From the economist Richard Florida (The rise of the creative class, Basic Books, New York 2002) we learned that a rising number of employees value freedom for creativity at the working place more than the salary. They require space for creativity and want to see themselves as - so to speak - employed innovators. In short, the rise of ASHOKA is part of a new admiration for the social entrepreneur. Having said that, I have four partly critical questions to Karabi Asharya:

1. What are your criteria for social innovation? Radicality as core criteria is overemphasised. Revolutionizing the fishing industry sounds less social to me, than teaching to fish.
2. What are your criteria to assess the system change impact of fellows? Isn't it sometimes more innovative to stabilise a system? Why do you emphasise system change at all?
3. And most important: Which role do you see for the state in social innovation? Arimoto San focusses on the role of the state; - you not at all. Is ASHOKA fed up with the state. Don't we need more system trust in the state, especially in the developing countries?

4. Why did ASHOKA opt for a life long appointment of fellows? It is a wonderful message in a world of short term projects, indeed. So, partly I am intrigued that you give social innovation more time to happen. Would you generalise this approach? Do we have to slow down our innovation processes?

TATTEO ARIMOTO aims at nothing less than a new understanding and thus a new form of innovation. He suggests new topics and new process, which he sees as two sides of the same coin. In his new governance of innovation, the state remains an important actor. He describes and brands this new innovation strategy as "Design Thinking" and "Issue Driven Innovation". I come back to these terms.

Firstly, I would like to ask, whether his new topics (climate, food, energy, diseases) are so new at all in science and technology. I would rather say, science and technology comes back to its 19th Century roots, which have been more issue driven than the period of so called basic or pure sciences in the 20th Century, when research became more and more an "autonomous subsystem".

Secondly, I would like to ask Arimoto San to become more radical in the proposed new processes of innovation. His suggestions (diffusion, entrepreneurship, government als platform organiser) are too cautious to my mind.

In a second step, Arimoto San presents the research areas of RISTEX als a model.

I would like to know, who selected these areas? Arimoto San proposed design thinking and issue driven innovation that is integrative and transdisciplinary approach and problem driven research. I agree but ask: Who selected the problems and integrated the perspectives? I believe, this has to be the stakeholders and at the end of the days a citizen driven process. We cannot leave it to researchers alone. Where are the participative, deliberative tools in his process? I think, RISTEX needs as transparent selection process in order to fulfill its own requirements for new

forms of social innovations. Does an applied, demand driven selection of research topics could harm creativity, autonomy and radicality of innovation and could limit research to a politically correct but boring research mode? Some scientist see this as a possible danger. Personally, I think that participative processes can lead to clear and path breaking decisions. I am very keen to learn more about the impact of RISTEX on the Japanese science funding system. How is it assessed? Why are the RISTEX research structures still quite marginal in Japan?

JULIA LANE and **STEFANO BERTUZZI** both emphasise an extremely important and relevant topic for innovation policy: accounting. No doubt: Social innovations need reliable forms of measurement and accounting. Without reliable accounting, we will not be able to shift budgets of a new innovation system. Classical innovation systems may be less innovative and efficient but they still have better accounting systems and thus can keep their position in governmental budgets.

The idea of new forms of accounting, however, is not new. In 1973, Meinolf Dierkes published his famous book on "Corporate Social Accounting" (Meinolf Dierkes/Raymond A. Bauer (eds.): Corporate Social Accounting. Praeger: New York/London 1973.) Most CSR reports of companies today do not even meet the proposed standards and quality criteria of Dierkes.

I like that Lane and Bertuzzi discuss three problems of new forms of reporting:

1. Additional reporting pressure on science and technology researchers. Lane/Bertuzzi present a new automatic reporting system with an impact visualization, which I do not trust. For instance, it counts the number of new jobs by research projects. But, the direct number of jobs is a more or less linear function of the research funds invested, unless you count indirectly stimulated new jobs. I cannot imagine this being done

automatically.

2. Long term effects of research. The final official approval of EMBREI 20 years after the invention is a good example that many effects come very late. How do you measure the important long-term-effects?
3. Social Effects. What about the social effects e.g. of EMBREI: of instance the number of marriages in the TNA-study group, or - more important - the number of healed patients of Crohns disease. I think, the impact measurement is still too focussed on money and jobs.

But, I fully agree that we have to implement new forms of science and technology research accounting for a public-impact-assessment of science and technology.

JOHANN EVERS (and **ROBBY BERLOZNIK**, who could not make it to Washington), focussed on new governance models for social innovations and differentiated between:

- Parliamentary Technology Assessment (OTA, IST in Belgium; TAB in Germany). It is not necessarily participative, but multidisciplinary, political and practical; it focusses on foresight and future studies, which at the moment become academic disciplines for the first time.
- Participatory Technology Assessment, which is not necessarily parliamentary, but deliberative, direct democratic, consultative and informative and an lead to a better collective binding decision making.

Evers focussed on the latter type and stated very convincingly that quality criteria for participative processes are decisive for their future growth and acceptance. He convincingly underlines the importance of quality (evaluation) criteria, but at the same time does present criteria which are not always clear enough. Where are the important criteria of equal access (e.g. by selection at random), the neutrality of the organizer of participative processes, the controversial information of the stake-

holders (citizens), the time for deliberation (without enough time, participative tools can become a mere showcase). In short: Evers presented an impressive list of projects and of participative methods but should give more special informations on quality and thus evaluation criteria for participative processes.

The third sub-session compares two running innovation programs for eco efficient villages in the UK and in Japan.

LAURA BUNT presents Mass Localism (within Big Green challenge) as a funding program for municipalities. They can apply to become eco-efficient villages. The program is not only open to researchers but mainly to social organisations, social entrepreneurs and communities, while

MASAYAKI HORIO San presents a similar funding program to support community-based action against global warming, but with a different target group. It too aims at supporting low-emission villages and the future of the country side, but the money does not go to municipalities but to university professors.

It would be extremely interesting to compare the impact and side effects of both programs with similar goals but different funding target groups. I can imagine that in Japan the projects might not be rooted enough in the local communities, while in the UK the research and university side is underrepresented. However, this is only a guess and only a serious comparative evaluation can quantify the relative strengths and weaknesses of the two programs and might come up with an innovative combination.

There is much to do in order to put innovations for social change and social innovations into practice.

Concluding Remarks: Next Steps



Yuko Harayama

Comments before Wrap up discussion

My task is to gather your comments, suggestions on this topic and by the end if it is possible to find what the next step is --- this is my task

Purpose of this session was, as it represented as by the title, "design thinking to mobilize science, technology and innovation".

Social challenge is at the goal but also what we would like to promote is design thinking

This concept is vague and well not defined at the moment.

But we already have some feeling or sense of this meaning

Now I would like to discuss with you how we can promote social challenge

I would like to oppose design thinking to "planification".

Usually when policy makers should define something, "first step is to ask ' what is the target' ". 2nd to decide policy measures, in our case investing in some field of S&T for example, then to wait that this something happens

We would like to do more than to

Yuko Harayama: Deputy Director of the OECD's Directorate for Science, Technology and Industry (DSTI)

planify. Within the framework of planification - we plan actions for the next coming 6 months, according to- the longer term targets. If we are away from the existing planification, your funding may well be cut - This approach is not appropriate for change, which may occurred based on experiments you operate on the ground.

That is the limit of planification so far
But now, to provoke new thinking for policy makers, we introduce the new term - "design thinking".

Based on the speakers presentation, we have found some communality in the way to develop innovative ideas. I know everybody have innovative ideas.

But the problem is to how to express your ideas in terms of concrete action.

That is the difficulty.

Sometimes we need to have an initiative coming from associative community.

We are focusing on policy makers and policy measures, but in any case There is a room to experiment and - based on its experimentation, we may prove new way to do thing. A change sharing experimentations with colleagues and counterparts. - we may move one step further . The trial is really crucial here.

We have also discussed on the role of the government, at the same time that looking the role of private actors. Usually we refer to PPP, easy to say and fashionable, but to make functioning PPP is very difficult

This morning, we have tried to put into practice the PPP.

1st focus was pm the private initiatives, ASHOKA. Its driving force being social institutional change. - Here we can find PPP in practice.

Not directly funding by the public money, but you have so big impacts on the societ.

For the Japanese and British cases, we have public money to induce change in social institution.

I note Arimotosan's group remark. Once you attend the stage of prototyping. -difficulty came when you want to make community-based action operation on the ground.

Throughout all this movement, what we can identify is the presence of: - innovation eco-system, with its social and economic impacts, and also institutional transformation.

Another challenge. We need to understand how all these elements interact each other. For this point, I refer to the SciSIP program and: Star metrics'.

We are happy to have leaders for the first step, but we are moving into how to understand the complexity of this mechanism. So how to work and how to operate?

We have to move into this direction and for that we have to have the international cooperation among US, European Commission - and Japan.

We have to tackle in a holistic way. Innovation is key words for all around world policy makers.- but we still do not have good understand of the mechanism through which innovation occurs; " technical transfer " as fashionable years ago, but it was just a channel - we have to tackle holistic way of approach.

We have to see what could be the impact of social innovation, social challenges and vice versa.

That is the starting point for wrap up discussion and I am happy to listen to your point of views from the audience and from speakers and hope we could see what actions we should take for the next step by the end of the session. Welcome your insight.

Concluding Remarks

Through our session, what we have a strong conviction in this discussion is that we should go ahead towards this direction with enthusiasm. The important thing is to share the experiences among all around the world.

We have same type of difficulties and some solutions for some contexts, which are useful giving some ideas. Of course we should contextualize the situation but it is crucial to share the information.

And backed by the good measurement for these issues, we need to have the platform for that. That could be my

homework for the OECD.

To tackle for the issues, we need to look in detail which type of indicators we should focus on in order to have a better understanding of innovation phenomena, It is not only measurement challenge but also we should be keen with how to make it operational more visualized.

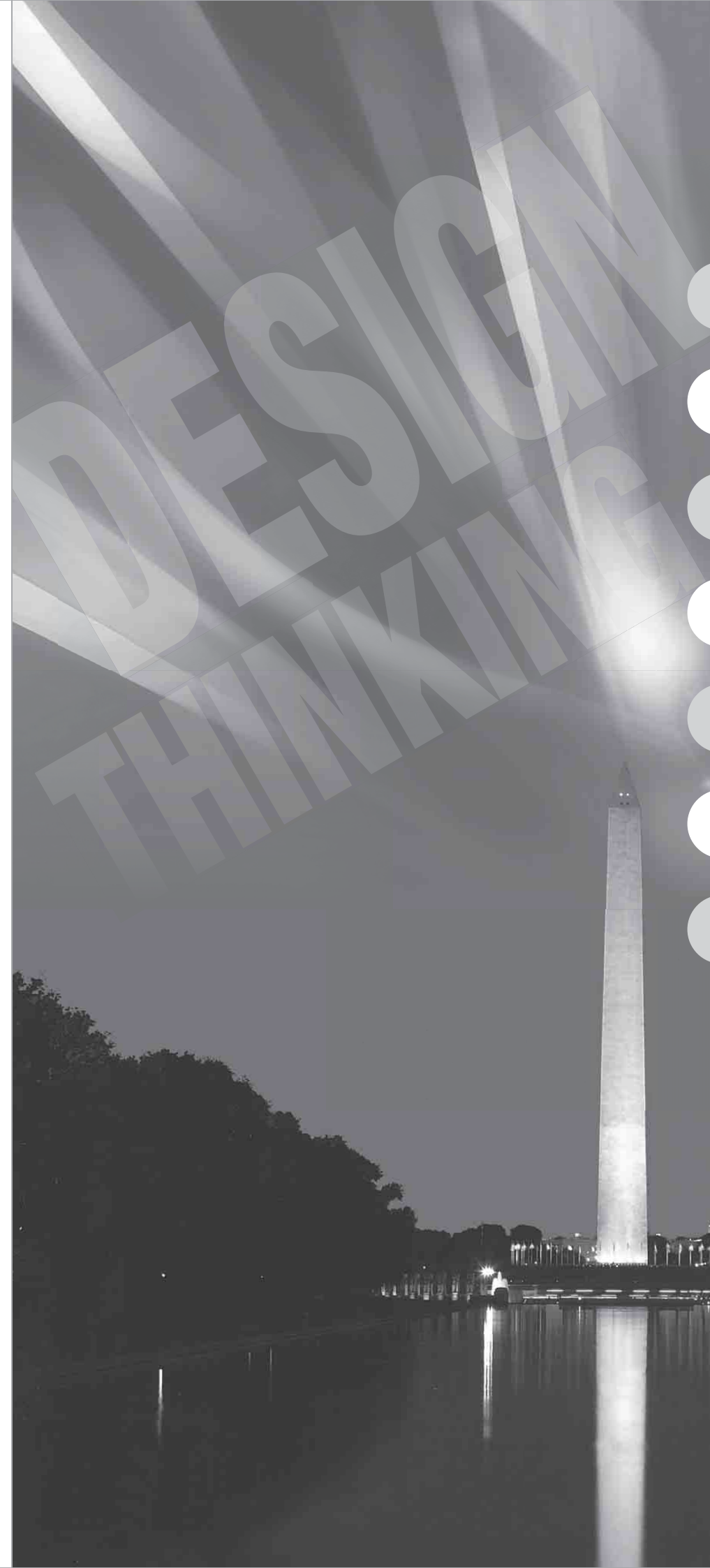
Your own experience, experience of your institution is the key.

I welcome them all together. All these experience constitute intellectual asset for taking action for the future.

So the next step will be 'Designing tomorrow together'.

Thank you very much for all of your participation.

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Design thinking to mobilize science, technology and innovation for social challenges

Yuko Harayama



Design Thinking to Mobilize Science, Technology & Innovation for Social Challenges

AAAS Annual Meeting
Washington, 20 February 2011
Yuko HARAYAMA / OECD

Social changes as a consequence of innovation, and/or...

- Above the policy discourse of "Innovation for economic growth"
- Innovation as a mean to solve social problems?

↓

- Who does initiate?
- Whom to mobilize?
- How to orchestrate?

What makes innovation different by targeting "Social" objective?



Understanding the nature of "social innovation"

- Actors
 - Active role of "Non-professional"
 - "Entrepreneur" versus "Social entrepreneur"
- Role of science and technology
 - From "Science driven" to "Science based"
 - From "Technology driven" to "Technology serving"
- Action
 - Designing and remolding social institutions



How to improve our capacity to address social challenges?

- Through experimentations
 - Session 1. Putting "design thinking" into practice
- Assessing social impact
 - Session 2. How to assess and measure social value of S&T?
- Learning from the ground
 - Session 3. Community-led innovation to address social challenges



WELCOME TO THE LEARNING SPACE!




Systemic Change to Achieve Environmental Impact and Sustainability

Karabi Acharya

Systemic Change to Achieve Environmental Impact and Sustainability

Examples of Ashoka Fellows, Leading Social Entrepreneurs



Karabi Acharya, Sc.D.
AAAS, February 2011

Ashoka

- Is the world's largest community of 2,500 leading social entrepreneurs across 70 countries working on every social issue
- Champions transformational social change ideas and supports the entrepreneurs leading them
- Connects social and business sectors to build an "eco-system" of initiatives that support the fast-growing social needs of the world

Ashoka elects over 100 Fellows a year, around the world. Each Fellow must meet five core criteria:

- New idea that changes the pattern in the field
- Creativity
- Entrepreneurial quality
- Ethical fiber
- Social impact

"Social entrepreneurs are not content just to give a fish, or teach how to fish. They will not rest until they have **revolutionized** the fishing industry."

— Bill Drayton, Ashoka Founder and CEO

Five paths to social system change ("revolutionizing a field")

- Market dynamics and value chains
- Public policy and industry norms
- Full inclusion and empathetic ethics
- Business-social congruence
- Culture of changemaking

By 10 years after election, 83% of Fellows have changed a system in at least one way.

On average, Fellows change the system in 3 ways.

I. Affecting Market Dynamics and Value Chains



Fellow Ishita Khanna (India) is building a green economy in the Himalayas

SURREAL SPITI
DISCOVER THE MAGIC OF SPITI. BE A PART OF PRESERVING IT.

2. Changing Public policy and Industry Norms

Fellow Joseph Adelagan (Nigeria) converts slaughterhouse waste to biogas.




3. Improving Inclusion and Empathetic Ethics

Fellow Willie Smits (Indonesia) revolutionized reforestation approaches to include people and the planet.



4. Business-Social Congruence



Fellow Albina Ruiz (Peru) creates efficient solid waste management systems that generate employment and contribute to better quality-of-life and cleaner cities.



5. Creating a Culture of Changemaking



Fellow Bernard Amadei (US) is transforming the field of engineering to "compassion in action" by integrating applied engineering skills and solving real problems in the developing world.



The only answer to more problems is more problem-solvers.

We envision a world where everyone is a changemaker.

How will you change the world?

Design Thinking to Induce New paradigm for Issue-driven Approach

Tateo Arimoto



Design Thinking to Induce New paradigm for Issue-driven Approach

February 20, 2011 in Washington D.C.
AAAS2011 Annual Meeting
Tateo ARIMOTO
Japan Science & Technology Agency (JST)
Tokyo, Japan



Since 1989 End of the Cold-War ICT revolution

Now *nature* TO THE EDGE OF THE EARTH

Globalization ⇒ The Conditions is Changing Rapidly ...

- Sustainable development
- Climate change, disasters
- Energy, water & resources shortage
- Aging society, Smarter cities
- Infectious diseases, Disparity
- Knowledge-based society

Climate change

World on the edge

The new masters of management

Economic crisis & New Emerging market



Since 1989

The Rules of games are Changing !!
Innovation & Entrepreneurship
Globalization and Localization

Shaping the Post-Crisis World

Shaping the Values and Leadership

Principles for a Post-Crisis World

Catalising the Next Wave of Growth through Science & Innovation

Rethink, Redesign and Rebuild

Green New Deal & Smart Ageing Society

Global Management & Governance of Enterprises and S&I

Shaped Norms for the New Reality

- Sustainable development
- Climate change
- Energy
- Aging society
- Infectious diseases
- Knowledge-based society

Climate change

The new masters of management

Economic crisis & New Emerging market

Innovation for what in the 21st century ?

- Innovation for profit
- Innovation for competitiveness
- Innovation for growth
- Innovation for employment
- Innovation for wellbeing & quality of life
- Innovation for safety, security & social cohesion
- Innovation for sustainable development

Innovation horizon is expanding.
Science and technology policy is changing.

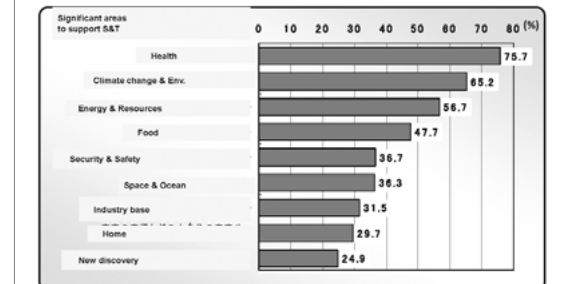
How to measure the values of states in 21st century

- OHard power:** military power, economic power
- OSoft and smart power:** quality of life, environment, health, safety, peace, education, culture, science & technology, university, intellectual network, connectivity, science diplomacy
- * From industrial society to knowledge-based society:** intangible assets, brains, R&D, brand, design, network & connectivity
- * Globalization and localization**

x. The Commission on the Measurement of Economic Performance and Social Progress (Sept. 14, 2009); STIGLITZ, Amartya SEN, FITOUSSI
*Classical GDP + Quality of Life + Sustainable Development and Environment



How should S&T respond to the national expectations?



Public Opinion Poll on Science and Technology, Jan, 2010

" OECD New Innovation Strategy ", May 2010 - Getting a head start on tomorrow -

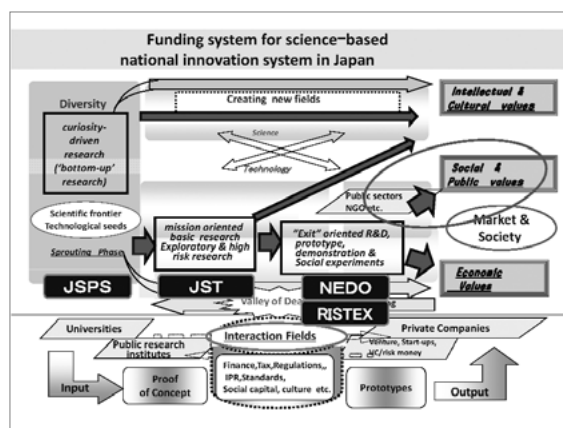
The broad concept of innovation embraced by the OECD Innovation Strategy emphasises the need for a better match between supply-side inputs and the demand side, including the role of markets. Moreover, policy actions need to reflect the changing nature of innovation.



- * Broadening policies to foster innovation beyond science and technology** in recognition of the fact that innovation involves a wide range of investments in intangible assets and of actors.
- * Education and training policies adapted to the needs of society today to empower people throughout society to be creative, engage in innovation and benefit from its outcomes.**

Greater policy attention to the creation and growth of new firms and their role in creating breakthrough innovations and new jobs.

- * Sufficient attention for the fundamental role of scientific research in enabling radical innovation and providing the foundation for future innovation.**
- * Improved mechanisms to foster the diffusion and application of knowledge through well-functioning networks and markets.**
- * Attention for the role of government in creating new platforms for innovation.**
- * New approaches and governance mechanisms for international cooperation in science and technology to help address global challenges and share costs and risks.**
- * Frameworks for measuring the broader, more networked concept of innovation and its impacts to guide policy making.**



Grand challenges we should meet

- The world is confronted with the global challenges of climate change, food and energy security, and infectious diseases which threaten sustainability.
- The **New Growth Strategy** should be empowered by S&T and innovation to transform the grand challenges to opportunities for thriving in the fiercer global competition.
- Due to complexity of the challenges, it is getting more difficult to find a solution by single discipline of S&T.
- A diversity of knowledge derived in **different disciplines of S&T along with social science and humanities should be integrated to address the challenges, which is characterized by Issue-driven Innovation beyond Discipline-oriented Innovation.**

Latest major international activities at RISTEX

- ✓ Held series of **OECD CSTP Workshops** (OECD Headquarters in Paris)
 - organized by OECD, JST/RISTEX and MEXT
 - 1st workshop "Workshop on Fostering Innovation to Address Social Challenges" (May 25-26, 2009)
 - 2nd workshop "Workshops on Transforming Innovation to Address Social Challenges" (November 9-10, 2009)
 - "Our approach for social challenge has been highly recognized by OECD, incorporated into ministerial conclusions (May 2010) and reflected in OECD Innovation Strategy"
- ✓ Held co-host **Symposium with British Council** (July 9th, 2009 Tokyo)
 - organized by JST/RISTEX and British Council (Tokyo)
 - * Object : Examined specific examples of best practice in the UK and Japan where research and innovation is being used to tackle social challenges to look at how government and stakeholders in the UK and Japan are integrating social issues into the research and innovation process
 - * Introduced core case-studies and shared perspective from RISTEX R&D focus area * Community-Based Actions against Global Warming and Environmental Degradation" and NESTA (National Endowment for Science, Technology and the Arts) focusing on environmental fields
- ✓ Held Symposium "Science in Society - a challenge in Japan"
 - organized by JST/RISTEX
 - Supported by Japanese Society for Science and Technology Studies
 - * Reported its initiative and research and development of RISTEX R&D Focus Area "Science and Technology and Humanity", discussed with speakers and discussants from Europe, North America, and Asian regions
 - (August 24th 2010 in Tokyo)

- ✓ Held **East Asian Region International Workshop** (October 10th-12th 2010 in Tokyo)
 - Organized by JST/RISTEX
 - * Object : Examine the approach for "Science for Society" in East Asian countries and regions comparatively, expand the exchange perspectives in line with each experiences and discuss further research advancement in East Asia
- ✓ Hold Session at **AAAS Annual Meeting** (scheduled February 20th, 2011 in Washington DC)
 - * Got accepted proposal "Design thinking to mobilize science, technology and innovation for social challenges" from JST/RISTEX (Highly deserved recognition of the importance of the topic working on OECD workshops)
 - * Nominated speakers at OECD workshops from Japan, US, UK, Germany and Belgium etc.
 - * Will highlight elements and good practices that support a more systematic approach for policy implications, looking into barriers and incentive designed to address social challenges
 - * Will kick around a few projects which gather social entrepreneurs and researchers in order to develop and demonstrate technologies, show its possibility of solving environmental issues
 - * Will these co-evolutionary approaches also be discussed

New Perspectives for Science and Innovation : No.1

- Bridging science and society
- Beyond the boundaries (disciplines, organizations, generations, nations)
- Reshaping science and innovation system
 - Reshaping the values and leadership principles for the new world
 - issue-driven S&I policy beyond discipline-oriented one
 - NOE (Network of Excellences) beyond COE (Center of Excellence)
- ⇒ Network, platform & connectivity for new Innovation

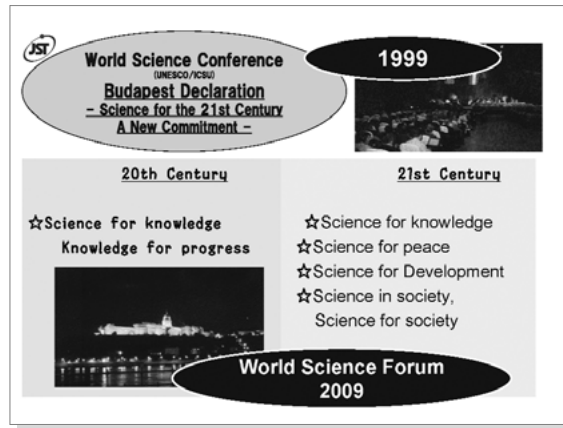
New Perspectives for Science and Innovation: No.2

- Development of human resources for enhancing social challenges
 - design and system thinking, non-traditional skills and sense, diversity and inclusiveness, collective intelligence, foresight under the complex and uncertain world
- Gravity of scientific activities moving to developing countries
 - "Silent Sputnik" (Obama, Rita Colwell) : (AAAS2010 Annual Conf. "Bridging Science and Society") (AAAS2011 "Science without Borders")
 - "Royal Society Global Science Report" : "New entrants are reshaping the landscape for science and innovation in the world. But what do these changes mean? How should policymakers, scientists and business leaders respond? And how do we strike the right balance between competition and collaboration?"
- Global governance of science
- Scientific integrity, Quality control of science

Thank you very much for your attention!!

Questions:
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APPENDIX

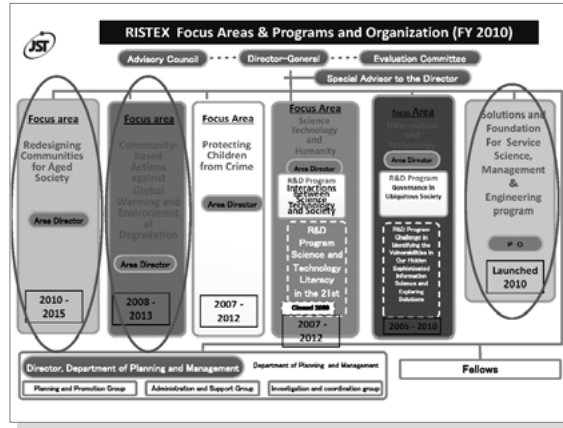
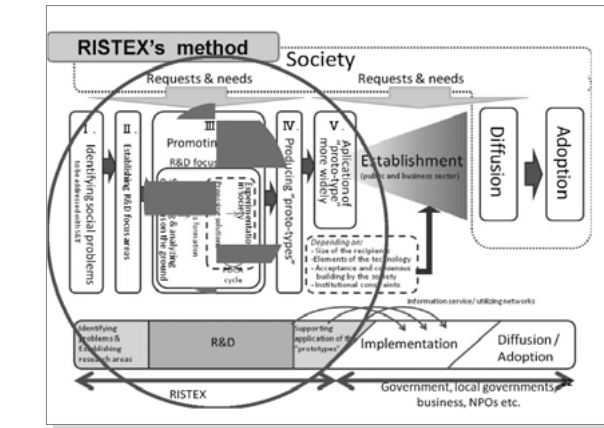
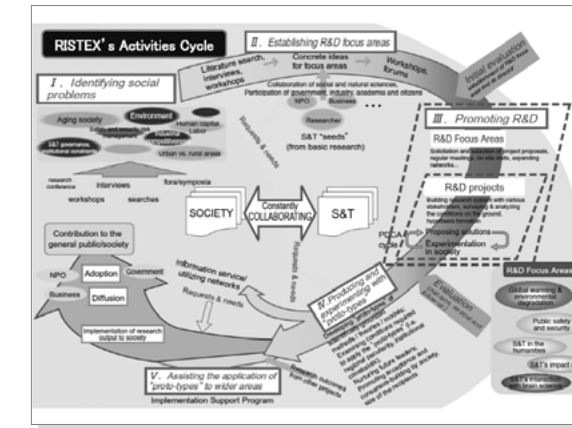


RISTEX / JST Research Institute of S&T for Society (RISTEX) / JST Mission

Creating social and public values through funding R&D which aims at finding solution of social problems

Features of RISTEX funding

- Problem-oriented R&D projects
- Multidisciplinary
- Application; technological innovation and social innovation
- Social experimentation, PDCA cycle
- Collaboration between practitioners/researchers
- Mutual communication between management side and research project teams



Principles of RISTEX's Activities

(IDENTIFYING SOCIAL PROBLEMS)

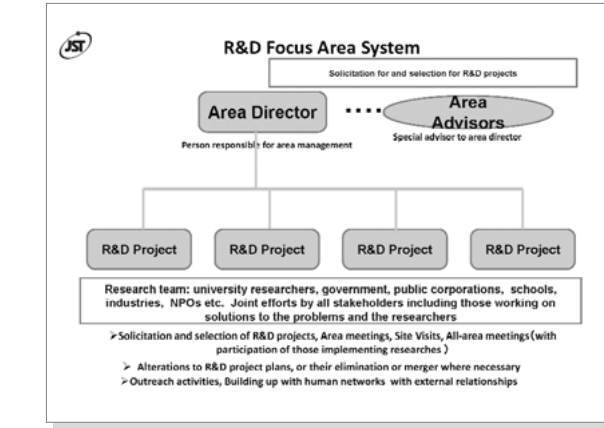
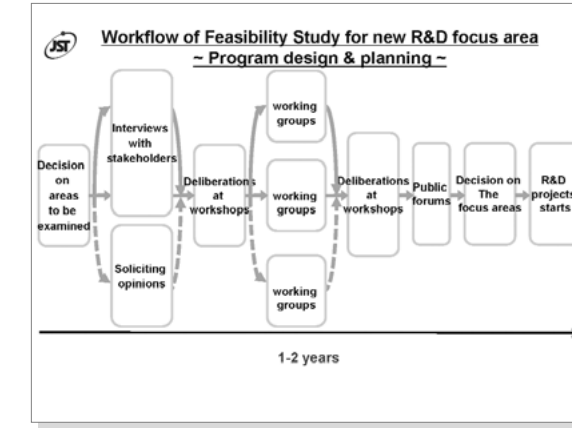
- Grip comprehensive various social issues
- Close communication with stakeholders

(implement R&D)

- Hands-on approach
- Collaboration of social and natural sciences
- Pursuit PDCA cycle intensively

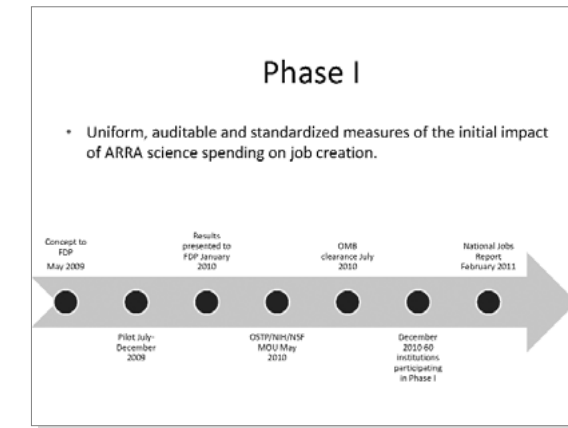
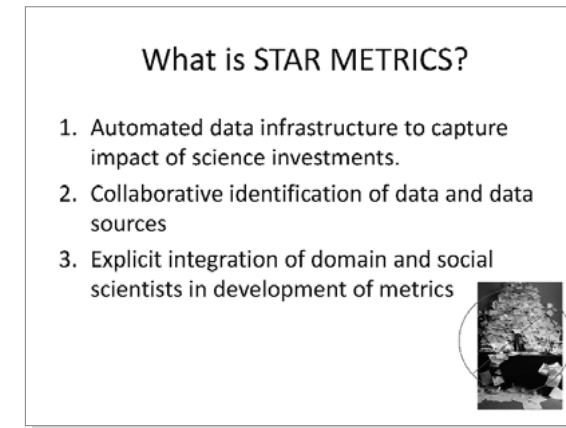
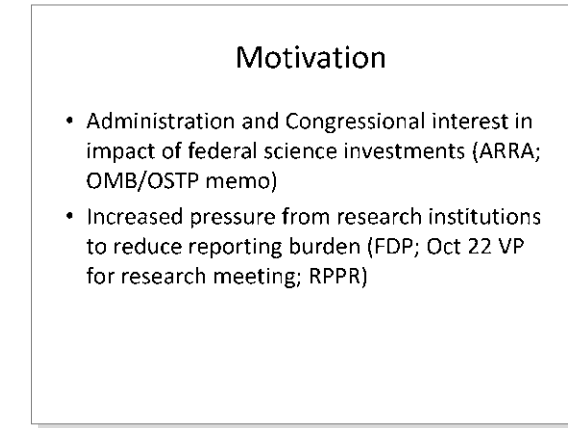
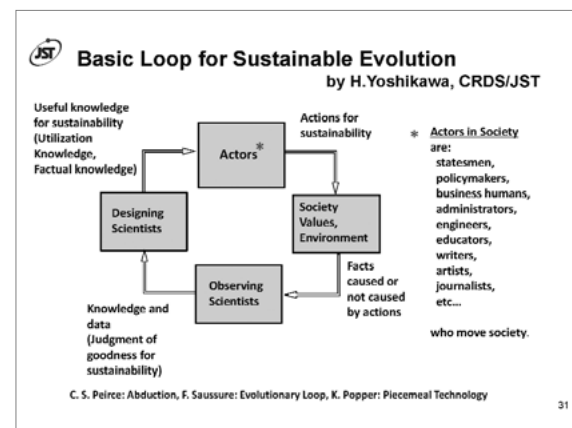
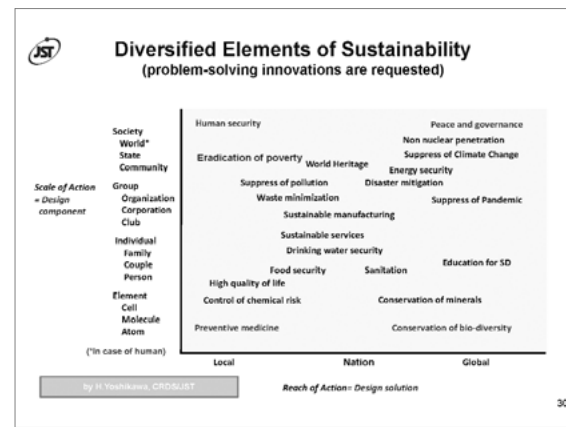
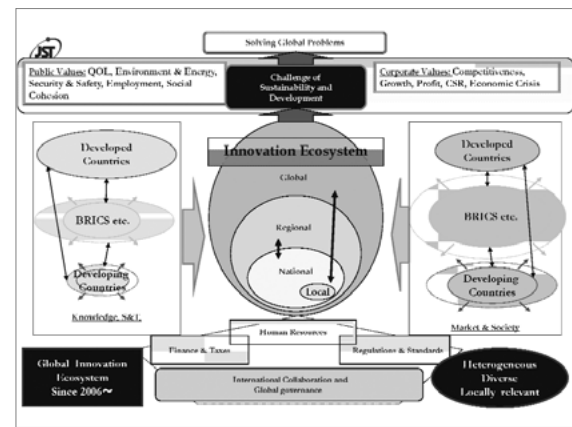
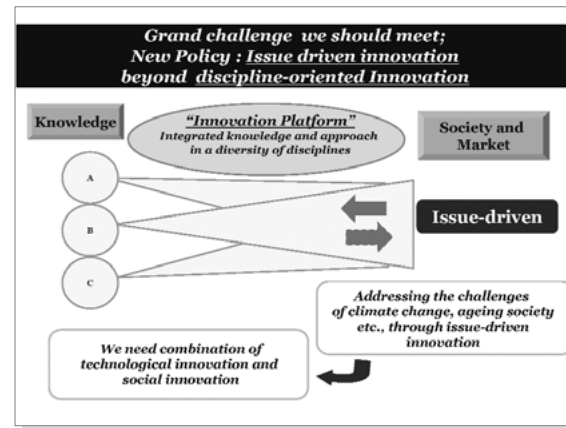
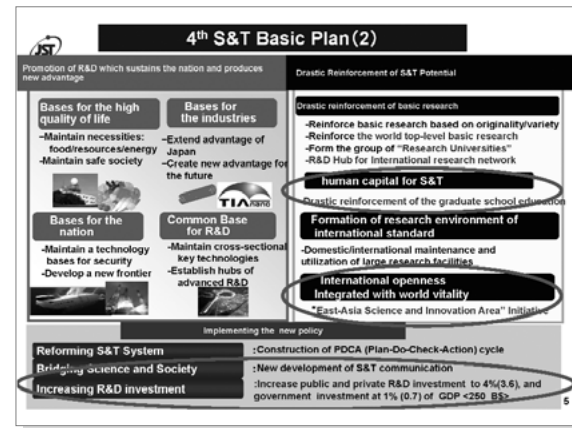
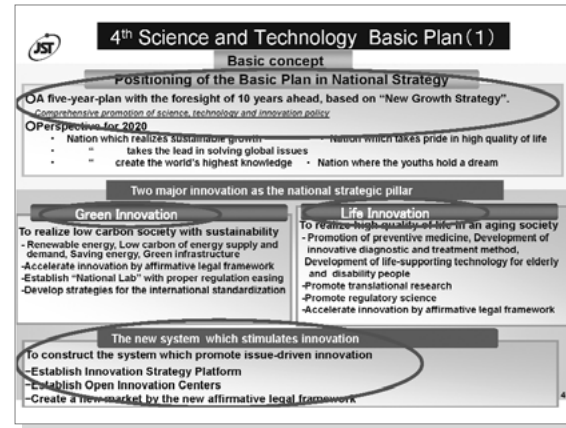
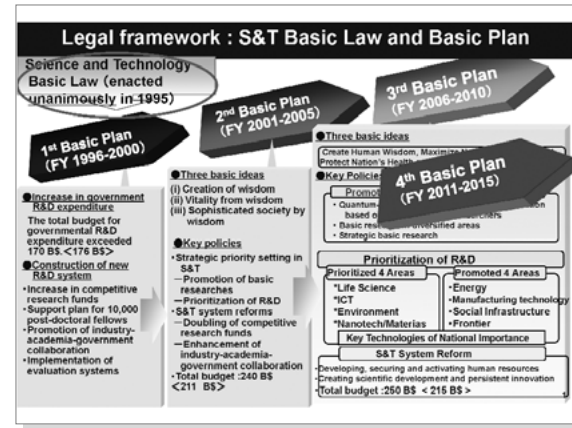
(application for outcome-conscious, outcome-oriented)

- Engage in output to Society



Science of Science Assessment

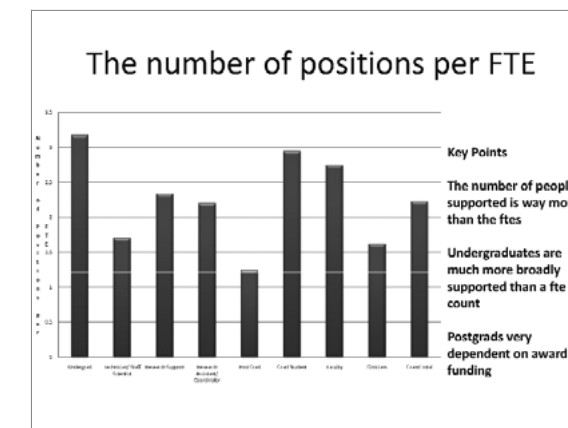
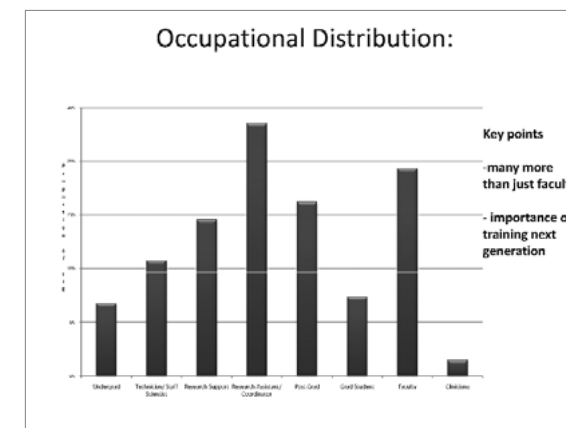
Julia Lane and Stefano Bertuzzi

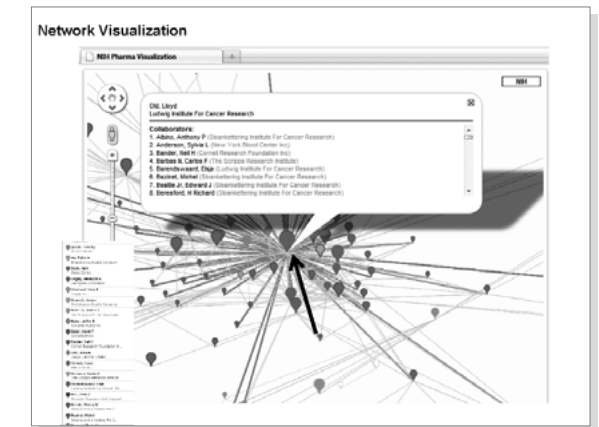
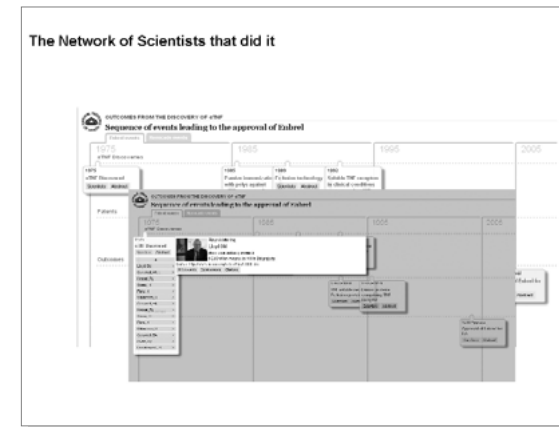
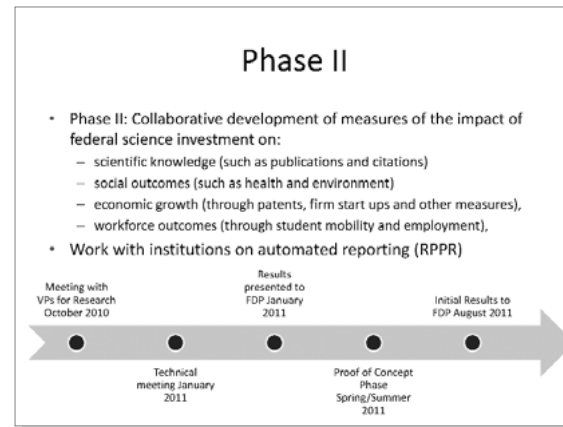
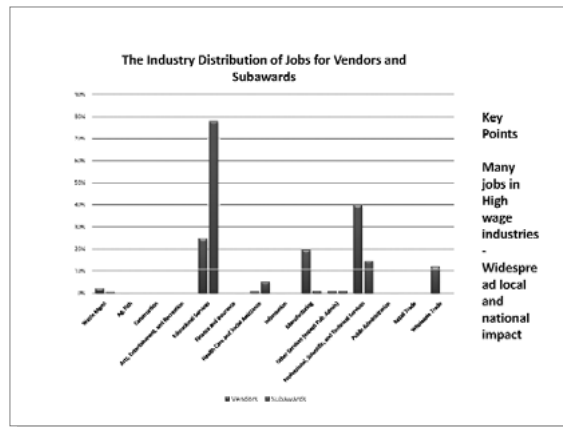


Initial Results of Jobs Report

Table 1:

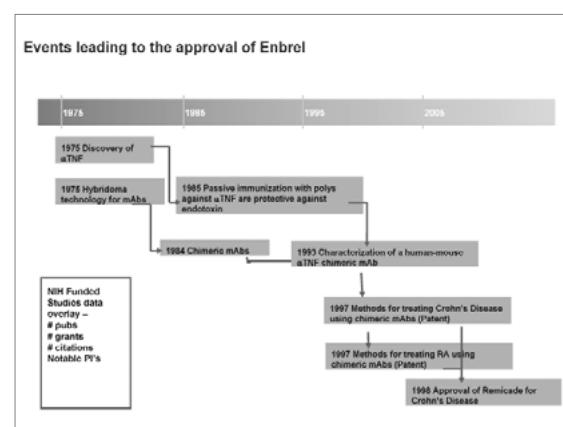
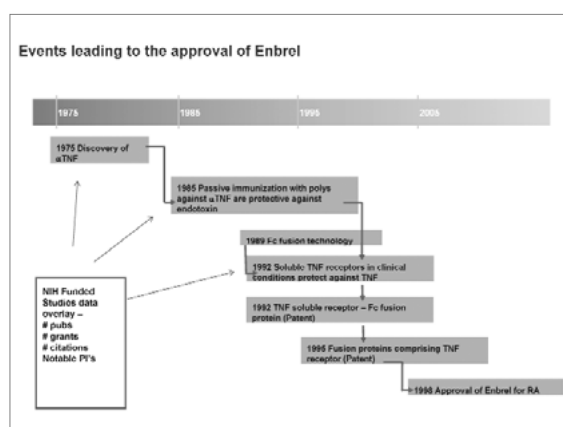
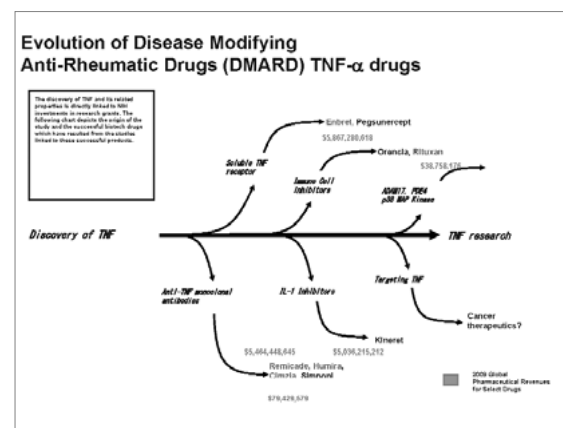
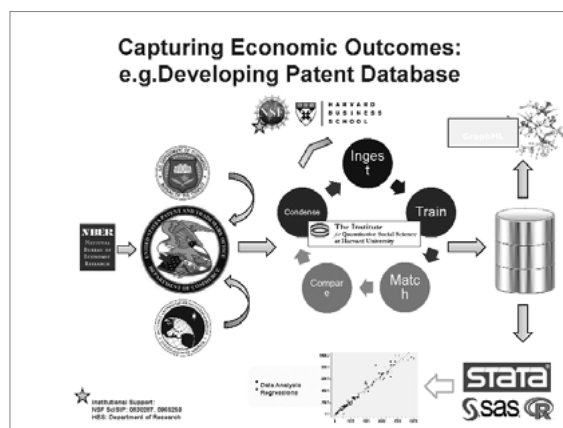
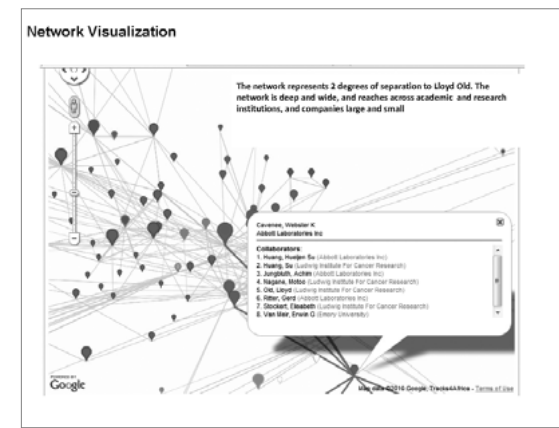
	Totals
NIH & NSF Est. Award	\$1,129,275,890
\$ Expenditures	
Number of awards	12,279
Total FTE Jobs supported by reporting universities	49,825.5
- Direct Payroll Charges	20,213
- Jobs from Vendors, Subcontracts and Institutional Support	29,612
FTE Jobs per award	4.06
Jobs per million dollars expended	44.12





- Goals of Proof of Concept**
- Identification of the policy and technical issues to be addressed in the development of tools to automatically capture the outputs of science investments (link to RPPR)
 - Development of a short run and long run implementation strategy
 - Development of a working document that can be used for the basis of discussions with national and international counterparts.

- Opportunity**
- Research Performance Progress Report (Research Business Models subcommittee)
 - New tools and platforms (Vivo, Lattes etc)
 - Interest in common and persistent identifiers



Governance in Science and Technology: citizen participation and social innovation

Johan Evers and Robby Berloznik

IST
 Instituut Samenleving & Technologie
GOVERNANCE IN SCIENCE AND TECHNOLOGY
 Citizens' engagement for social innovation?
 AAAS conference
 February 20, 2011
 Washington DC

ROBBY BERLOZNIK
 DIRECTOR IST

DR. JOHAN EVERS
 SENIOR PROJECT MANAGER IST

Outline

- Setting the stage
- What do we do?
- Citizens' participation and governance: some considerations

Participatory TA

WHAT DO WE DO?

SETTING THE STAGE

Technology assessment

Technology assessment is a scientific, interactive and communicative process which aims to contribute to the formation of public and political opinion on societal aspects of science and technology (Decker & Ladikas, 2004)

Forecasting developments → Assessing mutual impact
 Product → Process

Selection of IST projects

2002 GMO Food in Flanders	2008 CRISTI	2009 World Wide Views on climate change
2004 ICT and Elderly	2008 Flamish energy system 2050	2009 Smart grid
2005 Meetings of Minds - the future of brain sciences	2008 Youth and gaming	2009 Biofuels
2007 Poverty and Technology	2008 Road traffic and health	2010 Digital exclusion
		2010 Intelligent transport systems
		2010 Fertility: beyond the technology
		2010 Awards and ICT festival

Methodologies

- Theatre plays
- Focus groups
- Technology festival
- Awards
- Delphi methodology
- Scenario workshops
- Lectures
- Expositions
- Citizens' Convention/ Town hall meeting
- Consensus conference
- Didactical packages for scholars
- ...
- Participation toolkit

Technology assessment in the context of policy making

EPTA -members

- Catalonia (Spain)
- Flanders (Belgium)
- Finland
- France
- Germany
- Greece
- Italy
- Netherlands
- Norway
- Sweden
- Switzerland
- United Kingdom

EPTA-associates:

- Austria
- Council of Europe
- Poland
- USA

Parliamentary Technology Assessment (PTA)

Need for independent and societal assessments of S&T in decision making

Specific policy context: informing & advising parliaments

Parliament as 'chambres de reflexion'

Specific research context

Problem-driven, multidisciplinary research

Specific approach: strongly participative

Practical attitude

CITIZENS' PARTICIPATION AND GOVERNANCE: SOME CONSIDERATIONS

TA & Governance?

Governance means making systematic use of the richness of societal diversity, (re)order it, and define its boundaries in iterative governing interactions. (Kooiman, 2003:196)

TA aims to produce **better technology in a better society**, and emphasises the early involvement of a broad array of actors to facilitate social learning about technology and potential impacts. (Genus, 2006: 13)

Common goal:
 increase the democratic quality of decision-making on science and technology through participatory procedures

Some guiding principles in PTA

- Client-oriented
- Problem-driven rather than technology driven
- Constructive logic rather than acceptance logic
- Prospective and anticipatory rather than evaluative (*ex ante* rather than *ex post* or *ex durante*)

Modes of PTA

Instrumental

- Social science and policy analysis approaches
- Main customer = parliament or parliamentary committees

Discursive

- Deliberative processes
 - Experts, stakeholders and with lay-people
 - "Enlighten parliament" (and governmental) decision-making
 - Foster societal debate

Why public participation?
 To articulate societal preferences
 To make societal interests explicit

Resistance to public participation

- Validity of knowledge
 - Not scientific – status of lay knowledge?
 - Not representative – how to select citizens?
- Primacy of politics
 - representative versus deliberative democracy
- Cost-benefit:
 - time consuming
 - (social) return on investment
 - impact?

Evaluation criteria for public participation in governance

Inclusiveness	Comprehensiveness	Fairness/respect
Social learning	Consensual decision-making	Balancing consensus and dissent
Legitimacy	Process design	...

Conclusions



Public participation as developed in TA has a potential of being a source of inspiration for:

1. public governance that enable the political system to increase the democratic quality of decision-making;
2. S&T governance that enables the R&D system to identify and develop social innovation where societal demands and needs influence the direction of R&D and the design of innovative products, processes and services



THANK YOU!

WWW.SAMENLEVINGENTECHNOLOGIE.BE

JOHAN.EVERS@VLAAMSPARLEMENT.BE



Mass Localism: a way to help small communities solve big social challenges

Laura Bunt

Mass Localism

A way to help small communities respond to big social challenges

20th February 2011

Laura Bunt, Policy Advisor, Public & Social Innovation

NESTA

NESTA – brief introduction

- NESTA is the UK National Endowment for Science Technology and the Arts
- A public endowment to promote innovation in the UK
- We focus on innovation in public and private sectors
- Through a combination of practical and research work – eg the Public Services Innovation Lab

NESTA



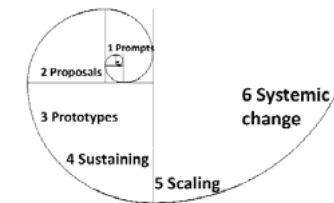
NESTA

Challenge for innovation?



NESTA

Social innovation is different



NESTA



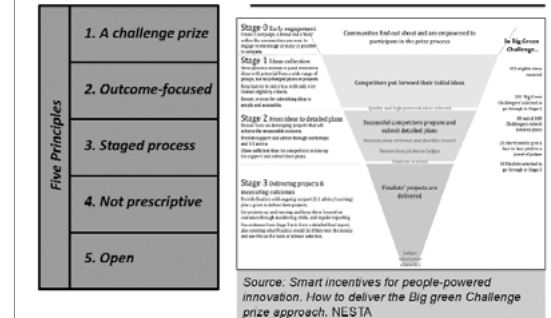
NESTA

“A £1 million innovation prize for community-led responses to climate change.”



NESTA

The staged process of the Big Green Challenge



NESTA



10 finalists
4 winners



...THE GREEN VALLEYS

NESTA

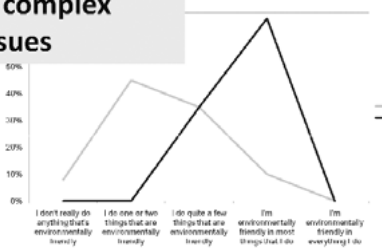
At least 10-46% reduction on baseline in the BGC year

At least 4860 t Co₂yr* in future years

*CO₂ reductions in the Big Green Challenge year were monitored by Cited on behalf of NESTA. This data provides a conservative estimate of reductions achieved by finalists across the Big Green Challenge year. The emissions reductions achieved, now and in the future, may well be higher than the reductions reported here.

NESTA

BGC changed behaviour – key to tackling complex social issues



NESTA

Mass Localism:

How government can support more widespread, local innovation and achieve impact at scale


NESTA

Mass Localism: principles

- Inspire challenge - promote a clear, measurable outcome
- Presume capacity to innovate
- Support and finance - challenge and advice as valuable as cash
- Remove barriers to participation
- Reward outcomes, not activity

NESTA

Mass local innovation?



NESTA

NESTA's work

Practical: The Big Green Challenge, Neighbourhood Challenge, Make It Local, 100% Open - Corporate open innovation challenges

Policy & Research: Mass Localism, Big Green Challenge evaluations, Social Challenge Prize Guide, Buying Power: SBRI health-check

NESTA

Socio-technical Routes Necessary for Saving the Society from Energy/Environment Crises

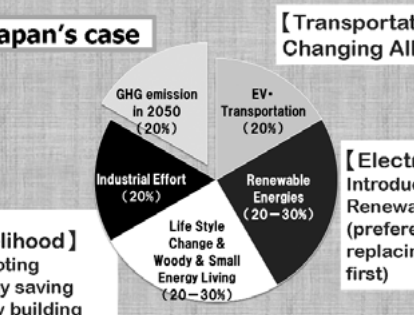
Masayuki Horio
JST-RISTEX R&D Area Director
Professor, Ryukoku University
Professor, Em., Tokyo Univ. A & T

To Make the World GHG Emission 50% from 1990 value w/ equal rights and w/ Japanese technical standard
Developed Countries ought to reduce by ~80%

Countries	Energy Consumption		CO ₂ Emissions		If CO ₂ emissions in half of 1990 and the standard of consumption and emission is based on Japanese per Capita Equivalent for 2000	
	1990	2000	1990	2000	Oil Equivalent Energy Consumption (MtCO ₂ e)	CO ₂ Emissions (MtCO ₂)
Japan	43.7	52.4	29.0	32.5	97	60
USA	192.8	230.4	116.8	133.9	72.3	21.5
Canada	20.8	25.1	12.7	11.7	7.8	2.5
UK	24.2	23.1	24.2	16.1	15.0	4.5
Germany	35.6	34.3	33.9	26.6	23.1	6.3
France	22.7	29.7	24.3	10.9	10.2	4.5
Italy	15.3	17.2	23.8	11.1	12.0	4.4
OECD Total	451.7	531.6	466.1	307.3	346.3	289.1
China	67.0	92.8	517.9	666	88.1	32.12
India	1.99	3.9	444.8	1.55	2.68	25.46
Indonesia	5.6	10.2	95.1	4.1	7.3	5.44
Brazil	4.45	21.6	7.8	5.8	9.2	4.45
Russia & NISs	153.7	102.8	127.8	102.4	63.2	73.0
Kenya	3	4	13.5	2	2	7.7
Africa total	23.8	30.3	334.4	19.4	2.38	20.28
World Total	778.7	904.2	2469.6	570.7	640.7	1544.1

GHG Minus 80% is not Impossible

Japan's case



EV-Transportation (20%)
Renewable Energies (20-30%)
Life Style Change & Woody & Small Energy Living (20-30%)
Industrial Effort (20%)
[Livelihood] Promoting Energy saving woody building

NESTA

Climate Skepticism & Denial in US

Risk Communication & Enlightenment Insufficient?

Belief/Nostalgia as the Hydrocarbon Frontier

Huge Changes & potential Losses in Businesses

Slow & Inefficient Actions in Japan has to change.

Ministry of Internal Affairs and Communications (MIC) just recently published a Report with Admonition to Biomass Projects over the last 8 yrs.

For 112 Projects having some quantitative data; GHGs balance: 440kt/y increase! (reduction 260, emission 700kt/y)

Design Approaches for Social Innovation

Engineers & Scientists: Designing Institutional Systems in Technical Innovation

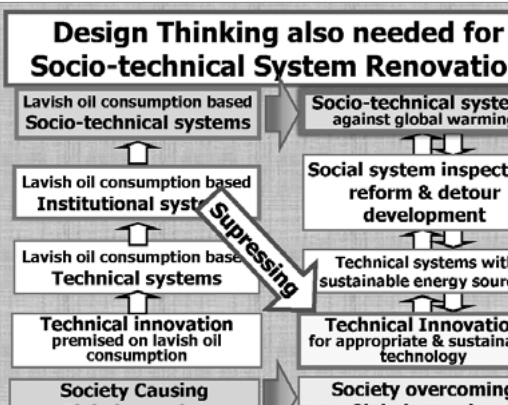
Academia, Consultants, Local Government & NPO: From Analytical & Enlightenment Approach to Collaborative Design Approach

Local Government: Design Thinking needed Green Reconstruction of the Local Techno-social system

Project Planners: Design Thinking needed to Integrate Issues for Comprehensive Solution

Distributor & Consumer Activists: Design Thinking needed to Make Supply Chain Green

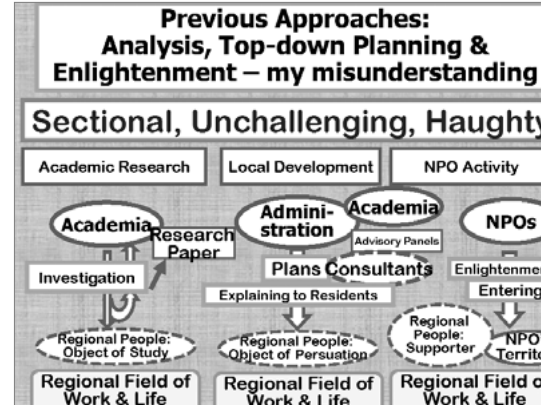
Design Thinking also needed for Socio-technical System Renovation



NESTA

Previous Approaches: Analysis, Top-down Planning & Enlightenment – my misunderstanding

Sectional, Unchallenging, Haughty



For 80% Reduction Design Thinking from the very Field of Regional Work & Life is needed

Collaborating, Challenging, Sharing

Future Image and Survival Strategies of Regional People

Policies for the future

Academia Regional Field of Work & Life Government NPO

Fossil-based Modernization: Local People remained in Passive Attitude

State Gov. Common Ideal Governance Modernization

Industries Machines & equipments

Public System Municipal city controlled

Layer of norm

Layer of techno-social system

Layer of local community

Poor collaboration with local community

Incomplete both technically & functionally

Local Community

Outline of Our R&D Program

Period: 2008-2013

Categories:

I: Fundamental R&D <<¥10M/y

II: w/ Social Experiments <¥30M/y

Applicants are requested to

- 1) organize collaborations among social/humanity and natural/engineering sciences,
- 2) organize collaborations among academia, local government, citizens and other stakeholders
- 3) submit a unique proposal with sociotechnical scenario,
- 4) submit a quantitative estimation of GHG reduction effect of the proposal

The program tackles the issues of:,,,

1. Trans-sectoral cooperation-both in government and academia
2. Equal partnership among local people, government, industry and academia
3. Appropriate technical challenges harmonized with social actions
4. Practical and profitable approaches Rather than qualitative, ethical and enlightening approaches
5. Trans-sectoral & regional target settings

Green Reconstruction of the Modern: Active Design Thinking needed

Common Target Sustainable Earth

Public Sustainable Technical System

Leadership & Lubrication needed

Layer of norm

Layer of techno-social system

Layer of Integrated Govern Community

Resources Society Environment

Energy/Environment Crises Need Measures able to Bind up Multiple Issues

Bio-Diversity Neo-natural Landscape Tackling Oil Price Soaring Country Side invigoration New Job Creation Climate Change Mitigation

Projects distributed nationwide

1. Development of Techniques and Theories for the Integrated Restoration and Revitalization of Local Commons
2. Unified Commercialization Policy for Utilizing Local Renewables and Local Finances through Inter-Regional Cooperation
3. To establish Regional Community System that Exits from Inducing Global Warming through Introducing Micro Hydro power
4. Proposing a Scenario and Road Map to realize a Nature Friendly Society Model for the Sustainable Shiga
5. Development of the Method of Evidence-based Analysis for Regional Sustainability in Economy and Environment
6. Construction of the Town of Kiryu for the Future with Anti-Global-Warming through the Regional Power
7. Forest and City Linage for Sustainable utilization of Wood and Biomass
8. Feasibility Study of the Eco-service Business Model using Eco-point system
9. De-'global warming' through inducing voluntary actions in Bunkyo-ku, Tokyo
10. Sustainable Intermediate/Mountainous Region Development via Eco-Mobility
11. Creating a Low-Carbon Production, Retail & Shopping System for Nagoya
12. Education and Utilization of Local Public Human Resources for Local Renewable Energy System Development
13. Greening Model Development for Existing Urban Area
14. Local full participation System Development for Promoting MU-Turn Settlements and Local Business Creation
15. B-Style: Local Resource based Sustainable Settlement Development

Developing Methodologies to make GHG Reduction Scenario affordable

Mass-Energy Scenario for GHG reduction 00t/yr

Technical scenario development not accommodating the present social system

Social coefficient (0~1) Social system reform plan, human resource raising, acceleration of realization rate

Social and temporal scenario

- System inspection
- Policy development
- Consensus development
- Human resource and governance development

Real reduction potential ΔΔ t/yr

How to Quantify & Design Social Issues relevant of GHG Reduction Scenario

Mass-Energy Scenario for GHG reduction 00t/yr

Technical scenario development not accommodating the present social system

Social coefficient (0~1) Social system reform plan, human resource raising, acceleration of realization rate

Social and temporal scenario

- System inspection
- Policy development
- Consensus development
- Human resource and governance development

Real reduction potential ΔΔ t/yr

Conducting Social Experiments New Approach is also needed

Social Experiment of the 1st Kind: Social Experiments conducted by a Definite Steering and Observing Group to Examine Collective Effect of Introducing New Technical Parts or Institutional Rules

Social Experiment of the 2nd Kind: Social Experiments conducted by Community based Steering and Observing Group for Their own Empowerment; Conductor=Object=Observer

New role of Engineering Faculty in Local City, Kiryu

City Government School of Engineering Gunma Univ. Public Transportation Companies

City of Kiryu Framework Agreement Graduate School Engineering

Gunma Pref. Forest Res. 東武鉄道 上毛電鉄 わたらせ渓谷鐵道

Local Media 三洋電機 富士重工 大塚製薬

News Paper, FM Stn. 朝日新聞 山田製作所

Private Companies 朝日新聞 山田製作所

Local Elementary and Jr High Schools (160000 Pupils) 生活協同組合 Commerce & Ind. Assoc.

Education Borad

Next Gen. Eco-Energy Soc. Next Gen. EV Research Soc.

Local full participation System Development for Promoting MU-Turn Settlements and Local Business Creation

B-Style: Local Resource based Sustainable Settlement Development

Their Original EV Development is now leading JST's Low Speed EV Community Bus Development

Their original in-wheel motor will be used for 8 wheel community bus

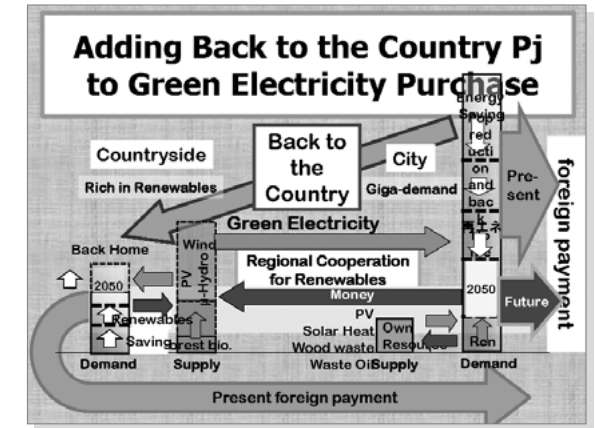
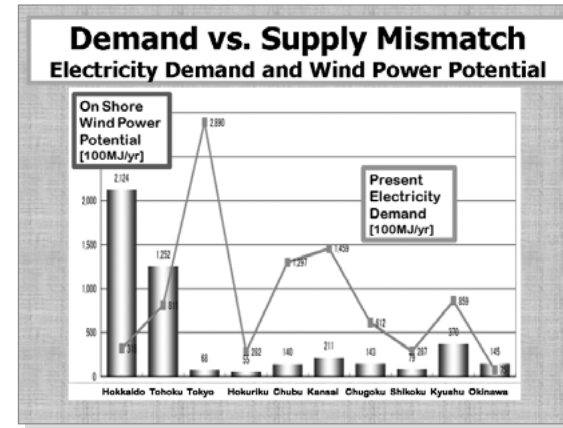
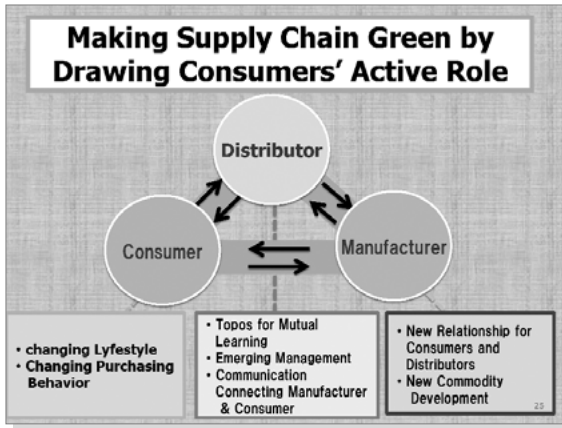
Additional Contents

1. What are we developing at JST-RISTEX?
2. Why Socio-technical and Inter-sectoral Collaboration Scenario Development is needed?

1. What are we developing at JST-RISTEX

Cultural Biomass Utilization

City Exploration by Citizens & Students



Issues associated with Green Electricity Purchase by Mega-cities

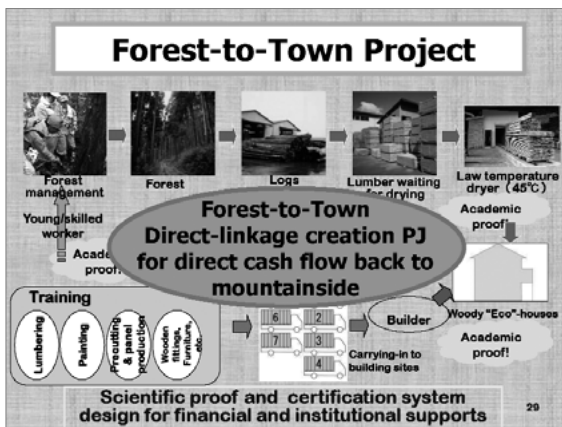
- Transmission Line Capacity Limit
- National Land Planning and Utilization of Local Potential necessary
- Overcrowded Urban Lifestyle should be improved.

Urban-countryside population exchange should also be formulated in terms of its GHG reduction effect

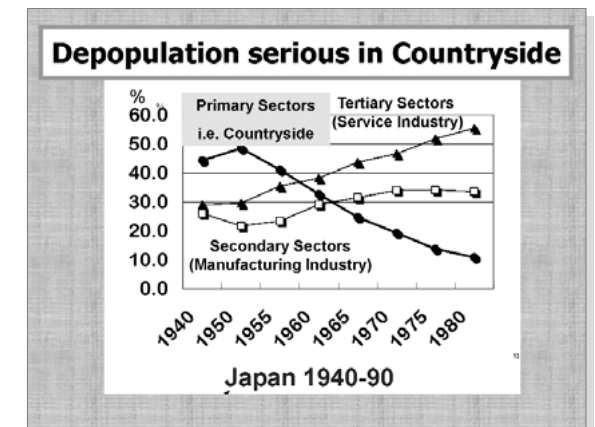
$$\text{Real reduction t-CO}_2/\text{yr} = \text{Countryside population increase} \times \text{Urban-countryside difference in per capita GHG emission}$$

Effect of population transfer

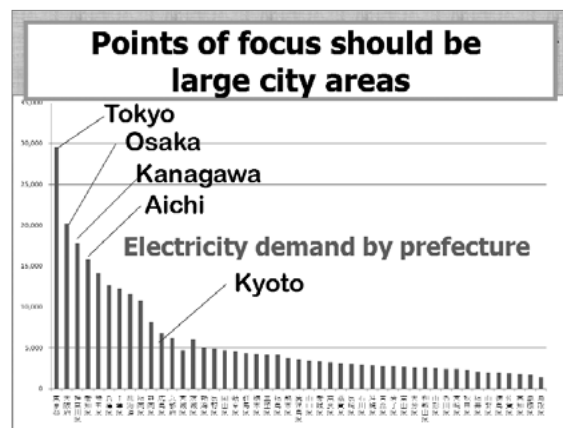
- + On site reduction effort
- + CO2 adsorption activity including forest management and nature restoration



How effective is the 'Back to the Country' in Japan?



2. Why Socio-technical and Inter-sectoral Collaboration Scenario Development is needed?



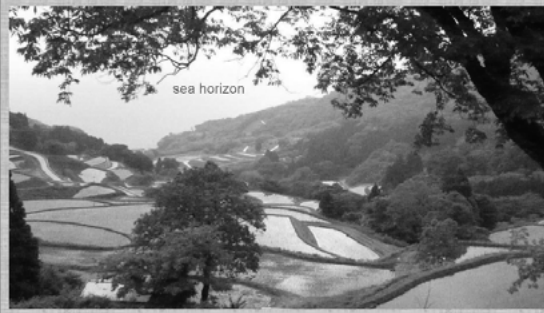
'Back to the Country' Background in Japan

- Much Improvements in Transportation & Communication Systems
- Cities and Villages are rather close
- Departure from previous policies:
 1. Dependent counteraction against de-population
 2. 'New Industrial City' program, a simple industrialization model

Japan's high micro-hydro potential comes from its high precipitation and steep and short rivers.

Country	Land Area (A)	Coast Line Length (C)	Ac. distance to coast (D)	Yearly Precipitation (E)	Highest Peak (F)	Mountain (G)
1 Micronesia	703	6,113	6706.6	0.2	745	Mt. Dulaan
2 Palau	459	1,549	3316.6	0.6	378	Mt. Dermal
3 Maldives	300	544	2136.7	0.9	193	Mt. Velidhoo
4 Timor	147	83.2	223.5	2.6	28	
20 Norway	324,220	83,225	426.9	7.0	763	Mt. Galdhøpiggen
28 Denmark	42,384	7,314	172.5	11.6	615	Mt. Hemmelberg
32 Philippines	298,174	30,200	121.7	18.4	1215	Mt. Apo
33 Greece	130,800	14,880	113.8	17.0	371	Mt. Olympus
36 Japan	374,744	20,750	79.4	25.2	1496	Mt. Fuji
43 New Zealand	268,680	15,134	56.3	56.5	1520	Aoraki/Mt. Cook
44 UK	241,980	12,428	51.4	38.9	758	Mt. Ben Nevis
52 Indonesia	1,826,490	54,716	30.0	66.8	1507	Mt. Rinjani/Lombok
55 Italy	294,020	7,500	28.3	77.4	944	Mt. Blanc
57 South Korea	98,190	2,418	24.0	61.4	1271	Mt. Halla
58 Canada	9,220,970	202,080	21.9	91.3	696	Mt. Atlas
61 Thailand	513,900	1,441	21.0	18.2	701	
62 Malawi	300,500	4,775	40.0	120.0	4005	Mt. Kinshasa
72 Holland	33,883	451	13.3	100.3	700	
76 Vietnam	325,300	3,444	10.6	168.9	3143	Fanxipan
78 Spain	499,542	4,904	9.9	201.3	456	
86 Sweden	410,034	3,218	7.8	255.4	209	Kotnuksaito
90 Germany	349,221	2,389	6.8	202.4	988	Zugspitze
93 France	545,830	3,427	6.3	318.4	850	MontBlanc
105 Finland	305,470	1,124	3.7	642.0	651	
109 Australia	7,617,930	25,760	3.4	591.5	1304	
119 India	2,973,190	7,600	2.4	848.0	2168	
124 Russia	16,995,800	37,853	2.2	600.9	691	
126 USA	9,158,900	18,924	2.2	916.5	1201	Mt. McKinley
134 China	9,326,410	14,500	1.6	1286.2	8850	Mt. Everest (Precip. Data Shanghai)

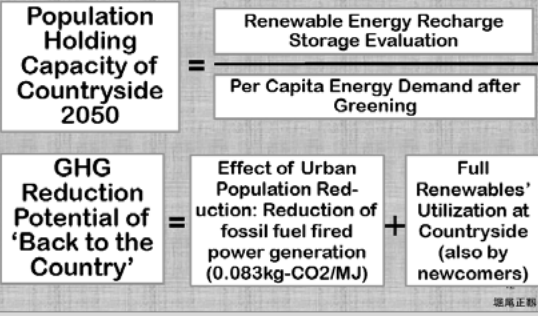
Well developed Farm Irrigation & the steep Mountain-to-Coast Water Flow



Sado-Iwakubi district 2010

Simple Evaluation: 'Back to the Country'

by Horio & Hidaka (2011)



Population and Renewable's Potential

by Horio & Hidaka (2011)

Households and population in different regions (2005)			
	Households	Households	
		number	population
Urban region	80.5%	39,495,337	100,603,432
Flat Farming region	8.6%	4,219,378	10,747,696
Intermediate Farming region	7.9%	3,875,940	9,872,883
Mountainous farming region	3.0%	1,471,876	3,749,196
Total	100.0%	49,062,530	124,973,207

Recharge Storage of Renewables			
Undeveloped Renewables	Heat (GJ/yr)	Electricity (GJ/yr)	
		(kWh/yr)	(GJ/yr)
Wood biomass	121,317,808	6,037,715,712	21,735,777
Hydro	-	44,779,636,000	161,206,890
Geotherm	-	19,090,000,000	68,508,000
Wind (on shore)	-	12,264,000,000	44,150,400

GHG Reduction Potential

by Horio & Hidaka (2011)

Present GHG emission			Total (t-CO2/yr)
Urban Region	Flat Farming Region	Intermediate & Mountainous Farming Region (Country)	
192,927,760	20,610,916	26,123,139	239,661,815
CO2 Emission Reduction by Countryside Greening and Back to the Country' Action			101,403,139
Present Country' Greening	Urban CO2 Reduction by back to the Country'		
26,123,139	75,280,000		
% CO2 Emission Reduction			42 (%)

Busy Countryside Contributes GHG Reduction

by Horio & Hidaka (2011)

Case	Population (Million)	
	Intermediate & Mountainous Farming Region (Country)	Urban & Flat Farming Regions
Present	12	108
BAU 2050	9	81
Case 'Back to the Country' 2050	24	66

Thank you very much for your attention!

Comments are appreciated.
Please forward them to
myhorio06@ca.wakwak.com



Annual Meeting

ARCHIVE: 17-21 February 2011 • Washington, DC



Science Without Borders

The increasing complexity of problems facing our nation as well as our planet offers immense challenges for coordinated, innovative problem-solving. So many important decisions on national security, education, health, sustainability of the planet, and the exploration of the universe depend on new-found knowledge gained by scientists and engineers. Expectations that science and technology will rise to these challenges are widely expected.

Many of these problems require an approach across several disciplines and areas of technical expertise. A diverse work force will also be necessary so that maximal talent and different approaches can be utilized. To train such a work force successfully presents the challenge of attracting talent from a range of backgrounds and transmitting content while maintaining relevance.

The theme — *Science Without Borders* — integrates the practice of science, both in research and teaching, that utilizes multidisciplinary approaches. It also takes into consideration the diversity of investigators and students.

The program will highlight science and teaching that cross conventional borders or break out from silos as well as ground-breaking areas of research, new and exciting developments, and cross-cutting activities in support of science, technology, and education. Sessions will feature strong scientific content to illustrate the interface of different disciplines and will exemplify a multidisciplinary approach to problem solving.

About AAAS

AAAS is the world's largest general scientific society, and publisher of the journal, *Science* as well as *Science Translational Medicine* and *Science Signaling*. AAAS was founded in 1848, and includes some 262 affiliated societies and academies of science, serving 10 million individuals. *Science* has the largest paid circulation of any peer-reviewed general science journal in the world, with an estimated total readership of 1 million. The non-profit AAAS is open to all and fulfills its mission to "advance science and serve society" through initiatives in science policy; international programs; science education; and more. For the latest research news, log onto [EurekAlert!](#), the premier science-news Web site, a service of AAAS.

Annual Meeting

ARCHIVE: 17-21 February 2011 • Washington, DC



President's Invitation

The Annual Meeting is one of the most widely recognized pan-science events, with hundreds of networking opportunities and broad global media coverage. An exceptional array of speakers will gather at the 2011 AAAS Annual Meeting from 17-21 February in Washington, D.C.

The meeting's theme—*Science Without Borders*—integrates interdisciplinary science, both across research and teaching, that utilizes diverse approaches as well as the diversity of its practitioners. The program will highlight science and teaching that cross conventional borders or break out from silos, especially in ground-breaking areas of research that highlight new and exciting developments in support of science, technology, and education. Sessions will feature strong scientific content to illustrate the interface of different disciplines or will exemplify a multidisciplinary approach to problem solving.

Everyone is welcome at the AAAS Annual Meeting. Those who join us will have the opportunity to choose among a broad range of activities, including plenary and topical lectures by some of the world's leading scientists and engineers, multidisciplinary symposia, cutting-edge seminars, career development workshops, and an international exhibition.

The Annual Meeting reflects tremendous efforts from the AAAS sections, divisions, and committees, which I gratefully acknowledge. I also extend a personal thanks to the members of the Scientific Program Committee who are tasked with assembling and choosing among many excellent ideas and proposals into this outstanding meeting.

I urge you to join us in Washington, D.C.

Dr. Alice S. Huang, AAAS President and Senior Faculty Associate in Biology, California Institute of Technology



Alice S. Huang, Ph.D.

Alice S. Huang, Ph.D. is the AAAS President and Senior Faculty Associate in Biology, California Institute of Technology.

PRELIMINARY PRESS PROGRAM

Join Us in
Washington, D.C. for Science and Fun

Cover symposia on the implications of finding other worlds, the next steps in brain-computer interfaces, frontiers in chemistry, the next big solar storm, and more. Talk to leaders in science, technology, engineering, education, and policy-making. Gather story ideas for the year ahead. Mingle with colleagues at receptions and social events. It's all available at the world's largest interdisciplinary science forum.

2011 AAAS Annual Meeting
Science Without Borders
17–21 February, Washington, D.C.



CURRENT AS OF 1 NOVEMBER 2010



2011 AAAS Annual Meeting
Science Without Borders



Dear Colleagues,

On behalf of the AAAS Board of Directors, it is my distinct honor to invite you to the 177th Meeting of the American Association for the Advancement of Science (AAAS).

The Annual Meeting is one of the most widely recognized pan-science events, with hundreds of networking opportunities and broad global media coverage. An exceptional array of speakers and attendees will gather at the Walter E. Washington Convention Center in Washington, D.C. **You will have the opportunity to interact with scientists, engineers, educators, and policy-makers who will present the latest thinking and developments in their areas of expertise.**

The meeting's theme — **Science Without Borders** — integrates interdisciplinary science, across both research and teaching, that utilizes diverse approaches as well as the diversity of its practitioners. The program will highlight science and teaching that cross conventional borders or break out from silos, especially in ground-breaking areas of research that highlight new and exciting developments in support of science, technology, and education. Sessions will feature strong scientific content to illustrate the interface of different disciplines or will exemplify a multidisciplinary approach to problem solving.

Everyone is welcome at the AAAS Annual Meeting. Those who join us will have the opportunity to choose among a broad range of activities, including plenary and topical lectures by some of the world's leading scientists and engineers, multidisciplinary symposia, cutting-edge seminars, career development workshops, and an international exhibition.

The following pages present the highlights of the scientific program to date. You can explore the program online, obtain updates, and develop a personal itinerary at www.aaas.org/meetings. **To register online** and obtain more information about the Newsroom, visit www.eurekaalert.org/aaasnewsroom.

I look forward to welcoming you in Washington, D.C.

Alice S. Huang, Ph.D., AAAS President and
Senior Faculty Associate in Biology,
California Institute of Technology

AAAS ANNUAL MEETING | 17–21 February 2011 | Washington, D.C.

AAAS Annual Meeting Newsroom

Useful Information

The AAAS Annual Meeting Newsroom, located in Room 204A on the Second Level of the Washington Convention Center, will provide an array of news opportunities and resources to news reporters and career science communicators who, with appropriate credentials, are eligible for complimentary meeting registration.

News briefings during the meeting will offer newsroom registrants access to some of the world's leading scientists. You are strongly encouraged to register in advance via our online registration site: www.eurekalert.org/aaasnewsroom. Credentialing criteria and other newsroom information are available via the "Newsroom Links" section of that site.

PLEASE NOTE FOR PLANNING PURPOSES:

AAAS news briefings and interview opportunities will begin on the morning of Thursday, 17 February, starting with the AAAS President's Press Breakfast.

Virtual Newsroom

EurekAlert! will host the Annual Meeting's virtual newsroom: <http://www.eurekalert.org/aaasnewsroom>.

The schedule of news briefings will be available to newsroom registrants upon their arrival at the meeting. The schedule also will be available online at the virtual newsroom beginning Monday, 14 February, to reporters who have log-in access to the embargoed section of the EurekAlert! Web site.

You may browse for the latest information on symposia at the main Annual Meeting Web site (www.aaas.org/meetings) using the "Browse the Program" link.

Embargo Policy

AAAS Annual Meeting newsroom registrants are required to observe news embargoes, which coincide with the date and time of the scientific session or a related news briefing, whichever comes first. AAAS will schedule daily news briefings on research and policy issues being discussed at the meeting. Attendance at news briefings is restricted to newsroom registrants.

A Note to Public Information Officers

Once again, we will be using the AAAS Annual Meeting Speaker Paper Recruitment System to ask speakers and their public information officers (PIOs) to submit information about presentations and upload supporting materials to our virtual newsroom.

Speakers and PIOs will receive instructions by e-mail on how to use the system. Reporters registered for the embargoed section of EurekAlert! will be able to gain access to speaker materials submitted to the virtual newsroom. Speaker papers also will be available on site at our AAAS Papers Room for the news media.

A Special Invitation

AAAS will host a reception at the Smithsonian's National Museum of the American Indian for all newsroom registrants to honor the winners of the 2010 AAAS Kavli Science Journalism Awards, endowed by The Kavli Foundation. Shuttle buses will be provided from the Washington Convention Center beginning at 6:45 PM.

When: Friday, 18 February ▶ Time: 7:00PM–10:00PM

Newsroom Badge Required



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 THE KAVLI FOUNDATION
 AAAS
ADVANCING SCIENCE. SERVING SOCIETY.

Daily Timetable

17 THURSDAY	18 FRIDAY	19 SATURDAY	20 SUNDAY	21 MONDAY
Daytime Newsroom Registration 7:00AM–5:00PM Washington Convention Center Level Two, Room 204A AAAS President's Breakfast and Briefing 7:45AM–8:30AM Washington Convention Center Level Two, Room 202A Forum for Sustainability Science Programs 1:00PM–6:00PM Grand Hyatt Washington	Daytime Newsroom Registration 7:30AM–5:00PM Washington Convention Center Level Two, Room 204A European Commission Breakfast 7:45 AM–9:00AM Washington Convention Center Level Two, Room 202A Concurrent Symposia 8:00AM–9:30AM 8:30AM–11:30AM 10:00AM–11:30AM Washington Convention Center Body and Machine Seminar 8:30AM–4:30PM Washington Convention Center Career Workshops 8:00AM–5:00PM Washington Convention Center Exhibitor Workshops 8:00AM–5:00PM Washington Convention Center Exhibit Hall D 10:00AM–5:00PM Washington Convention Center Topical Lectures 12:00PM–12:45PM Washington Convention Center American Junior Academy of Sciences (AJAS) Poster Session 1:00PM–5:00PM Washington Convention Center Exhibit Hall D Concurrent Symposia 1:00PM–2:30PM 1:30PM–4:30PM 3:00PM–4:30PM Washington Convention Center EurekAlert! Reception 2:00PM–4:00PM Room to be determined. Evening Plenary Lecture 5:00PM–6:00PM Washington Convention Center Street Level, East Salon AAAS Science Journalism Awards 7:00PM–10:00PM Smithsonian's National Museum of the American Indian <i>(Shuttle buses begin departing the Washington Convention Center at 6:45PM. Press badge required).</i>	Daytime Newsroom Registration 7:30AM–5:00PM Washington Convention Center Level Two, Room 204A Helmholtz Association Breakfast 7:45AM–9:00AM Washington Convention Center Level Two, Room 202A Concurrent Symposia 8:00AM–9:30AM 8:30AM–11:30AM 10:00AM–11:30AM Washington Convention Center Other Worlds Seminar 8:30AM–4:30PM Washington Convention Center Career Workshops 8:00AM–5:00PM Washington Convention Center Exhibitor Workshops 8:00AM–5:00PM Washington Convention Center Exhibit Hall D 10:00AM–5:00PM Washington Convention Center Family Science Days and "Meet the Scientists" Speaker Series 11:00AM–5:00PM Washington Convention Center Student Poster Competition 11:00AM–5:00PM Washington Convention Center Topical Lectures 12:00PM–12:45PM Washington Convention Center AJAS Oral Presentations 1:30PM–4:30PM Renaissance Downtown Concurrent Symposia 1:00PM–2:30PM 1:30PM–4:30PM 3:00PM–4:30PM Washington Convention Center Evening Plenary Lecture 5:00PM–6:00PM Washington Convention Center Street Level, East Salon AAAS Awards Ceremony and Reception 6:00PM–7:30PM Renaissance Downtown Ballroom Level, Grand Ballroom	Daytime Newsroom Registration 7:30AM–5:00PM Washington Convention Center Level Two, Room 204A Think Canada Breakfast 7:45AM–9:00AM Washington Convention Center Level Two, Room 202A Concurrent Symposia 8:00AM–9:30AM 8:30AM–11:30AM 10:00AM–11:30AM Washington Convention Center Frontiers in Chemistry Seminar 8:30AM–4:30PM Washington Convention Center Career Workshops 8:00AM–5:00PM Washington Convention Center Exhibitor Workshops 8:30AM–5:00PM Washington Convention Center Exhibit Hall D 10:00AM–5:00PM Washington Convention Center Family Science Days and "Meet the Scientists" Speaker Series 11:00AM–5:00PM Washington Convention Center Topical Lectures 12:00PM–12:45PM Washington Convention Center General Poster Session 1:00PM–5:00PM Washington Convention Center Concurrent Symposia 1:00PM–2:30PM 1:30PM–4:30PM 3:00PM–4:30PM Washington Convention Center Evening Plenary Lecture 5:00PM–6:00PM Washington Convention Center Street Level, East Salon	Daytime Newsroom Registration 7:30AM–10:30AM Washington Convention Center Level Two, Room 204A Plenary Lecture 8:30AM–9:30AM Washington Convention Center Street Level, East Salon Concurrent Symposia 9:45AM–11:15AM 9:45AM–12:45PM Washington Convention Center

Disclaimers

Abstracts and synopses of material presented at the AAAS Annual Meeting reflect the individual views of the author and not necessarily those of the AAAS, its Council, Board of Directors, officers, or the views of the institutions with which the authors are affiliated. Presentation of ideas, products, or publications at the AAAS Meeting or the reporting of them in resulting news accounts does not constitute endorsement by AAAS.

Special Events for Newsroom Registrants

AAAS President's Breakfast and Briefing

17 February 7:45AM–8:30AM

The breakfast briefing with AAAS President Alice Huang will be held in Room 202A, Washington Convention Center.

International Reporters Reception

17 February 8:00PM–10:00PM
Grand Hyatt Washington

AAAS welcomes international reporters with a special reception in the Constitution Ballroom C/D/E. Newsroom badges will be required.

European Commission Press Breakfast

18 February 7:45 AM–9:00AM

Newsroom registrants are invited to this sponsored breakfast briefing in Room 202A, Washington Convention Center.

Science Journalism Roundtable

18 February 12:00PM–1:00PM

Winners of the 2010 AAAS Kavli Science Journalism Awards will be invited to a special luncheon in their honor, hosted by The Kavli Foundation, to include a moderated roundtable discussion. All newsroom registrants will be welcome. Priority seating will be provided for working reporters. Room 202A, Washington Convention Center.

EurekaAlert! Reception

18 February 2:00PM–4:00PM

All newsroom registrants are invited. Room to be determined, Washington Convention Center.

AAAS Kavli Science Journalism Awards

18 February 7:00PM–10:00PM

All newsroom registrants are invited to a reception at the Smithsonian's National Museum of the American Indian. The awards program has been endowed by The Kavli Foundation. Shuttle buses will be provided from the Washington Convention Center beginning at 6:45PM.

Note: Meeting press badges are required.

Helmholtz Association Breakfast

19 February 7:45AM–9:00AM

This networking and information opportunity, sponsored by the Helmholtz Association of German Research Centers, will be held in Room 202A, Washington Convention Center.

Think Canada Breakfast

20 February 8:00AM–9:00AM

All newsroom registrants are invited to this breakfast sponsored by the "Think Canada" research partners. Room 202A, Washington Convention Center.

Local Science Writers Party

19 February To Be Determined

The D.C. Science Writers Association will host an evening party for newsroom registrants. Details to come.

NASW Student Programs and Travel Fellowships

The National Association of Science Writers (NASW) will again sponsor several programs for student journalists at the AAAS meeting. Funding from NASW will provide travel fellowships for up to 10 undergraduate students to attend the meeting and cover a session for the NASW website. Application deadline is December 1. Details will be posted at <http://www.nasw.org/resource/beginning>. NASW also will sponsor its popular mentoring program, pairing undergraduate and graduate students with senior journalists, and an internship fair for summer writing positions with professional editors. All activities require student membership in NASW.

General Information

Meeting Location

Meeting events will be held in downtown Washington, DC at the Washington Convention Center, the Renaissance Downtown Hotel, and the Grand Hyatt Washington.

On-Site Press Registration

Press registration will be located in the Washington Convention Center, Level Two, Room 204A. Hours are as follows:

Thursday	17 February	7:00AM–5:00PM
Friday–Sunday	18–20 February	7:30AM–5:00PM
Monday	21 February	7:30AM–10:30AM

Note: Access to the AAAS Annual Meeting Newsroom requires appropriate press credentials. Valid photo ID is required on site. See details online at www.eurekaalert.org/aaasnewsroom.

For questions about press registration call AAAS Press Registration at (202) 326-6440 or send an e-mail to media@aaas.org.

The Newsroom

The Newsroom, located in the Washington Convention Center, Level Two, Room 204A, hosts hundreds of print, broadcast, and online reporters from around the world. It offers news briefings, a newsroom equipped with Internet access and computers, a papers room with copies of speaker presentations, a reporters' coffee lounge, and private interview rooms.

Discount Hotel Rates

AAAS has negotiated special rates for AAAS Meeting attendees at the Renaissance Downtown Hotel, the Grand Hyatt Washington, the Embassy Suites, and the Hampton Inn. The AAAS hotels are close to the space occupied by AAAS at the Washington Convention Center. Events also will be held at the Renaissance Downtown and the Grand Hyatt Washington. When you register online for the Newsroom, you will receive a code number for making reservations at official meeting hotels through the AAAS Travel Desk. Do not contact the hotels directly. Go to www.aaas.org/meetings and click on "Hotels and Travel" to book a room.

AAAS Family Science Days and "Meet the Scientists!" Speakers Series

Stop by Exhibit Hall D on Saturday and Sunday to take part in free, fun, hands-on science opportunities and hear a diverse range of scientists describe their amazing explorations. The 2011 Family Science Days will feature exciting, interactive programming for children and will include a series of unique opportunities for young people to speak directly with top scientists who will explain what it takes to succeed in "cool science careers."

Saturday	19 February	11:00AM–5:00PM
Sunday	20 February	11:00AM–5:00PM

Exhibition

The Exhibition will be located in Hall D at the Washington Convention Center. Hours are as follows:

Friday	18 February	10:00 AM–5:00 PM
Saturday	19 February	10:00 AM–5:00 PM
Sunday	20 February	10:00 AM–5:00 PM

Barrier-Free Environment

Accommodations for people with disabilities will be provided on request at all general lectures and sessions. Services include interpreters or real-time captioning for persons who are deaf or hearing impaired, audio-recorded highlights, and mobility assistance within and outside the conference facilities as needed. In addition, a resource room for people with disabilities will be available in the Salon F, Street Level, at the Washington Convention Center.

Discount Travel to Washington, DC

For details about discounts on airfare and rail, visit www.aaas.org/meetings and click on "Hotels and Travel" then "Travel Discounts."

Airport Transportation

For information about transportation to and from the airport, visit www.aaas.org/meetings and click on "Hotels and Travel" then "Transportation."

Environmental Practices

A CD contains speaker and poster abstracts. Program materials are produced with recycled material. Recycling containers are provided on site.

Register online: Save time and register in advance at: www.eurekaalert.org/aaasnewsroom.

AAAS ANNUAL MEETING | 17–21 February 2011 | Washington, D.C.

Plenary Lectures

Thursday, 17 February

PRESIDENT'S ADDRESS

Alice S. Huang

AAAS President and Senior Faculty Associate in Biology, California Institute of Technology

Dr. Huang is a distinguished virologist and proponent for women in science. She was previously a professor of microbiology and molecular genetics at Harvard Medical School and subsequently dean for science at New York University. She is particularly interested in interdisciplinary research, the organization of higher educational institutions, and in policy issues related to education, science, and technology. She was the first to purify and characterize defective interfering viral particles. Her suggestion that these particles play a major role in viral pathogenesis stimulated work on many viral systems including plant viruses, and has led to the possibility of using these particles for disease prevention. She is a fellow of the Academia Sinica in Taiwan, American Women in Science, the Academy of Microbiology, and the AAAS, and has consulted on science policy for government agencies in Singapore, Taiwan, and China. She received her B.A., M.A., and Ph.D. degrees in microbiology from Johns Hopkins University.

Friday, 18 February

John P. Holdren

Assistant to the President for Science and Technology, Director of the White House Office of Science and Technology, and Co-Chair of the President's Council of Advisors on Science and Technology

Dr. Holdren holds advanced degrees in aerospace engineering and theoretical plasma physics from MIT and Stanford and is highly regarded for his work on energy technology and policy, global climate change, and nuclear arms control and nonproliferation. He is a member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences as well as foreign member of the Royal Society of London. A former AAAS president, his awards include a MacArthur Foundation Prize Fellowship, the John Heinz Prize in Public Policy, the Tyler Prize for Environmental Achievement, and the Volvo Environment Prize. Prior to joining the Obama administration, Dr. Holdren was Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy at Harvard University's Kennedy School of Government as well as professor in Harvard's Department of Earth and Planetary Sciences and Director of the independent, nonprofit Woods Hole Research Center. He also served as one of President Bill Clinton's science advisors from 1994 to 2001.

Saturday, 19 February

Frances H. Arnold

Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry, California Institute of Technology

Frances Arnold is a pioneer in the use of methods of laboratory evolution to generate novel and useful enzymes and organisms for applications in medicine and in alternative energy. Her multidisciplinary approach reveals insight into the way natural evolution might have occurred. She holds more than 20 patents and patent applications, has co-authored 220 scientific publications, and edited several books on protein engineering and laboratory protein evolution. Dr. Arnold is a member of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. Recent awards and honors include the Linnaeus Lectureship at Uppsala University in Sweden and the Genencor Award in Enzyme Engineering. She received a bachelor's degree in mechanical and aerospace engineering from Princeton University and a Ph.D. degree in chemical engineering from the University of California, Berkeley.

Sunday, 20 February

PLENARY PANEL ON BIOSECURITY

Rita R. Colwell

Distinguished University Professor, University of Maryland, College Park, and Johns Hopkins University Bloomberg School of Public Health

Dr. Colwell's interests are focused on global infectious diseases, water, and health, and she is developing an international network to address emerging infectious diseases and water issues, including safe drinking water for both the developed and developing world. She recently chaired a study committee of the National Research Council that wrote *Responsible Research with Biological Select Agents and Toxins*. Dr. Colwell has held many advisory positions in the U.S. government, nonprofit science policy organizations, and private foundations as well as in the international scientific research community. A former AAAS president, she is the recipient of 54 honorary doctorates, and is a member of the National Academy of Sciences, the Royal Swedish Academy of Sciences, Stockholm, the American Academy of Arts and Sciences, and the American Philosophical Society. She has a B.S. degree in bacteriology and M.S. degree in genetics from Purdue University, and a Ph.D. degree in oceanography from the University of Washington.

Anthony S. Fauci

Director, National Institute of Allergy and Infectious Diseases (NIAID), National Institutes of Health

Dr. Fauci oversees an extensive research portfolio of basic and applied research to prevent, diagnose, and treat infectious diseases such as HIV/AIDS and other sexually transmitted infections, influenza, tuberculosis, malaria and illness from potential agents of bioterrorism. NIAID also supports research on transplantation and immune-related illnesses, including autoimmune disorders, asthma and allergies. Dr. Fauci serves as one of the key advisors to the White House and Department of Health and Human Services on global AIDS issues, and on initiatives to bolster medical and public health preparedness against emerging infectious disease threats such as pandemic influenza. He is also a member of the National Science Advisory Board for Biosecurity, which deals with such questions as how to prevent published research in biotechnology from aiding terrorism without slowing scientific progress. Fauci graduated from College of the Holy Cross and received his medical degree from Cornell University.

Claire M. Fraser-Liggett

Director of the Institute for Genome Sciences and Professor of Medicine, University of Maryland School of Medicine, Baltimore

Dr. Fraser-Liggett was previously the president and director of The Institute for Genomic Research, and has played a role in the sequencing and analysis of human, animal, plant, and microbial genomes to better understand the role that genes play in development, evolution, physiology and disease. She led the teams that sequenced the genomes of several microbial organisms, including important human and animal pathogens, and as a consequence helped to initiate the era of comparative genomics. She has served on a number of National Research Council committees on counter-bioterrorism, domestic animal genomics, polar biology, and metagenomics. Dr. Fraser-Liggett has more than 220 scientific publications and has served on committees of the National Science Foundation, U.S. Department of Energy, and National Institutes of Health. She received her Ph.D. degree in pharmacology from State University of New York, Buffalo.

The Honorable Rush Holt

U.S. Congressman

Prior to his election in 1998 to represent New Jersey's 12th District, Dr. Holt worked as an educator, scientist, and arms control expert. At the U.S. State Department, he monitored the nuclear programs of countries such as Iraq, Iran, North Korea, and the former Soviet Union. From 1980 to 1988, he served on the faculty at Swarthmore College, where he taught courses in physics, public policy, and religion. From 1989 until his 1998 congressional campaign, he was Assistant Director of the Princeton Plasma Physics Laboratory, the largest center for alternative energy research in New Jersey. Dr. Holt serves on the House Committee on Education and Labor, the Committee on Natural Resources, and the Permanent Select Committee on Intelligence, its only scientist. He also chairs the Select Intelligence Oversight Panel.

Moderator: Jeanne Guillemin, Ph.D.

Senior Advisor, MIT Security Studies Program, Research Professor, Boston College, Chestnut Hill, MA

Trained in sociology and anthropology, Dr. Guillemin has long been involved in issues regarding medicine, infectious diseases, and biological weapons. She is the author of *Anthrax: The Investigation of a Deadly Outbreak*, which documents the U.S.-Russian inquiry into the contested cause of the 1979 Sverdlovsk anthrax outbreak. Prior to this research, she investigated the "yellow rain" controversy of the 1980s. Both projects involved U.S. allegations against the Soviet Union for treaty violations involving biological weapons. Her latest book is *Biological Weapons: From the Invention of State-Sponsored Programs to Contemporary Bioterrorism*. She has been a delegate to the annual Pugwash Working Group on the Chemical and Biological Weapons Conventions, a participant in the Belfer Center Executive Session on Domestic Preparedness, and was on the World Health Organization editorial board for its 2004 guide to public health responses to biological and chemical weapons attacks.

Monday, 21 February

To be announced

Topical Lecture Series

Attend lectures on prominent topics across a range of disciplines.

G. Wayne Clough

Secretary, Smithsonian Institution

Topic To Be Announced

Regina E. Dugan

Director, Defense Advanced Research Projects Agency

Topic To Be Announced

Robert M. Hazen

Senior Staff Scientist, Geophysical Laboratory, Carnegie Institution for Science, and Clarence Robinson Professor of Earth Science, George Mason University

The Deep Carbon Observatory

Samantha B. Joye

Professor of Marine Sciences, University of Georgia, Athens

Offshore Ocean Aspects of the Gulf Oil Well Blowout

Gerard Karsenty

Paul A. Marks Professor and Chair, Department of Genetics and Development, Columbia University Medical Center

Biology Without Walls: The Novel Endocrinology of Bone

Colin Phillips

Professor of Linguistics, Neuroscience, and Cognitive Science, University of Maryland, College Park

Linguistic Illusions: Where You See Them, Where You Don't

Lisa Randall

Frank B. Baird, Jr. Professor of Science, Harvard University

String Theory and New Physics

Sean C. Solomon

Director, Department of Terrestrial Magnetism, Carnegie Institution for Science

Exploring the Planet Mercury: The MESSENGER Mission

George M. Whitesides

Woodford L. and Ann A. Flowers University Professor, Harvard University

Changing the Paradigms of Science

GEORGE SARTON MEMORIAL LECTURE IN THE HISTORY AND PHILOSOPHY OF SCIENCE

Lawrence M. Principe

Drew Professor of the Humanities, Johns Hopkins University

Revealing the Secrets of Alchemy

JOHN P. MCGOVERN LECTURE IN THE BEHAVIORAL SCIENCES

Linda M. Bartoshuk

Bushnell Professor of Community Dentistry and Behavioral Science, University of Florida, Gainesville

We Live in Different Taste Worlds: How Do We Know and What Does It Mean?

Seminars

Day-long seminars address topics at the intersection of science and society.

Body and Machine

No border is more fundamental than the one between humans and the external world. The limits of our body are defined by our brain—how we grasp an object or move around in a room is determined by how the brain perceives where the body is in space and time. These limits can be manipulated, extended, and explored when traditional scientific disciplines work together. By combining the fields of neuroscience, medicine, engineering, and information systems, science is rising to the challenge of finding solutions to disabilities that affect human experience.

Linking Mechanics, Robotics, and Neuroscience: Novel Insights from Novel Systems

This session focuses on the role of mechanics and the physical embodiment of sensory and motor structures in the study of systems neuroscience. The panel's research integrates techniques from engineering and neuroscience to investigate sensorimotor function and to construct more sensate and dextrous robots and biomimetic devices. Talks will illuminate reciprocal relationships between mechanics, robotics, and sensory neuroscience using model systems that range from crickets, golden moles, and rats to humans and humanoid-robots. Topics include the bizarre inner ear bones of the golden mole that exhibit unique mechanical specializations to permit the animal to sense both minute substrate vibrations and airborne sound; and the use of robotic models and dynamic simulations to quantify tactile processing in the rat whisker system. Using both psychophysical and robotic studies, the session also explores the remarkable integration of visual and tactile sensory inputs that enables manipulation and grasping with the hand. These

interdisciplinary approaches give equal emphasis to intricate biomechanical mechanisms, ecological contexts, and technological implementation, enabling teams to build new devices and advance our understanding of nature.

Organized by: Mitra J.Z. Hartmann, Northwestern University

SPEAKERS

Jérôme Casas, Centre National de la Recherche Scientifique

Air-Flow Sensing Hairs in Crickets and Biomimetic Micro-Electro-Mechanical Systems (MEMS) Sensors

Peter M. Narins, University of California, Los Angeles

Mostly Malleus: Ground Sound Detection by the Golden Mole

Mitra J.Z. Hartmann, Northwestern University
Characterizing the Complete Mechanosensory Input to the Rat Vibrissal Array

Danica Kragic, Center for Autonomous Systems, Stockholm

Attention, Segmentation, and Learning for Object Manipulation

Francisco J. Valero-Cuevas, University of Southern California

A Systems-Based Engineering Approach to Sensorimotor Control of the Human Hand

Mind and Machine: The Next Step in Neuroprosthetics and Brain Computer Interfaces

A more profound understanding of how the brain functions has led to major advances in brain-computer interfaces (BCI). Once considered science fiction, neuroprosthetics are now helping disabled people rediscover — or experience for the first time — capacities that greatly improve quality of life. Through systems that monitor brain activity and translate it into actions such as moving a wheelchair or selecting a letter from a virtual keyboard, people with disabilities are exploring the world in new ways. This session will focus on both non-invasive interfaces, where control comes mainly from electroencephalographic activity, as well as interfaces that incorporate implants in the brain. Both forms of prostheses restore patients' experience with the world and blur the lines between man and machine. Future uses of these

technologies may one day allow an augmented human to go far beyond the confines of the body and open new territories of possibility, particularly relevant for paralyzed humans and for people in challenging environments like space.

Organized by: Michael D. Mitchell, Ecole Polytechnique Fédérale de Lausanne (EPFL), and Christian Simm, Swissnex San Francisco, CA

SPEAKERS

Dan Moran, Washington University, St. Louis

Neural Oscillations and Motor and Language Processing

José del R. Millan, EPFL

Multitasking with Non-Invasive Neuroprosthetics

Christa Neuper, Graz University of Technology
Future Directions in Hybrid Brain-Computer Interfaces

Andrew Schwartz, University of Pittsburgh

Useful Signals from the Motor Cortex

Jonathan R. Wolpaw, Wadsworth Center

BCIs: Traditional Assumptions Meet Emerging Realities

Frontiers in Chemistry

Along with many organizations worldwide, AAAS is celebrating the International Year of Chemistry to acknowledge the achievements of chemistry, its contributions to the well-being of humankind, and what the future may hold. New organic materials will have broad industrial and societal impacts on information technology, energy, and biosensing. New knowledge about molecular self-assembly will provide the structural foundation for the next generation of artificial molecular machines. Research and teaching in these fields involves multidisciplinary approaches and diverse, international investigators. This seminar will disclose cutting-edge research across a variety of scientific disciplines, thereby

exemplifying a multidisciplinary approach to scientific exploration.

Frontiers in Organic Materials for Information Processing, Energy, and Sensors

Over the past 15 years, new technologically and biologically important developments of broad industrial and societal interest have resulted from cutting-edge research, namely in photonics, displays, and biological labeling. This session is designed to allow a diverse audience to learn about state-of-the-art research in the area of functional pi-systems. The focus will be largely, but not exclusively, on the chemistry of such materials. In doing so, the session will provide a critical forum where participants can discuss not only fundamental aspects of the chemistry and physics of functional pi-systems but also the technology drivers and biologically important applications. The latter are often neglected at more specialized conferences on displays, organic photovoltaics, or nonlinear optics. Topics to be covered include organic semiconductor materials, photovoltaic organic materials and devices, organic electroactive materials and devices, self-assembly and aggregation of organic materials, and nonlinear optics and two-photon processes in organic materials.

Organized by: Seth R. Marder and Jean-Luc Bredas, Georgia Institute of Technology, and Tobin J. Marks, Northwestern University

SPEAKERS

Alan Heeger, University of California, Santa Barbara

Plastic Solar Cells and Photodetectors: Self-Assembly by Spontaneous Phase Separation

Richard Friend, University of Cambridge
Current and Future Scientific and Commercial Opportunities for Organic Electronics

Zhenan Bao, Stanford University

Organic Materials Based Flexible Electronic Sensors

Larry Dalton, University of Washington, Seattle

Electro-Optic Technology: Implications for Telecommunications, Computing, and Sensing

Joseph W. Perry, Georgia Institute of Technology

Organic Photonic Materials for All-Optical Signal Processing

Mark E. Thompson, University of Southern California

New Molecular Materials for Energy Based Optoelectronics: Solar Energy and Lighting

Molecular Self-Assembly and Artificial Molecular Machines

All living systems rely on complex supramolecular structures with highly sophisticated components, which operate within cell membranes and cell compartments. Nature is remarkable in composing such complex organizations to achieve the necessary functions of life. The study of model molecular constructs in this realm provides an important window for enhancing our understanding. Moreover, the design and fabrication of artificial molecular machines is one of the great scientific challenges of our times. This session on molecular self-assembly and artificial molecular machines will contain lectures that reflect the current state of the art in this exciting research area.

Organized by: Miguel A. Garcia-Garibay, University of California, Los Angeles, and Bruce E. Maryanoff, The Scripps Research Institute

SPEAKERS

J. Fraser Stoddart, Northwestern University

Fashioning Functional Materials with Integrated Mechanostereochemical Systems

Josef Michl, University of Colorado and Institute of Organic Chemistry and Biochemistry

Artificial Surface-Mounted Molecular Rotors

Nadrian C. Seeman, New York University

DNA: Not Merely the Secret of Life

Stacey F. Bent, Stanford University

Nanostructuring for Efficient Energy Conversion

M. Reza Ghadiri, The Scripps Research Institute

Toward Synthetic Biology: Design and Study of Complex Peptide Networks

Ben L. Feringa, University of Groningen

Molecular Motors: In Control of Molecular Motion

DISCUSSANT

Miguel A. Garcia-Garibay, University of California, Los Angeles

Other Worlds

Speakers in this seminar will represent multidisciplinary and multinational initiatives that are closely coordinated at national

and international levels. The Kepler Mission will do something that no other mission can do: determine the frequency of Earth-like planets in our galaxy and begin to constrain the prevalence of life in our universe. Other efforts are engaged in searching for evidence of extraterrestrial life, a broadly and deeply multidisciplinary, interdisciplinary, and transdisciplinary endeavor. The world's largest dedicated, full-time astronomical instrument — Very Long Baseline Array — spans more than 5,000 miles, providing astronomers with the sharpest vision of any telescope on Earth or in space. The array has an ability to see fine detail equivalent to being able to stand in New York City and read a newspaper in Los Angeles.

Kepler: Looking for Other Earths

NASA's Kepler Mission is determining the frequency of habitable, Earth-like planets in the universe by searching for the tiny dimming in brightness of the planet's host star when the planet's orbit takes the planet in front of the star. Kepler is a space telescope that is staring at over 150,000 stars in the constellations of Cygnus and Lyra, waiting for the multiple, periodic transits that indicate a planet is in orbit. Kepler was launched in March 2009, and by February 2011 will have been taking data for nearly 2 years, long enough to begin to assess the frequency of Earth-size planets on year-long orbits around solar-type stars. Based on ground-based planet searches by other techniques, the expectation is that Kepler will discover large numbers of super-Earths, planets with masses up to about 15 times that of Earth, which appear to accompany roughly one-third of all solar-type stars. Kepler should then discover dozens of Earth-like planets, that is, planets of Earth-size orbiting in the habitable zones of their stars. The mission will also make an extraordinary contribution to our understanding of stellar structure and evolution, as the same high photometric precision needed to detect Earths also means that stellar brightness variations will be measured to unprecedented accuracies over the

3.5-year mission lifetime, permitting seismological studies of stellar interiors and new insights into variable stars.

Organized by: Alan P. Boss, Carnegie Institution for Science, and William J. Borucki, NASA Ames Research Center

SPEAKERS

William J. Borucki, NASA Ames Research Center

Kepler Mission Overview and Planet Discoveries

Matthew J. Holman, Harvard-Smithsonian Center for Astrophysics

Searching for Planets by Transit Timing Variations

Sara Seager, Massachusetts Institute of Technology

Planet Discoveries in a Physical Context

William Chaplin, University of Birmingham, United Kingdom

Results for Solar-like Oscillators Observed by Kepler

Conny Aerts, Instituut voor Sterrenkunde

Asteroseismology Across the HR Diagram

Martin D. Still, NASA Ames Research Center

The Kepler Guest Observer Program

Seeking Signs of (ET) Life: The Search Steps Up on Mars and Beyond

This session will report on the latest developments in the search for evidence of extraterrestrial life, a broadly and deeply multidisciplinary, interdisciplinary, and transdisciplinary endeavor. Speakers will address Mars exploration, astrobiology and the search for extraterrestrial life, and the need for planetary protection in the course of this search. The session will focus especially on the Mars Science Laboratory mission to be launched in 2011 -- the first roving analytical laboratory and first dedicated astrobiology mission to Mars since Viking. Speakers also will address the global space community's plans for exploring Europa and other environments potentially habitable for extraterrestrial life, reporting on science goals and technology requirements.

Organized by: Linda Billings, George Washington University

SPEAKERS

Mary A. Voytek, NASA

Greatest Hits and Grand Challenges in Astrobiology

Cassie Conley, NASA

Preserving the Planets—Ours and Others: Planetary Protection in Space Exploration

Andrew Steele, Carnegie Institution of Washington

The Search for Life on Mars: Mars Science Laboratory and Mars Sample Return

The Universe Revealed by High-Resolution, High-Precision Astronomy

Very long baseline interferometry uses multiple radio antennas separated by large geographical distances to deliver the highest possible resolution imaging and astrometric precision for the scientific study of the Universe. Because radio emission is little affected by the intervening dust and gas that often obscures the optical and infrared radiation emitted by astronomical objects, radio telescopes can probe deep into regions that are otherwise inaccessible, such as the molecular clouds where stars and planets form, and the center of the galaxy. The Very Long Baseline Array (VLBA) of the National Radio Astronomy Observatory (NRAO) consists of 10 identical, 25-meter diameter antennas that operate at centimeter and millimeter wavelengths on transcontinental baselines of up to 8,000 kilometers and provides the science community the highest resolution and astrometric precision of any astronomical telescope. Invigorated by state-of-the-art technologies that have markedly improved its sensitivity and flexibility, the VLBA is enabling a wide range of transformative science: mapping the structure and dynamics of the entire Milky Way; searching for planets around low-mass stars; accurately measuring the masses of the supermassive black holes located at the centers of many galaxies; precisely determining the expansion rate of the Universe; and more.

Organized by: Mark T. Adams, NRAO

SPEAKERS

Geoffrey C. Bower, University of California, Berkeley

Seeking New Planets at Radio Wavelengths
Mark J. Reid, Harvard-Smithsonian Center for Astrophysics

Mapping Our Galaxy in 3D

James A. Braatz, NRAO

Supermassive Black Holes and Precision Cosmology with Megamasers

Cutting-Edge Symposia

Brain and Behavior

Scientific and Ethical Issues for the Surgical Treatment of Psychiatric Disorders

Friday, 18 February 8:30AM-11:30AM
 Organized by: Mahlon DeLong, Emory University School of Medicine, Atlanta, GA

SPEAKERS

Mahlon DeLong, Emory University School of Medicine, Atlanta, GA
History and Lessons from Movement Disorders for Psychiatric Disorders
 Benjamin Greenberg, Brown University Medical School, Providence, RI
Long-Term Deep Brain Stimulation (DBS) for Obsessive-Compulsive Disorder
 Michael Okun, University of Florida, Gainesville
Obsessive Compulsive Disorders and Tourette Syndrome: Avoiding DBS Failures
 Helen Mayberg, Emory University School of Medicine, Atlanta, GA
DBS for Major Depressive Disorders
 Joseph Fins, New York Presbyterian Hospital-Weill Cornell Center, New York City
DBS and the Ethical Mandate To Foster Trust and Sustain Scientific Advances

Crossing Borders in Language Science: What Bilinguals Tell Us About Mind and Brain

Friday, 18 February 1:30PM-4:30PM
 Organized by: Judith F. Kroll, Pennsylvania State University, University Park

SPEAKERS

Janet F. Werker, University of British Columbia, Vancouver, Canada
Perceptual Foundations for Bilingual Acquisition in Infancy
 Judith F. Kroll, Pennsylvania State University, University Park
The Bilingual Is a Mental Juggler: Behavioral and Electrophysiological Evidence
 Karen Emmorey, San Diego State University, CA
Bilingualism Across Signed and Spoken Languages
 Teresa Bajo, University of Granada, Spain
Variations in Inhibitory Control in Language Selection During Production and Comprehension
 Sonja A. Kotz, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany
The Impact of Cognitive Functions on Bilingual Processing: Neuroimaging Evidence
 Ellen Bialystok, York University, Toronto, Canada
Protective Effects of Bilingualism for Cognitive Aging and Dementia

Transatlantic Synergies To Promote Effective Traumatic Brain Injury Research

Saturday, 19 February 8:00AM-9:30AM
 Organized by: Patrizia Tosetti, European Commission, Directorate-General for Research/Health, Brussels, Belgium; Ramona Hicks, National Institute of Neurological Disorders and Stroke (NINDS), Bethesda, MD

SPEAKERS

*David K. Menon, University of Cambridge, United Kingdom
Traumatic Brain Injury Research: State of Play and Unmet Needs
 Walter J. Koroshetz, NINDS, Bethesda, MD
Comparative Effectiveness in Traumatic Brain Injury: Problem Rich/Solution Poor?
 Ruxandra Draghia-Akli, European Commission, Directorate-General for Research/Health, Brussels, Belgium
Benefits of International Collaboration in Traumatic Brain Injury Research

Chronic Illness Management and Cognitive Science: Translation Beyond Genes?

Saturday, 19 February 10:00AM-11:30AM
 Organized by: Howard Leventhal, Rutgers University, New Brunswick, NJ

SPEAKERS

Howard Leventhal, Rutgers University, New Brunswick, NJ
The Cognitive-Affective Science of Chronic Illness Management: It Isn't All Genes
 Ethan A. Halm, University of Texas Southwestern Medical Center, Dallas
Addressing Patients' Common-Sense Minds for Treatment Adherence in Chronic Illnesses
 Denise Park, University of Texas, Dallas
Illness Management from the Perspective of Cognitive Neuroscience

The Science of Eating: Perception and Preference in Human Taste

Saturday, 19 February 10:00AM-11:30AM
 Organized by: Albert H. Teich and Rieko Yajima, AAAS Science and Policy Programs, Washington, DC; Jill Pace, American College of Real Estate Lawyers, Rockville, MD

SPEAKERS

Gary Beauchamp, Monell Chemical Senses Center, Philadelphia, PA
The Biological and Genetic Bases for Human Taste Perception and Preference
 Jane Leland, Kraft Foods, Glenview, IL
The Science of Taste Perception and Its Use in the Development of Delicious Foods
 José Andrés, José Andrés Think Food Group, Washington, DC

Experimental Cooking: Exploring the Frontier in New Taste Experiences

From Artificial Limbs to Virtual Reality: How the Brain Represents the Body

Saturday, 19 February 1:30PM-4:30PM
 Organized by: Michael D. Mitchell, École Polytechnique Fédérale de Lausanne, Switzerland; Christian Simm, swissnex San Francisco, CA

SPEAKERS

Todd Kuiken, Northwestern University, Chicago, IL
A Neural Interface for Artificial Limbs: Targeted Muscle Reinnervation
 Olaf Blanke, École Polytechnique Fédérale de Lausanne, Switzerland
The Neuroscience of Self-Consciousness: From the Body to Subjectivity
 Miguel Nicolelis, Duke University Center for Neuroengineering, Durham, NC
Freeing the Brain from the Body
 Hod Lipson, Cornell University, Ithaca, NY
Self-Reflective Machines
 Mel Slater, University of Barcelona, Spain
Body Representation in Immersive Virtual Reality

Science Behind Improved Foreign Language Expertise: Meeting the Global Challenge

Sunday, 20 February 8:00AM-9:30AM
 Organized by: Amy S. Weinberg, University of Maryland, College Park

SPEAKERS

Robert O. Slater, National Security Education Program, Arlington, VA
U.S. Government Strategies To Solve the Global Challenge: History and Prospects
 Catherine Doughty, University of Maryland, College Park
Cognitive Dimensions of Second Language Expertise
 Lee Osterhout, University of Washington, Seattle
Neuroscience and Second Language Acquisition

Cultural Evolutionary Dynamics of Cooperation

Sunday, 20 February 8:30AM-11:30AM
 Organized by: David M. Carballo, Boston University, MA

SPEAKERS

David M. Carballo, Boston University, MA
Cultural Evolutionary Dynamics of Cooperation: An Introduction
 Charles Stanish, University of California, Los Angeles

Ritual, Labor, and the Evolution of Cooperation
 Paul Roscoe, University of Maine, Orono
Large-Scale Collective Action, War, and Political Evolution
 Benjamin Chabot-Hanowell, University of Washington, Seattle
Modeling Polity Emergence Using Patron-Client, Bargaining, and Reproductive Skew
 Monica L. Smith, University of California, Los Angeles
Caste as a Cooperative Economic Entitlement Strategy in Chiefdoms and States
 Richard Blanton, Purdue University, West Lafayette, IN
Collective Action and the Virtuous Commoner

From Freud to fMRI: Untangling the Mystery of Stuttering

Sunday, 20 February 10:00AM-11:30AM
 Organized by: Nan Ratner, University of Maryland, College Park

SPEAKERS

Dennis Drayna, National Institute on Deafness and Other Communication Disorders, Rockville, MD
Identifying the Genetic Contributions to Stuttering
 Luc de Nil, University of Toronto, Canada
Brain Anatomy and Function in People Who Stutter
 Anne Smith, Purdue University, West Lafayette, IN
How Stuttering Emerges from the Interfaces Between Linguistic and Motor Processing

Hunter-Gatherers and Language Change

Sunday, 20 February 1:00PM-2:30PM
 Organized by: Claire Bowern, Yale University, New Haven, CT

SPEAKERS

Claire Bowern, Yale University, New Haven, CT
New Insights on Language Change in Hunter-Gatherer Groups
 Patrick McConvell, Australian National University, Canberra
Loans in Hunter-Gatherer Basic Vocabulary
 Patience Epps, University of Texas, Austin
The Historical Development of Numeral Systems: Insights from Hunter-Gatherers

Neurodegenerative Diseases: A Need for Multidisciplinary and Global Approaches

Sunday, 20 February 1:00PM-2:30PM
 Organized by: Elmar Nimmesgern, European Commission, Brussels, Belgium; Philippe Amouyel, Institut Pasteur de Lille, France

SPEAKERS

Thomas Gasser, Hertie Institute for Clinical Brain Research, Tübingen, Germany
New Approaches to Neurodegenerative Disease Research

Neil Buckholtz, National Institute on Aging, Bethesda, MD
Alzheimer's Disease Neuroimaging Initiative: Assessing Disease Progression
 Laura Fratiglioni, Karolinska Institute, Stockholm, Sweden
Multidomain Interventions To Postpone Onset of Alzheimer's Disease

Molecules to Mind: Challenges for the 21st Century

Sunday, 20 February 1:30PM-4:30PM
 Organized by: Bruce Altevogt, Institute of Medicine, Washington, DC

SPEAKERS

Kathie Olsen, Association of Public and Land-grant Universities, Washington, DC
Neurotechnology: Integration of Neuroscience, Engineering, and the Physical Sciences
 David Clayton, University of Illinois, Urbana
Neurogenomics: From Genes to Brains to Behavior (and Back Again)
 *Mehmet Yanik, Massachusetts Institute of Technology, Cambridge
High-Throughput Neurotechnology
 *Karl Deisseroth, Stanford University, CA
Optical Neuroengineering Technologies for Analysis of Brain Circuits
 *Henrik Ehrsson, Karolinska Institutet, Stockholm, Sweden
Cognitive Neuroscience of Body Self-Perception
 Huda Akil, University of Michigan, Ann Arbor
The Future of Clinical Neuroscience Research: Genomes and Neural Circuits

Thinking About Thinking: How Do We Know What We Know?

Sunday, 20 February 3:00PM-4:30PM
 Organized by: Chloe Kembery and Eva Hoogland, European Science Foundation, Strasbourg, France

SPEAKERS

John David Smith, State University of New York, Buffalo
Recent Developments in the Study of Animal Metacognition
 Josef Perner, University of Salzburg, Austria
Metacognition of Ignorance: What Can Animal Studies Teach Us?
 Joëlle Proust, Institut Jean-Nicod, Paris, France
Thinking About Thinking: Evolutionary, Developmental, and Epistemological Aspects

Nature, Nurture, and Antisocial Behavior: Biological and Biosocial Research on Crime

Monday, 21 February 9:45AM-11:15AM
 Organized by: William Alex Pridemore, Indiana University, Bloomington

SPEAKERS

Adrian Raine, University of Pennsylvania, Philadelphia

A Neurodevelopmental Basis to Criminal Behavior
 Nathalie M.G. Fontaine, Indiana University, Bloomington
Genetic and Environmental Influences on the Development of Callous-Unemotional Traits
 Dustin Pardini, University of Pittsburgh Medical Center, PA
Brain Function Abnormalities Associated with Chronic and Desisting Criminal Behavior

Climate Change

Climate Change: Altering the Physics, Ecology, and Socioeconomics of Fisheries

Friday, 18 February 8:30AM-11:30AM
 Organized by: Rashid Sumaila, University of British Columbia, Vancouver, Canada; William W.L. Cheung, University of East Anglia, United Kingdom

SPEAKERS

Rashid Sumaila, University of British Columbia, Vancouver, Canada
Current Contribution of Global Fisheries to Human Welfare
 Jorge Sarmiento, Princeton University, NJ
Effects of Climate Change on the Biophysics of the Ocean
 William W.L. Cheung, University of East Anglia, United Kingdom
Climate Change and the Ecology of Fish and Fisheries
 Vicky Lam, University of British Columbia, Vancouver, Canada
Climate Change Impacts on Fisheries and Human Welfare
 Moustapha K. Gueye, United Nations Environmental Program, Geneva, Switzerland
Food Security Implications of Climate Change Impacts on Fisheries
 Philippe Cury, Center for Mediterranean and Tropical Fisheries Research, Montpellier, France
Ecosystem-Based Fisheries Management Under Climate Change

Comparing National Responses to Climate Change: Networks of Debate and Contention

Friday, 18 February 1:30PM-4:30PM
 Organized by: Jeffrey P. Broadbent, University of Minnesota, Minneapolis

SPEAKERS

Jeffrey P. Broadbent, University of Minnesota, Minneapolis
Comparing National Responses to Climate Change: Networks, Discourse, and Action
 Dana R. Fisher, Columbia University, New York City
Understanding Political Discourse on Climate Change in U.S. Congressional Hearings
 Sony Pellissery, Institute of Rural

Management, Anand, India
Contestations on Climate Science in the Development Context: The Case of India
 Sun-Jin Yun, Seoul National University, South Korea
Climate Change Media Debates in Korea
 Jun Jin, Tsinghua University, Beijing, China
Role of Chinese Environmental Non-Governmental Organizations in International Talks
 Koichi Hasegawa, Tohoku University, Sendai, Japan
Japan's Climate Change Media and Politics: 2008–2009

Rethinking Adaptation to a Changing Global Environment

Saturday, 19 February 8:00AM-9:30AM
Organized by: Gregory P. Dietl, Paleontological Research Institution, Ithaca, NY

SPEAKERS
 Gregory P. Dietl, Paleontological Research Institution, Ithaca, NY
Cross-Scale Interactions and Adaptation
 John N. Thompson, University of California, Santa Cruz
The Coevolutionary Process Across Constantly Changing Environments
 Geerat J. Vermeij, University of California, Davis
Escalation, Interdependence, and Source Populations

Adapting to a Clear and Present Danger: Climate Change and Ocean Ecosystems

Saturday, 19 February 8:30AM-11:30AM
Organized by: Chad English, Communication Partnership for Science and the Sea, Silver Spring, MD; Scott Doney, Woods Hole Oceanographic Institution, MA; Mary Ruckelshaus, National Oceanic and Atmospheric Administration (NOAA) Northwest Fisheries Science Center, Seattle, WA

SPEAKERS
 Francis Chan, Oregon State University, Corvallis
"A" Is for Anoxia and Acidification: Shifts in Oxygen and Chemistry in Coastal Waters
 J. Emmett Duffy, Virginia Institute of Marine Science, Gloucester Point
Wetlands and Estuaries: How Things Will Change Where the Land Meets the Sea
 Nancy Knowlton, Smithsonian National Museum of Natural History, Washington, DC
Resilient Reefs and Mangroves: Ecosystem-Based Adaptation to Climate Change
 Anne Hollowed, National Marine Fisheries Service, Seattle, WA

From Climate Change to Fish on Your Plate: Managing Fisheries in a Changing World
 *William Sydeman, Farallon Institute for Advanced Ecosystem Research, Petaluma, CA
A Bird's Eye View: What Our Feathered Friends Can Tell Us About Our Changing Oceans

Mary Ruckelshaus, NOAA Northwest Fisheries Science Center, Seattle, WA
Changing Management to Manage Change: New Approaches from Natural and Social Science

In Hot Water: Rising Public Health Concerns from Changing Ocean Conditions

Saturday, 19 February 10:00AM-11:30AM
Organized by: Carolyn Sotka, NOAA Oceans and Human Health Initiative, Charleston, SC; Paul Sandifer, NOAA, Washington, DC

SPEAKERS
 Erin K. Lipp, University of Georgia, Athens
Dust in the Wind: How Global Desertification Is Affecting Pathogenic Marine Vibrios
 Stephanie Moore, NOAA Northwest Fisheries Science Center, Seattle, WA
The Risk Factor: Climate Change Opens Windows of Opportunity for Harmful Algal Blooms
 Sandra McLellan, University of Wisconsin, Milwaukee
When it Rains, It Pours: Climate and Waterborne Disease Transmission in Urban Coastal Ecosystems

Where Ocean Meets Land: Dynamic Shorelines in a Warming World

Saturday, 19 February 1:30PM-4:30PM
Organized by: Charna Meth, Consortium for Ocean Leadership, Washington, DC; Gregory S. Mountain, Rutgers University, Piscataway, NJ

SPEAKERS
 Gregory S. Mountain, Rutgers University, Piscataway, NJ
Introduction: The What, How, and Why of Sea-Level Change
 Craig Fulthorpe, University of Texas, Austin
Sea Level in Deep Time: The Record from Continental Margins
 Alexander Tudhope, University of Edinburgh, Scotland
Sea Level Through the Millennia: The Record from Coral Reefs
 Gary Mitchum, University of South Florida, St. Petersburg
Sea Level on the Human Scale: Tidal Measurements and Satellite Altimetry
 S. Jeffress Williams, U.S. Geological Survey (USGS), Woods Hole, MA
Sea-Level Rise in the Coming Years: Impacts to Dynamic Coasts
 Margaret Davidson, NOAA Coastal Services Center, Charleston, SC
Preparing for the Future: Adaptive Strategies To Deal with Changing Shorelines

Can Reef Fisheries Take the Heat? Ecological and Economic Impacts of Climate Change

Sunday, 20 February 8:30AM-11:30AM
Organized by: Joshua E. Cinner, Australian Research Center, Townsville

SPEAKERS
 Nicholas A.J. Graham, Australian Research Center, Townsville
Impacts of Climate Change to Coral Reef Fishes
 Tim M. Daw, University of East Anglia, United Kingdom
It's Not Just About the Fish! Multiple Pathways of Climate Impacts on Fisheries
 R. Quentin Grafton, Australian National University, Canberra
The Economics of Adapting to Climate Change in Capture Fisheries
 Edward H. Allison, WorldFish Center, Penang, Malaysia
A Global Perspective on the Vulnerability of Societies to the Impacts of Climate Change
 Joshua E. Cinner, Australian Research Center, Townsville
Linking Social Science and Ecology To Confront the Climate Challenge

Changing Climate, Changing Approaches: Conservation in the Face of Climate Change

Sunday, 20 February 8:30AM-11:30AM
Organized by: Michelle M. McClure, NOAA Northwest Fisheries Science Center, Seattle, WA

SPEAKERS
 Peter Kareiva, The Nature Conservancy, Seattle, WA
When Climate Demands New Goals: From Resistance to Resilience to Transformation
 Thomas E. Reed, University of Washington, Seattle
Evolution, Plasticity, and the Challenges of Climate Change for Species Conservation
 Kyle Van Houtan, NOAA Pacific Islands Fisheries Science Center, Honolulu, HI
Sea Turtles, Storms, and Sea Levels
 Russell Brainard, NOAA Pacific Islands Fisheries Science Center, Honolulu, HI
Hard Corals: Assessing Extinction Risk Under Climate Change

Limiting Climate Change: Reducing Black Carbon and Tropospheric Ozone Precursors

Sunday, 20 February 1:30PM-4:30PM
Organized by: Frank Raes, European Commission, Joint Research Center (JRC), Institute for Environment and Sustainability, Ispra, Italy; Geraldine Barry, European Commission, JRC, Brussels, Belgium

SPEAKERS
 Drew Shindell, NASA Goddard Institute for Space Studies, New York City
Limiting Near-Term Climate Change While Improving Human Well-Being
 Teppei Yasunari, NASA Goddard Earth Sciences and Technology Center, Greenbelt, MD
Impacts of Black Carbon (BC) Pollution on Himalayan Glaciers
 Markus Amann, International Institute for Applied Systems Analysis, Laxenburg, Austria

Win-Win and Win-No-Lose Control Measures for Black Carbon and Ozone
 Frank Raes, European Commission, JRC Institute for Environment and Sustainability, Ispra, Italy
Benefits of BC and Tropospheric Ozone Reduction Measures for Climate, Health, and Ecosystems
 Erika Rosenthal, Earthjustice, Washington, DC
Good Practice in Reducing Black Carbon Emissions at the Local Level
 Martin Williams, King's College, London, United Kingdom
Developing Integrated Air Pollution and Climate Change Policies

How Climate Change Affects the Safety of the World's Food Supply

Monday, 21 February 9:45AM-11:15AM
Organized by: Ewen C. Todd, Michigan State University, East Lansing

SPEAKERS
 Sandra A. Hoffman, Resources for the Future, Washington, DC
Climate Change, Food Safety, and Policy Analysis: What Are the Fundamental Challenges?
 Cristina Tirado, University of California, Los Angeles
To be announced online

Research Infrastructures: The Emergence of Key Players for Environmental Research

Monday, 21 February 9:45AM-11:15AM
Organized by: Janine Delahaut, European Commission, Brussels, Belgium; Elena Righi-Steele, European Commission, Brussels, Belgium

SPEAKERS
 Philippe Ciaï, Laboratory of Climate Sciences and Environment, Gif-sur-Yvette, France
Integrated Carbon Observation System To Quantify Greenhouse Gas Fluxes Across Europe
 Massimo Cocco, National Institute of Geophysics and Volcanology, Rome, Italy
European Plate Observing System: A Long-term Integration Plan for Solid Earth Sciences
 Timothy L. Killeen, National Science Foundation (NSF), Arlington, VA
The U.S. Research Infrastructures Program for Environmental Research

Education

Learning Research and Educational Practice: How Can We Make Better Connections?

Friday, 18 February 8:00AM-9:30AM
Organized by: Janice Earle and Soo-Siang Lim, NSF, Arlington, VA

SPEAKERS
 Javier Movellan, University of California, La Jolla
Integration Across Levels of Analysis: Social Robots for Use in Classrooms
 Kenneth Koedinger, Carnegie Mellon University, Pittsburgh, PA
Scaling Up and Scaling Down: Toward a Two-Way Street Between Science and Practice
 Phillip Bell, University of Washington, Seattle
STEM Interest Development and Learning Across Home, School, and Out-of-School Settings

Celebrating Marie Curie's 100th Anniversary of Her Nobel Prize in Chemistry

Friday, 18 February 10:00AM-11:30AM
Organized by: Penny J. Gilmer, Florida State University, Tallahassee; Alan Rocke, Case Western Reserve University, Cleveland, OH

SPEAKERS
 Patricia A. Baisden, Lawrence Livermore National Laboratory, Livermore, CA
Marie Curie, the Premier Chemist, Co-Discoverer of Radiation and Radioactivity
 Pnina G. Abir-Am, Brandeis University, Waltham, MA
Historical Perspectives on the Public Memory of Marie S. Curie
 Julie Des Jardins, Baruch College, New York City
The Marie Curie Complex: The Hidden History of Women in Science

Engaging Students in Undergraduate STEM Education with a Focus on Global Stewardship

Friday, 18 February 1:00PM-2:30PM
Organized by: Jay B. Labov, National Academy of Sciences, Washington, DC; Catherine Middlecamp, University of Wisconsin, Madison; Melvin D. George, University of Missouri, Columbia

SPEAKERS
 Susan Singer, Carleton College, Northfield, MN
Evidence of What Works in Undergraduate STEM Education
 Catherine Middlecamp, University of Wisconsin, Madison
Matching Our Curriculum to Our Planet: An Interdisciplinary Approach
 Judith Ramaley, Winona State University, MN
Bringing Together STEM and Global Sustainability Communities: Next Steps for Academe

Just-in-Time Support for Science Teaching: Web-Based Approaches

Friday, 18 February 1:30PM-4:30PM
Organized by: Nancy P. Moreno and Deanne B. Erdmann, Baylor College of Medicine, Houston, TX

SPEAKERS
 Nancy P. Moreno, Baylor College of Medicine, Houston, TX

Online Educator Support: What Works?
 Marsha Maytas, American Physiological Society, Bethesda, MD
Frontiers in Physiology: Promoting Teacher Reflection and Interaction Online
 Vikram Savkar, Scitable by Nature Education, Cambridge, MA
The Issue of Currency in Teaching Training
 Deanne B. Erdmann, Baylor College of Medicine, Houston, TX
Tips for Designing Successful Online Courses and Workshops
 David Micklos, Cold Spring Harbor Laboratory, NY
Search Engine Optimization To Increase Audiences for Online Science Education
 Louisa Stark, University of Utah, Salt Lake City
Multimedia Approaches to Supporting Teachers in Implementing Curriculum Materials

The Challenge of Teaching Evolution in the Islamic World

Friday, 18 February 3:00PM-4:30PM
Organized by: Eugenie C. Scott, National Center for Science Education, Oakland, CA

SPEAKERS
 Taner Edis, Truman State University, Kirksville, MO
A Brief History of Islamic Creationism in Turkey
 Jason R. Wiles, Syracuse University, NY
Teaching and Learning About Biological Evolution in the Muslim World
 Salman Hameed, Hampshire College, Amherst, MA
The Future of Acceptance of Evolution in the Muslim World

Invisible Men? Addressing the Participation of Minority Males in Science and Engineering

Saturday, 19 February 8:00AM-9:30AM
Organized by: Catherine Didion, National Academy of Engineering, Washington, DC

SPEAKERS
 Eric Jolly, Science Museum of Minnesota, St. Paul
Addressing the Dearth of Native American Males in Science and Engineering
 Florence Bonner, Howard University, Washington, DC
African American Males in Higher Education: Diminishing Returns
 Carlos Rodríguez, American Institutes for Research, Washington, DC
Cultural Competency Curriculum Modules: How To Effectively Reach Diverse Students

The University of the Future

Saturday, 19 February 8:30AM-11:30AM
Organized by: Robert M. Nerem, Georgia Institute of Technology, Atlanta; James J. Duderstadt, University of Michigan, Ann Arbor

SPEAKERS

*Bruce M. Alberts, AAAS/*Science*, Washington, DC
Getting To Know Each Other Better: Repairing Growing Misunderstanding and Distrust
 Mohamed H. Hassan, Third World Academy of Sciences, Trieste, Italy
Overshadowed by Oil: Reaching Out to Developing Countries in the Organization of the Islamic Conference
 Magdi Yacoub, Imperial College London, United Kingdom
A Country in Focus: Egypt's Decade of Science

Cross-Border Responses to Global Challenges: Can Everybody Win?

Friday, 18 February 1:00PM-2:30PM
Organized by: David Wilkinson, and Geraldine Barry, European Commission, JRC, Brussels, Belgium

SPEAKERS

William B. Bonvillian, Massachusetts Institute of Technology, Washington, DC
The Challenge of Pioneering Knowledge
 David Wilkinson, European Commission, JRC, Brussels, Belgium
The Challenge of Formulating and Feeding Scientific Advice into International Policy-Making
 Martin Schuurmans, European Institute of Innovation and Technology, Budapest, Hungary
The Challenge of Stimulating World-Leading Innovations

International Territory: Science at Sea, Science in Space, and Science at the Poles

Friday, 18 February 3:00PM-4:30PM
Organized by: Charna Meth, Consortium for Ocean Leadership, Washington, DC; Susan Humphris, Woods Hole Oceanographic Institution, MA

SPEAKERS

Elizabeth Screation, University of Florida, Gainesville
Science at Sea: Twenty-Four Countries Exploring the Seafloor
 Sunita L. Williams, NASA Johnson Space Center, Houston, TX
Science in Space: Five Agencies Operating in Zero Gravity
 George Watters, NOAA Fisheries Service, La Jolla, CA
Science at the Poles: Twenty-Five Countries Protecting Living Resources

Europe, Africa, and Asia: Rising on the Same Tide

Saturday, 19 February 8:00AM-9:30AM
Organized by: Geraldine Barry, European Commission, JRC, Brussels, Belgium

SPEAKERS

Robert-Jan Smits, European Commission, JRC, Brussels, Belgium
A United Europe of Innovation States: Can It Be Done?
 Surin Pitsuwan, Association of Southeast Asian Nations (ASEAN), Jakarta, Indonesia
ASEAN: Shifting to a More Environmental Perspective

Networks, Collaboration, and Research in a Non-Western Context: The Role of Technology

Saturday, 19 February 8:00AM-9:30AM
Organized by: B. Paige Miller, University of Wisconsin, River Falls; Ricardo B. Duque, University of Vienna, Austria

SPEAKERS

B. Paige Miller, University of Wisconsin, River Falls
Gendered Networks and Technology Use: Examining Female Researchers Careers Over Time
 Marcus A. Ynalvez, Texas A&M International University, Laredo
Networks, Collaboration, and Productivity in Resource-Rich Research Institutions in a Non-Western Context
 Wesley M. Shrum, Louisiana State University, Baton Rouge
Mobile Knowledge: Does the Impact of Cell Phones Depend on Development?

Research Integrity in the Global Perspective

Saturday, 19 February 8:30AM-11:30AM
Organized by: Melissa S. Anderson, University of Minnesota, Minneapolis

SPEAKERS

Nicholas H. Steneck, University of Michigan, Ann Arbor
Research Integrity as a Global Concern
 Wei Yang, Zhejiang University, Hangzhou, China
Integrity in Chinese-U.S. Collaborative Science
 Carthage Smith, International Council for Science, Paris, France
The Role of the International Council for Science in Promoting Research Integrity
 Ren Yi, University of Southern Queensland, Toowoomba, Australia
Government and Institutional Policies on Research Integrity: Australian Perspective
 Melissa S. Anderson, University of Minnesota, Minneapolis
Empirical Evidence on Integrity in International Research Collaborations

Foreign Participation in National Technology Development Programs

Saturday, 19 February 3:00PM-4:30PM
Organized by: Christopher Hill, George Mason University, Arlington, VA; George R. Heaton Jr., Technology Policy International, Newton Center, MA; David Cheney, SRI International, Arlington, VA

SPEAKERS

Patrick Windham, Stanford University, CA
A Survey of National Policies Toward Non-National Participation in Technology Programs
 Astrid-Christina Koch, EU Delegation to the United States, Washington, DC
Encouraging Foreign Participation in the EU Framework Program
 Atsushi Sunami, National Graduate Institute for Policy Studies, Tokyo, Japan
Toward the Creation of an Asian Research Area: The Initial Step

Joining Global Efforts in Post-Disaster Recovery and Reconstruction

Sunday, 20 February 8:00AM-9:30AM
Organized by: Delilah Al Khudhairi, European Commission, JRC Institute for the Protection and Security of the Citizen, Ispra, Italy; Geraldine Barry, European Commission, JRC, Brussels, Belgium

SPEAKERS

Stuart Gill, The World Bank, Washington, DC
The Post-Disaster Needs Assessment Process: Model, Tools, and Recommendations
 Francesco Pisano, United Nations Institute for Training and Research, Geneva, Switzerland
The Role of Geospatial Information in Post-Crisis Damage Assessment
 Delilah Al Khudhairi, European Commission, JRC Institute for the Protection and Security of the Citizen, Ispra, Italy
Technological Advances and Challenges for Operational Post-Disaster Damage Assessment

Bridging Nations and Fields: East Asian Approaches to Science and Technology Policy

Sunday, 20 February 8:30AM-11:30AM
Organized by: Asuka Hoshikoshi, National Institute of Science and Technology Policy (NISTEP), Tokyo, Japan

SPEAKERS

Suk Joon Kim, Science and Technology Policy Institute, Seoul, South Korea
S&T Cooperation for Global Green Growth: Issues and Initiatives
 June Seung Lee, Korea Institute of Science and Technology Evaluation and Planning, Seoul
Korea's S&T Knowledge-Sharing Activities with Developing Countries
 Rongping Mu, Chinese Academy of Sciences, Beijing
Innovation as a Social Process: New Framework of Innovation Policy in China
 Kumi Okuwada, NISTEP, Tokyo, Japan
A New Foresight Breaking Up the Borders
 Terutaka Kuwahara, NISTEP, Tokyo, Japan
Issues and Challenges of the Japanese S&T Policy in the Next Decade

Bringing Innovation to International Development: New Actors, New Mechanisms

Sunday, 20 February 1:30PM-4:30PM
Organized by: Tiora V. Jones and Alex Deghan, U.S. Agency for International Development (USAID), Washington, DC; Mark Doyle, NSF, Arlington, VA

SPEAKERS

Alex Dehgan, USAID, Washington, DC
USAID and NSF: Partnerships in Science for Development
 Robynn K. Strum, Office of Science and Technology Policy, Washington, DC
New Approaches to International Development Through the USG
 Akira Nakanishi, Japan Science and Technology Agency, Tokyo
Science and Technology Partnerships for Sustainable Development: Messages from Japan
 Peter H. Diamandis, X PRIZE Foundation, Playa Vista, CA
Prizes and Promise for International Development
 Rob Horsch, Bill and Melinda Gates Foundation, Seattle, WA
Foundations and Government: New Partners in Development
 Dan Chorian, Nike, Beaverton, OR
Nike Launch: Using S&T To Redefine How We Do Business in the Developing World

The Practice of Science Diplomacy in the Earth Sciences

Sunday, 20 February 1:30PM-4:30PM
Organized by: Thomas J. Casadevall, USGS, Denver, CO; Ester Szein, The National Academies, Washington, DC; Melody Brown Burkins, University of Vermont, Burlington

SPEAKERS

Eric Calais, Purdue University, West Lafayette, IN
The January 12, 2010, Haiti Earthquake: A Science Diplomacy Opportunity
 Julie L. Kunen, U.S. Agency for International Development (USAID), Washington, DC
Science Diplomacy for Development at USAID
 Jeff L. Doebrich, USGS, Reston, VA
Science in Support of Economic Development and Stabilization in Iraq and Afghanistan
 Pedro Sánchez, The Earth Institute at Columbia University, Palisades, NY
Soil Science-Based Policies Reducing World Hunger in Tune with the Environment
 John S. Pallister, USGS Cascades Volcano Observatory, Vancouver, WA
Volcano Science Diplomacy
 Jonathan T. Overpeck, University of Arizona, Tucson
The IPCC, International Science Diplomacy, and the Challenge of Climate Change

Can Global Science Solve Global Challenges?

Monday, 21 February 9:45AM-11:15AM
Organized by: Tracey Elliott, Royal Society, London, United Kingdom

SPEAKERS

Chris Llewellyn Smith, University of Oxford, United Kingdom
Global Approaches to Global Problems
 *Vaughan Turekian, AAAS Center for Science Diplomacy, Washington, DC
The Changing Balance of Power in Global Science: A U.S. Perspective
 Mohamed H. Hassan, Third World Academy of Sciences, Trieste, Italy
Solving Global Challenges Through Scientific Collaboration

Human Biology and Health**Evolutionary Personalized Medicine**

Friday, 18 February 8:00AM-9:30AM
Organized by: Turkan K. Gardenier, Pragmatica Corp., Vienna, VA

SPEAKERS

Sholom Wacholder, NIH, Bethesda, MD
Lessons Learned from Genetic and Epidemiologic Studies of Cancer
 Knut M. Wittkowski, Rockefeller University, New York City
µGWAS on a Grid Enabling Small Sample Screening for Common Complex Conditions
 Alan Shuldiner, University of Maryland, Baltimore
Directing the Course of Treatment with Pharmacogenomics

Global Health Care: Advances and Challenges

Friday, 18 February 8:30AM-11:30AM
Organized by: Metin Akay, University of Houston, TX

SPEAKERS

*Jeanne Shaheen, U.S. Senate, Washington, DC
Smart Global Health-Care Policy
 Susan Blumenthal, Georgetown School of Medicine, Washington, DC
Global Health Challenges and Opportunities
 Jon Skinner, Dartmouth Institute for Health Policy and Clinical Practice, Hanover, NH
Global Health-Care Productivity
 Felix Frueh, Medco Health Solutions, Bethesda, MD
A Real-World Perspective on Pharmacogenetics in Clinical Practice
 John T. McDevitt, Rice University, Houston, TX
A Point-of-Care Test To Assess CD4 Counts in the Developing World
 Jay H. Sanders, Global Telemedicine Group, McLean, VA
Global Telemedicine and Local Health Care: Advances and Challenges

The Human Body as Supra-Organism, Microbial Observatory, and Ecosystem at Risk

Friday, 18 February 10:00AM-11:30AM
Organized by: David A. Relman, Stanford University, Palo Alto, CA; Jeffrey I. Gordon, Washington University School of Medicine, St. Louis, MO

SPEAKERS

David A. Relman, Stanford University, Palo Alto, CA
Perturbation of the Human Microbiome: Unrest at Home
 Jeffrey I. Gordon, Washington University School of Medicine, St. Louis, MO
Dining in with Trillions of Friends: Our Gut Microbiome and Nutritional Status
 *Jeremy K. Nicholson, Imperial College London, United Kingdom
Human Metabolism from a Microbial Perspective

Epigenetic Processes in Development: Gene-Environment Interplay

Friday, 18 February 1:30PM-4:30PM
Organized by: Stephen J. Suomi, NIH, Bethesda, MD; Jeanne Brooks-Gunn, Columbia University, New York City

SPEAKERS

Steven Cole, University of California, Los Angeles
Social Regulation of Human and Nonhuman Primate Gene Expression
 Stephen J. Suomi, NIH, Bethesda, MD
Risk, Resilience, and Gene-Environment Interplay in Primates
 Jeanne Brooks-Gunn, Columbia University, New York City
Gene-Environment Interplay in a Family and Neighborhood Context
 W. Thomas Boyce, University of British Columbia, Vancouver, Canada
Early Experience, the Brain, and Human Development: The HELP Project

Reducing the Cost of Health Care Through Science and Engineering

Friday, 18 February 1:30PM-4:30PM
Organized by: Raphael C. Lee, University of Chicago, IL; Anice Anderson, Private Consultant, Terre Haute, IN

SPEAKERS

Tomas J. Philipson, University of Chicago, IL
The Impact of Technology and Innovation on U.S. Health-Care Cost
 Francis Collins, NIH, Bethesda, MD
The Trend Toward Personalized Medicine and Its Economic Impact
 William A. Hawkins, Medtronic Inc., Minneapolis, MN
Advanced Medical Technologies Improve Quality of and Prolong Life
 David O. Meltzer, University of Chicago, IL
Balancing the Effectiveness and Costs of

Drugs and Devices

Joseph V. Bonventre, Harvard-MIT Health Science and Technology Division, Boston, MA
Training of Physician-Scientists Adept with Advanced Technology

Medicine Safety in a World of Science Without Borders

Saturday, 19 February 8:00AM-9:30AM
Organized by: William T. Beck, University of Illinois, Chicago; Guill Wientjes, Ohio State University, Columbus

SPEAKERS

Zachary Shriver, Harvard–Massachusetts Institute of Technology, Cambridge
Structural and Biological Aspects of Heparin Impurities and Contaminants
Robert Linhardt, Rensselaer Polytechnic Institute, Troy, NY
Heparin and Other Polydisperse Drugs: How To Monitor Their Safety
Ali Al-Hakim, U.S. Food and Drug Administration, Silver Spring, MD
Impact of Heparin Crisis on Public Standards and Regulatory Process

Personalized Medicine: Moving Forward or Backward?

Saturday, 19 February 10:00AM-11:30AM
Organized by: Jennie C. Hunter-Cevera, RTI International, Research Triangle Park, SC; Anice Anderson, Private Consultant, Terre Haute, IN

SPEAKERS

Susan Sumner, RTI International, Research Triangle Park, NC
Personalized Medicine Studies in Obesity
Karen E. Nelson, J. Craig Venter Institute, Rockville, MD
The Human Microbiome
Michael Amos, NIST, Gaithersburg, MD
Measurement Science: A Key to Reducing the Cost and Improving the Quality of Health Care in the 21st Century

Anthropology and Global Health: Genes, Biology, and Culture

Saturday, 19 February 1:30PM-4:30PM
Organized by: Cynthia M. Beall, Case Western Reserve University, Cleveland, OH

SPEAKERS

Anna Di Rienzo, University of Chicago, IL
Adaptation to Climate and Susceptibility Genes for Diseases of Global Significance
*Peter Zimmerman, Case Western Reserve University School of Medicine, Cleveland, OH
Susceptibility to Plasmodium vivax Malaria: New Perspectives from Madagascar
Kathleen Barnes, Johns Hopkins School of Medicine, Baltimore, MD
The Hygiene Hypothesis and Vulnerability to Asthma
David Van Sickle, University of Wisconsin, Madison
Cultural Variation in Diagnosis and

Management of Asthma

*Margaret Bentley, University of North Carolina, Chapel Hill
Improving Growth and Development Under Conditions of Under or Overnutrition
Marcia Inhorn, Yale University, New Haven, CT
Assisted Reproduction, Islamic Bioethics, and Middle Eastern Technosc

Diseases Without Borders: TB and AIDS

Saturday, 19 February 1:30PM-4:30PM
Organized by: Anne E. Goldfeld, Harvard Medical School, Boston, MA

SPEAKERS

Anne Goldfeld, Harvard Medical School, Boston
Science Across Borders and Access to TB and AIDS Care in Africa and Asia
Gail Cassell, Eli Lilly and Company, Indianapolis, IN
Drug-Resistant TB: A Disease with No Borders
Beatrice Hahn, University of Alabama, Birmingham
Crossing the Species Barrier: Origin of Human AIDS and Malaria in Wild-Living Apes
Stefan H.E. Kaufmann, Max Planck Institute for Infection Biology, Berlin, Germany
Biomarkers and Vaccines Across Borders

Humans Without Borders: Evolutionary Processes at Work In Humans and Their Relatives

Sunday, 20 February 8:00AM-9:30AM
Organized by: James J. Smith, Michigan State University, East Lansing; Robin Smith, National Evolutionary Synthesis Center, Durham, NC

SPEAKERS

Greg Wray, Duke University, Durham, NC
Evolution of Malaria Resistance in Baboons: Hope for Humans?
Nina Jablonski, Pennsylvania State University, University Park
Human Skin Pigmentation as an Example of the Action of Natural Selection
Sarah Tishkoff, University of Pennsylvania, Philadelphia
Evolution of Lactose Tolerance in Human Populations in Africa

Oral Clefts: Equal Opportunity Disorders

Sunday, 20 February 1:00PM-2:30PM
Organized by: Margarita Zeichner-David, University of Southern California, Los Angeles

SPEAKERS

Terry Beaty, John Hopkins Bloomberg School of Public Health, Baltimore, MD
Oral Clefts: Moving from Genome-Wide Studies Toward Functional Genomics
Mary Marazita, University of Pittsburgh, PA
Insights into the Genetics and Phenotypes of Cleft Lip and Palate from International Collaboration

Mark Urata, Childrens Hospital Los Angeles
Treatment of Oral Clefts

Oral Sex Is Sex and Can Lead to Cancer

Sunday, 20 February 10:00AM-11:30AM
Organized by: Margarita Zeichner-David, University of Southern California, Los Angeles

SPEAKERS

Bonnie Halpern-Felsher, University of California, San Francisco
Adolescents and Oral Sex: Is It Really Something To Worry About?
Maura L. Gillison, Ohio State University, Columbus
Oral Sex and Risk for Oral HPV Infection and Oropharyngeal Cancer
Diane Harper, University of Missouri, Kansas City
HPV: What New Places Does It Live, What New Diseases Does It Cause?

One Health: From Ideas to Implementation, Rhetoric to Reality

Sunday, 20 February 1:30PM-4:30PM
Organized by: Barbara Hyde, American Society for Microbiology, Washington, DC

SPEAKERS

Stanley Maloy, San Diego State University, CA
Overview of One Health: People, Animals, and the Environment
Tracey S. McNamara, Western University of Health Medicine, Pomona, CA
The Role of Animal Surveillance in Detecting Emerging Infectious Diseases
Stephen S. Morse, Columbia University, New York City
Global Monitoring of Emerging Infectious Diseases: Predicting Outbreaks by Monitoring
Larry Madoff, Massachusetts Department of Health, Boston
One Health in Action: Monitoring Emerging Disease Threats on the Internet

The Surprising Influenza H1N1 Pandemic, Waves I and II: The Race to Vaccinate

Sunday, 20 February 3:00PM-4:30PM
Organized by: M. Elizabeth Halloran, University of Washington, Seattle

SPEAKERS

Ira M. Longini Jr., University of Washington, Seattle
View from Science and Modeling
Robin A. Robinson, U.S. Department of Health and Human Services, Washington, DC
View from Making Policy
Richard Knox, National Public Radio, Washington, DC
View from the Reporter: Compiling and Telling the Story

Interfering with Gene Expression and Interfering with Disease

Monday, 21 February 9:45AM-12:45PM
Organized by: Judy Lieberman, Harvard Medical School, Boston, MA

SPEAKERS

Robert Darnell, Rockefeller University, New York City
Identifying microRNA-Regulated Genes
Klaus Rajewsky, Harvard Medical School, Boston, MA
microRNAs that Regulate the Immune Response
Paloma Giangrande, University of Iowa Health Care, Iowa City
Aptamer-siRNA Chimeras for Targeting Prostate Cancer
Judy Lieberman, Harvard Medical School, Boston, MA
Interfering with Sexually Transmitted Infection
John Maraganore, Alnylam Pharmaceuticals, Cambridge, MA
Interfering with Disease

Land and Oceans

From Practice to Theory and Back: Ecosystem Services and Marine Spatial Planning

Friday, 18 February 8:00AM-9:30AM
Organized by: Anne Guerry, Stanford University, CA; Mary Ruckelshaus, NOAA Northwest Fisheries Science Center, Seattle, WA; Paul Sandifer, NOAA, Washington, DC

SPEAKERS

Paul Sandifer, NOAA, Washington, DC
Where the Rubber Meets the Road: Using Ecosystem Services in Marine Decision-Making
Mary Ruckelshaus, NOAA Northwest Fisheries Science Center, Seattle, WA
The Blueprint: Building Ecosystem Services into Marine Spatial Planning
Anne Guerry, Stanford University, CA
Getting Under the Hood: Models for Sound Science and Effective Decision-Making

Beyond Lines on Maps: Marine Spatial Planning for a Dynamic World

Friday, 18 February 8:30AM-11:30AM
Organized by: Karen L. McLeod, Oregon State University, Corvallis; Donald F. Boesch, University of Maryland Center for Environmental Science, Cambridge

SPEAKERS

Heather Leslie, Brown University, Providence, RI
New Insights for Marine Spatial Planning Through the Lens of Ecological Resilience
Margaret Anne McManus, University of Hawaii of Manoa, Honolulu
Climate, Currents, and Connectivity: The Dynamics of Larval Dispersal

Dale Haidvogel, Rutgers University, New Brunswick, NJ
Making Sense of Variability and Change in Oceans: Lessons from U.S. GLOBEC
Heather Tallis, Stanford University, CA
Ecosystem Services for the Future: A Marriage of Biophysical and Social Variability
Meg Caldwell, Stanford University, CA
An Ocean Policy Triple Play? Flexible Governance, Certainty, and Ecosystem Protection
Donald F. Boesch, University of Maryland Center for Environmental Science, Cambridge
Expecting the Unexpected: An Adaptive Vision for Marine Spatial Planning

2050: Will There Be Fish in the Ocean?

Friday, 18 February 1:30PM-4:30PM
Organized by: Villy Christensen, University of British Columbia, Vancouver, Canada

SPEAKERS

Reg Watson, University of Tasmania, Hobart, Australia
Making Fishing Effort in the World Ocean Sustainable: Lessons from Historic Trends
Villy Christensen, University of British Columbia, Vancouver, Canada
Biomass of Fish in the World Ocean, 1950–2050: A Century of Decline?
Jacqueline Alder, United Nations Environment Program, Nairobi, Kenya
The Oceans in 2050: Marine Biodiversity Outlook After CBD 2010
Siwa Msangi, International Food Policy Research Institute, Washington, DC
Fish to 2030: Meeting the Steadily Increasing Demand for Fish
Henrik Österblom, Stockholm Resilience Center, Stockholm, Sweden
Emerging Global Social Networks To Counter the Fisheries Crisis
Rashid Sumaila, University of British Columbia, Vancouver, Canada
How Can Ecosystem Policies Help Avoid Future Collapses in the World Fisheries?

GM Crop Regulations: Safety Net or Insurmountable Obstacle?

Friday, 18 February 1:30PM-4:30PM
Organized by: Donald P. Weeks, University of Nebraska, Lincoln; Wayne Parrott, University of Georgia, Athens; Alan McHughen, University of California, Riverside

SPEAKERS

Nina Fedoroff, Pennsylvania State University, University Park
Why We Need To Craft Science-Based Regulations for GM Crops and Animals in the United States
Roger Beachy, U.S. Department of Agriculture, Washington, DC
The Success and Safety of Transgenic Crops and Foods
Kent Bradford, University of California, Davis
The Promise of Safe, Nutritious, and More Enjoyable Foods From Transgenic Plants

Drew L. Kershen, University of Oklahoma, Norman
The Present Regulatory Systems, Their Complexity, and Costs
Hector Quemada, Donald Danforth Plant Science Center, St. Louis, MO
Challenges in the Development of Transgenic Crops by the Public Sector
Alan McHughen, University of California, Riverside
Whither “Orphan” GM Specialty and Small Market Crops?

Norman Borlaug’s Impact on World Agriculture: Will There Be a Second Green Revolution?

Friday, 18 February 1:30PM-4:30PM
Organized by: Edward Runge, Texas A&M University, College Station; Ronald L. Phillips, University of Minnesota, St. Paul

SPEAKERS

Ronald L. Phillips, University of Minnesota, St. Paul
Norman Borlaug and the Future of the Green Revolution
Peter Langridge, University of Adelaide, Australia
Science Needed To Feed 9.5 Billion People, Sustainably and with Reduced Inputs
Usha Barwale-Zehr, Maharashtra Hybrid Seeds Company Limited, Jalna, India
Educating Farmers, the Public, and Policy-Makers
Mark W. Rosegrant, International Food Policy Research Institute, Washington, DC
Trade-Offs and a Food Production Road Map for 2050

Marine Spatial Planning: A Science-Based Tool for Conservation and the Economy

Saturday, 19 February 8:30AM-11:30AM
Organized by: Elliott A. Norse, Marine Conservation Biology Institute, Bellevue, WA

SPEAKERS

Alan Thornhill, U.S. Department of the Interior, and Sally Yozell, U.S. Department of Commerce, Washington, DC
U.S. Implementation of Ecosystem-Based Marine Spatial Planning
Lance Morgan, Marine Conservation Biology Institute, Glen Ellen, CA
A Biogeographic/Ecosystem Framework for Marine Spatial Planning
Charles Wahle, NOAA, Monterey, CA
Understanding Ocean Uses: The Heart of Coastal and Marine Spatial Planning
John Annala, Gulf of Maine Research Institute, Portland, ME
Impacts of Marine Spatial Planning on Commercial and Recreational Fisheries
Sarah Carr, NatureServe, Arlington, VA
Analytical Tools for Visualizing Geographic Data and Generating Zoning Scenarios
Steven Gaines, University of California, Santa Barbara

Maximizing Ecosystem and Economic Resilience in a Variable and Changing World

Plant Breeding Today: Genomics and Computing Advances Bring Speed and Precision

Saturday, 19 February 10:00AM-11:30AM
Organized by: Ian Graham and Elspeth Bartlett, University of York, United Kingdom

SPEAKERS

Ian Graham, University of York, United Kingdom
Molecular Approaches Speed Up Plant Breeding of Medical and Developing Country Crops
Edward S. Buckler, Cornell University, Ithaca, NY
Dissecting the Genetics of Complex Agronomic Traits for Crop Improvement
*Susan Rotherford McCouch, Cornell University, Ithaca, NY
Discovery of Genes for Crop Improvement from Wild Ancestor Plants

Global and Local Responses to the Nitrogen Challenge: Science, Practice, and Policy

Saturday, 19 February 1:30PM-4:30PM
Organized by: Todd S. Rosenstock and Thomas P. Tomich, University of California, Davis

SPEAKERS

Walter V. Reid, David and Lucile Packard Foundation, Los Altos, CA
Bridging the Nitrogen Science and Policy Divide
Cheryl A. Palm, Earth Institute, Palisades, NY
Nitrogen, Development, and Sustainability: Trade-Offs Between Too Little and Too Much
Alan R. Townsend, University of Colorado, Boulder
Catch 22: The Nitrogen Cycle and Human Welfare
Thomas P. Tomich, University of California, Davis
A Framework for Action: Lessons from the California Nitrogen Assessment
Cliff Snyder, International Plant Nutrition Institute, Conway, AZ
Nitrogen Stewardship: Balancing Crop Production Management and Environmental Protection

A New Vision for Research: Goals for the National Institute of Food and Agriculture

Sunday, 20 February 8:30AM-11:30AM
Organized by: Roger Beachy, U.S. Department of Agriculture, Washington, DC; Brian A. Larkins, University of Arizona, Tucson

SPEAKERS

Roger Beachy, U.S. Department of Agriculture, Washington, DC
Restructuring Research To Meet Agricultural Needs
Keith Yamamoto, University of California, San Francisco

The New Biology: Agriculture's Role in Meeting Societal Grand Challenges
Steve E. Koonin, U.S. Department of Energy, Washington, DC

Role of DOE-NIFA Collaborations in Achieving Renewable Bioenergy Goals
Nicholas Kalaitzandonakes, University of Missouri, Columbia
Fostering Rural Prosperity and Ensuring Environmental Sustainability

Global Agricultural History: Mapping the Past for Modeling the Future

Sunday, 20 February 8:30AM-11:30AM
Organized by: William E. Doolittle, University of Texas, Austin; Mats Widgren, Stockholm University, Sweden

SPEAKERS

William E. Doolittle, University of Texas, Austin
Farming on and Transformation of Turtle Island, Native North America
William I. Woods, University of Kansas, Lawrence
Agriculture on the Hollow Continent, South America AD 1000-1800
Mats Widgren, Stockholm University, Sweden
Mapping Pre-Colonial African Agricultural Systems
Janek Myrdal, Swedish University of Agricultural Sciences, Uppsala
Agricultural Systems of Eurasia AD 1000, 1500, 1800
Ulf Jonsson, Stockholm University, Sweden
The Great Leap Forward: Changing Flows and Commercial Patterns of Land Use

Invasive Species: What Harm Do They Do?

Sunday, 20 February 8:30AM-11:30AM
Organized by: Peter Alpert, Invasive Species Advisory Committee, Amherst, MA

SPEAKERS

Carla D'Antonio, University of California, Santa Barbara
Earth, Water, and Fire: Effects of Invasive Species on Ecological Processes
Susan Williams, University of California, Bodega Bay
From Sea to Sea: Effects of Invasive Species in Marine Systems
Mark Davis, Macalester College, St. Paul
Invasive Species: The Importance of Distinguishing Harm from Change
Jason Shogren, University of Wyoming, Laramie
Valuing Invasive Species Control
David M. Lodge, University of Notre Dame, IN
Science Informing Policy: Risk Assessment for Invasive Species

Lost at Sea: Where Are the Humans in Marine Ecosystem Management?

Sunday, 20 February 1:30PM-4:30PM
Organized by: Rebecca Gruby, Morgan Gopnik, and Larry Crowder, Duke University Marine Laboratory, Beaufort, NC

SPEAKERS

Sue Ranger, Marine Conservation Society, Ross on Wye, United Kingdom
Foundations for Management of a Marine Turtle Fishery in the Turks and Caicos Islands
Morgan Gopnik, Duke University Marine Laboratory, Beaufort, NC
Don't Leave Marine Spatial Planning to the Experts
Xavier Basurto, Duke University Marine Laboratory, Beaufort, NC
Taking Human Institutions Seriously in the Study of Coastal Social-Ecological Systems
Leila Sievanen, Center for Environmental Studies, Brown University, Providence, RI
Including Humans: Placing People in Marine Ecosystem-Based Management
Betsy Beymer, University of Illinois, Urbana
Desirable States: The Politics of Resilience Thinking
Kevin St. Martin, Rutgers University, Piscataway, NJ
Enacting Human Dimensions of Marine Ecosystem-Based Management in Maine and Norway

Fishing for Solutions: Community Institutions for Effective Resource Management

Monday, 21 February 9:45AM-12:45PM
Organized by: Astrid J. Scholz, Ecotrust, Portland, OR

SPEAKERS

Seth Macinko, University of Rhode Island, Kingston
The Political Economy of Fisheries Management in the United States
Bonnie McCay, Department of Human Ecology, New Brunswick, NJ
The Human Dimension of Fisheries: People, Places, and Their Adaptive Responses
Rashid Sumaila, University of British Columbia, Vancouver, Canada
A Cautionary Note on Individual Transferable Quotas
J. Marty Anderies, Arizona State University, Tempe, AZ
Design Principles for Robust Fisheries Governance Systems
John O. Ledyard, California Institute of Technology, Pasadena, CA
Design Matters: Applied Approaches to Creating Effective Fisheries Management Systems
Astrid J. Scholz, Ecotrust, Portland, OR
Communities and Catch Shares: Results from an Interdisciplinary Analysis

The Science Endeavor

Perspectives on Research and Development in the President's FY 2012 Budget Request

Friday, 18 February 8:30AM-11:30AM
Organized by: Patrick J. Clemins, AAAS Science and Policy Programs, Washington, DC

SPEAKERS

Patrick J. Clemins, AAAS Science and Policy Programs, Washington, DC
R&D Investment in the FY 2012 Budget Request: A Preliminary Analysis
Kei Koizumi, Office of Science and Technology Policy, Executive Office of the President, Washington, DC
Perspectives from the Obama Administration
*Dahlia Sokolov, U.S. House Committee on Science and Technology, Washington, DC
Perspectives from Congress
*Howard Gobstein, Association of Public and Land-grant Universities, Washington, DC
Perspectives from Academia
*Jere Glover, Small Business Technology Council, Washington, DC
Perspectives from Small Business
*Manfred Horvat, Vienna University of Technology, Austria
Perspectives from the International Community

Measurements as a Cornerstone of Global Trade and Quality of Life

Friday, 18 February 10:00AM-11:30AM
Organized by: David Anderson, European Commission, JRC Institute for Reference Materials and Measurements, Geel, Belgium; Geraldine Barry, European Commission, JRC, Brussels, Belgium

SPEAKERS

Christine M. Pfeiffer, Centers for Disease Control and Prevention, Atlanta, GA
Nutrition: Obtaining Reliable Data To Study the Health Status of the U.S. Population
Hun Young So, Korean Research Institute of Standards and Science, Yuseong Daejeon
Data for Environmental Monitoring and Protection: Who Can You Trust?
Hendrik Emons, European Commission, JRC Institute for Reference Materials and Measurements, Geel, Belgium
Challenges for Reliable Measurements Across the Boundaries Physics-Chemistry-Biology

Networks and Culture of Scientific and Technological Communities in Global Policy

Friday, 18 February 1:00PM-2:30PM
Organized by: Darryl Farber and Denis F. Simon, Pennsylvania State University, University Park

SPEAKERS

Caroline Wagner, Pennsylvania State University, University Park
The New Invisible College: Science as Social Network
Denis F. Simon, Pennsylvania State University, University Park
The Evolving Fabric of Innovation in China: Creativity, Communities, and Complexities
Judi Wakhungu, African Center for Technology Studies, Nairobi, Kenya
S&T Policy Networks and Human Well-Being in Africa

Solving the Weight of Evidence Problem: A Way Forward?

Friday, 18 February 3:00PM-4:30PM
Organized by: Heather E. Douglas, University of Tennessee, Knoxville

SPEAKERS

Jacob Stegenga, University of California, La Jolla
The Subjectivity of Meta-Analysis in Practice
Lorenz Rhomberg, Gradient Corp., Cambridge, MA
Weight of Evidence Frameworks in the Regulatory Context: A Conceptual Comparison
Heather E. Douglas, University of Tennessee, Knoxville
Explanations, Predictions, and Weight of Evidence: Rigor with a Qualitative Approach?

Publication Without Borders: Spawning Countries, Disciplines, Audiences, and Roles

Saturday, 19 February 8:00AM-9:30AM
Organized by: Barbara Gastel, Texas A&M University, College Station

SPEAKERS

Deborah L. Partain, Texas A&M University, College Station
From Ship to Shore: Publication Support in the Integrated Ocean Drilling Program
Banalata Sen, National Institute of Environmental Health Sciences, Research Triangle Park, NC
Environmental Health Perspectives: An Interdisciplinary Journal Reaches Out
Sara Gwynn, International Network for the Availability of Scientific Publications, Oxford, United Kingdom
The Journals Online Projects: Adding Visibility to Developing-Country Research

As Borders Dissolve, Which Standards and Mechanisms Prevail?

Saturday, 19 February 1:30PM-4:30PM
Organized by: Mary Kavanagh, European Commission, Directorate-General for Research, Brussels, Belgium

SPEAKERS

John Wood, Association of Commonwealth Universities, London, United Kingdom
As Borders Dissolve, Which Standards Prevail?
Wouter Los, University of Amsterdam, Netherlands
Virtual Research Environments: Dealing with Other People's Samples and Data
Raymond Orbach, University of Texas, Austin
Ethical Issues in Global Science
Linda Miller, New York University Langone Medical Center, New York City
The Role of Peer Review in the Governance of Science
Yukimo Hamano, World Intellectual Property Organization, Geneva, Switzerland

Managing Intellectual Property Rights in International Scientific Collaboration
Iain Gillespie, Organization for Economic Cooperation and Development, Paris, France
Do We Need New Global Scientific Mechanisms To Respond to Global Challenges?

The Digitization of Science: Reproducibility and Interdisciplinary Knowledge Transfer

Saturday, 19 February 1:30PM-4:30PM
Organized by: Victoria C. Stodden, Columbia University, New York City

SPEAKERS

Keith A. Baggerly, University of Texas M.D. Anderson Cancer Center, Houston
The Importance of Reproducibility in High-Throughput Biology: Case Studies
Victoria C. Stodden, Columbia University, New York City
Policies for Scientific Integrity and Reproducibility: Data and Code Sharing
Fernando Perez, University of California, Berkeley
Reproducible Software versus Reproducible Research
Robert Gentleman, Genentech Inc., South San Francisco, CA
Strategies for Reproducible Research
David Donoho, Stanford University, CA
An Invitation to Reproducible Computational Research
Mark Liberman, University of Pennsylvania, Philadelphia
Lessons for Reproducible Science from the DARPA Speech and Language Program

Crisis Averted? How a Critical Shortage in Helium-3 Was Good and Bad for Science

Saturday, 19 February 10:00AM-11:30AM
Organized by: Benn Tannenbaum, AAAS Center for Science, Technology, and Security Policy, Washington, DC

SPEAKERS

Julie Bentz, National Security Staff, Executive Office of the President, Washington, DC
Crisis Management: How the U.S. Government Responded to the Shortage
Gregory Slovik, U.S. Department of Homeland Security, Washington, DC
Crisis as Opportunity: Why a Shortage of He-3 Led to New Science
Valerie LaTraverse, Embassy of Canada, Washington, DC
Crisis Consequences: International Impact of the He-3 Shortage

Design Thinking To Mobilize Science, Technology, and Innovation for Social Challenges

Sunday, 20 February 8:30AM-11:30AM
Organized by: Yoko Nitta, Tateo Arimoto, and Suguru Ishiguro, Japan Science and Technology Agency, Tokyo

SPEAKERS

Laura Bunt, National Endowment for Science, Technology, and Arts, London, England
Mass Localism: A Way To Help Small Communities Solve Big Social Challenges
 Masayuki Horio, Japan Science and Technology Agency, Tokyo
Tackling Climate Change Through Multidisciplinary Research Underpinning Community-Based Action
 Julia Lane, NSF, Arlington, VA
Science of Science Assessment
 Robby Berloznik, Institute Society and Technology, Brussels, Belgium
Governance in Science and Technology: Citizens' Engagement for Social Innovation
 Karabi Acharya, Ashoka, Systematic Change to Achieve Environmental Impact: Examples of Ashoka Fellows
Connecting 2,500 Social Entrepreneurs in 70 Countries To Achieve Collaborative Impact

It Is Unethical Not to Do Research with Animals

Sunday, 20 February 3:00PM-4:30PM
 Organized by: Stuart Zola, Emory University, Atlanta, GA

SPEAKERS

Stuart Zola, Emory University, Atlanta, GA
Historical Examples
 John Vandeberg, Southwest National Primate Research Center, San Antonio, TX
The Current State
 Zachary Johnson, University of Nevada, Reno
The Future

Modeling Across Millennia: Interdisciplinary Paths to Ancient Socionatural Systems

Sunday, 20 February 3:00PM-4:30PM
 Organized by: Timothy A. Kohler and Stefani A. Crabtree, Washington State University, Pullman

SPEAKERS

Ben Fitzhugh, University of Washington, Seattle
Scales of Vulnerability and Resilience in Human Settlement of the Kuril Islands
 Herbert D. G. Maschner, Idaho State University, Pocatello
Archeology as Long-Term Ecology: The Dynamics of Humans and Marine Ecosystems on the North Pacific
 J. Daniel Rogers, National Museum of Natural History, Washington, DC
Modeling Human-Environmental Interactions in Inner Asia: Households to Empires
 Timothy A. Kohler, Washington State University, Pullman
The Village Ecodynamics Project: Modeling the Deep Pueblo Past
 Patrick V. Kirch, University of California, Berkeley
Islands as Model Systems for Long-Term Human Ecodynamics
 C. Michael Barton, Center for Social Dynamics and Complexity, Tempe, AZ

Looking for the Future in the Past: Long-Term Change in Socioecological Systems

Reaching a Global Standard in Research Integrity

Monday, 21 February 9:45AM-12:45PM
 Organized by: Chloe Kembery and Vanessa Campo-Ruiz, European Science Foundation, Strasbourg, France

SPEAKERS

Harriet Wallberg-Henriksson, Karolinska Institutet, Stockholm, Sweden
Prevention and Treatment: Putting a Policy into Action
 Ovid Tzeng, University System of Taiwan, Taipei
Global Insights: Experiences of Research Integrity from Asia
 John Galland, U.S. Department of Health and Human Services, Rockville, MD
National Implementation of Research Integrity: Good Research Practice Education
 *Ragnvald Kalleberg, University of Oslo, Norway
Hitting the Headlines: Research Integrity Scandals Shaping Legislation
 Lars Feld, University of Heidelberg, Germany
Proving Fraud in Science: Seeking Evidence-Based Research Integrity Policy
 Ulrike Beisiegel, German Research Foundation, Bonn
The Conciliatory Approach: Mediation and the Role of the Ombudsman

Science and Society

Communication Outside the Box

Friday, 18 February 8:00AM-9:30AM
 Organized by: Michel Claessens, European Commission, Brussels, Belgium; David Bennett, Delft University of Technology, Netherlands; Richard Jennings, University of Cambridge, United Kingdom

SPEAKERS

Chris Smith, University of Cambridge, United Kingdom
The Naked Scientists
 Rikke Schmidt Kjærgaard, Harvard Medical School, Boston, MA
Science, Art, and Visual Communication
 Patricia Osseweijer, Delft University of Technology, Netherlands
Imagine: An Innovative Approach to Science Communication

Evangelicals, Science, and Policy: Toward a Constructive Engagement

Friday, 18 February 10:00AM-11:30AM
 Organized by: Peyton West and Jennifer Wiseman, AAAS Science and Policy Programs, Washington, DC

SPEAKERS

James Childress, University of Virginia, Charlottesville
Evangelical Christians and Stem Cell Research Policy

James McCarthy, Harvard University, Cambridge, MA

The Scientists and Evangelicals Initiative: Partnering to Protect the Environment
 William Newsome, Stanford University School of Medicine, CA
Neuroscience and Evangelical Christianity: Anticipating and Alleviating Concerns

Science Without Borders and Media Unbounded: What Comes Next?

Friday, 18 February 10:00AM-11:30AM
 Organized by: Bud Ward, Yale Forum on Climate Change and the Media, White Stone, VA

SPEAKERS

Tom Rosensteil, Project for Excellence in Journalism, Washington, DC
The Quickly Changing State of the News Media
 Seth Borenstein, Associated Press, Washington, DC
Reporting on Climate Change for a Wire Service
 Elizabeth Shogren, National Public Radio, Washington, DC
Covering Climate Science and Climate Controversies for National Public Radio

Earthwatch and the HSBC Climate Partnership: A Unique Citizen Science Model

Friday, 18 February 1:00PM-2:30PM
 Organized by: Kristen Kusek, Earthwatch Institute, Boston, MA

SPEAKERS

Dan Bebber, Earthwatch Institute, Oxford, United Kingdom
Around the World with Earthwatch: Taking Stock of Carbon in Five Forests
 Geoffrey "Jess" Parker, Smithsonian Environmental Research Center, Edgewater, MD
Evidence for a Recent Growth Increase in Eastern Forests
 William Thomas, HSBC, London, United Kingdom
How My Light Bulb Went Off: From Climate Skeptic to Sustainability Leader

Doing Good with Good OR: Applying Operations Research for Societal Impact

Friday, 18 February 3:00PM-4:30PM
 Organized by: Karen Smilowitz, Northwestern University, Evanston, IL; Ozlem Ergun, Georgia Institute of Technology, Atlanta

SPEAKERS

Yann LeTallec, Clinton Health Access Initiative, Cambridge, MA
Improving Global Health with Operations Research
 Jeremie Gallien, London Business School, United Kingdom

Improving the Public Distribution of Essential Drugs in Africa: The Case of Zambia

David Sarley, John Snow Inc., Arlington, VA
Improving the Equity and Access to Essential Health Through Optimization Modeling

Communicating Diversity in Science: Implications for Climate Change Denial

Saturday, 19 February 8:00AM-9:30AM
 Organized by: Prajwal Kulkarni, U.S. Environmental Protection Agency, Washington, DC

SPEAKERS

Thomas Lessl, University of Georgia, Athens
Reforming Scientific Communication About Anthropogenic Climate Change
 Naomi Oreskes, University of California, San Diego
Of Mavericks and Mules
 Gavin Schmidt, NASA Goddard Institute for Space Studies, New York City
Between Sound Bites and the Scientific Paper: Communicating in the Hinterland

Surprise ... It's Science! Reaching New Audiences in Unconventional Ways with Festivals

Saturday, 19 February 8:00AM-9:30AM
 Organized by: Jan Riise, European Science Events Association, Onsala, Sweden; Ben Wiehe, MIT Museum, Cambridge

SPEAKERS

Loren Thompson, University of California, La Jolla
Celebrate for the Week, Energize for the Year
 Savita Custead, Bristol Natural History Consortium, United Kingdom
The Role of Science in Society
 Mikkel Bohm, Danish Science Communication, Copenhagen
Science, Innovation, and Integration: Science as a Multicultural Mediator

Reaching Out to People in East Asia on Green Issues: Policies and Practices

Saturday, 19 February 10:00AM-11:30AM
 Organized by: Sook-Kyoung Cho, Korea Foundation for the Advancement of Science and Creativity, Seoul; Masataka Watanabe, Japan Science and Technology Agency, Tokyo; Sun Mengxin, China Association for Science and Technology, Beijing

SPEAKERS

Yoon Chung, Korea Foundation for the Advancement of Science and Creativity, Seoul
Low Carbon, Green Growth, and RGB Campaign for All Koreans
 Donghong Cheng, China Association for Science and Technology, Beijing
Green Issues: New Challenges Toward China's Science Communication

Koichi Kitazawa, Japan Science and Technology Agency, Tokyo
How, When, and Where Should We Discuss Green Issues?

Earth Science and Evolution

Saturday, 19 February 1:00PM-2:30PM
 Organized by: Jere H. Lipps, University of California, Berkeley

SPEAKERS

Samuel Bowring, Massachusetts Institute of Technology, Cambridge
Geochronology and Evolution
 Brian R. Pratt, University of Saskatchewan, Saskatoon, Canada
Paleoenvironments and Evolution
 Jere H. Lipps, University of California, Berkeley
Geology and Evolution: Partners in Science

TV Meteorologists Communicating Climate Change

Saturday, 19 February 3:00PM-4:30PM
 Organized by: Katherine E. Rowan, George Mason University, Fairfax, VA

SPEAKERS

Edward W. Maibach, George Mason University, Fairfax, VA
Hey Mr. Weatherman, Is This [insert unusual weather event here] Related to Global Warming?
 Kris Wilson, University of Texas, Austin
How TV News Directors View Climate Change and Their Weathercasters
 Katherine E. Rowan, George Mason University, Fairfax, VA
Best Practices of TV Meteorologists Communicating Climate Change

When Pollution Gets Personal: Ethics of Reporting on Human Exposures

Sunday, 20 February 8:00AM-9:30AM
 Organized by: Julia G. Brody, Silent Spring Institute, Newton, MA

SPEAKERS

Gwen Collman, National Institute of Environmental Health Sciences, Research Triangle Park, NC
New Expectations for Individuals' Right-To-Know in Environmental Health Research
 Rachel Morello-Frosch, University of California, Berkeley
Reporting Cord Blood Contaminants to Mothers in the California Biomonitoring Program
 Shaun Goho, Harvard Law School, Cambridge, MA
Is It Safe? Legal Requirements to Disclose Measurements in Homes

Techno-Optimism or Pessimism? Media Coverage of Quick Fixes for Global Climate Change

Sunday, 20 February 10:00AM-11:30AM

Organized by: Cristine Russell, Harvard Kennedy School, Cambridge, MA

SPEAKERS

Bryan Walsh, Time Magazine, New York City
Are Journalists Up to the Task of Covering Green Technologies?
 Eli Kintisch, AAAS/Science, Washington, DC
Hacking the Planet: How The Media Cover Geoengineering
 *David Dickson, SciDev.net, London, United Kingdom
International Perspectives on Media Coverage of Energy Technologies

Innovative Strategies for Ensuring Access to the Benefits of Scientific Progress

Sunday, 20 February 1:00PM-2:30PM
 Organized by: Jessica M. Wyndham, AAAS Science and Human Rights Program, Washington, DC; Joseph G. Perpich, JG Perpich, Bethesda, MD

SPEAKERS

James Love, Knowledge Ecology International, Washington, DC
Patent Pools to Prize Funds: Innovation Incentives Address Needs of the Marginalized
 Carol Mimura, University of California, Berkeley
Humanitarian Rights Clauses and Innovation
 Christin Lis, Gilead Sciences, Foster City, CA
Private Sector Initiatives Serving the Developing World: The Gilead Model

Astronomical Pioneering: The Implications of Finding Other Worlds

Sunday, 20 February 1:30PM-4:30PM
 Organized by: Jennifer Wiseman and Peyton West, AAAS Science and Policy Programs, Washington, DC

SPEAKERS

Wesley Traub, NASA Jet Propulsion Laboratory, Pasadena, CA
International Discoveries of Exoplanets: What We Are Finding Out About Other Worlds
 Howard A. Smith, Smithsonian Astrophysical Observatory, Cambridge, MA
On Living Alone in the Universe: New Indications of Our Probable Solitude, and Jewish Perspectives on Life in the Cosmos
 Jennifer Wiseman, AAAS Science and Policy Programs, Washington, DC
Uniqueness of Earth and the Significance of Life in Christian Perspectives
 Nidhal Guessoum, American University of Sharjah, United Arab Emirates
Islamic Views on Extrasolar Life
 Seth Shostak, SETI Institute, Mountain View CA
The World-Wide Societal Impact of Finding Intelligent Life Beyond Planet Earth

Crossing Boundaries with Citizen Science

Sunday, 20 February 1:30PM-4:30PM

Organized by: Janis L. Dickinson and Bart Selman, Cornell University, Ithaca, NY

SPEAKERS

Luis Von Ahn, Carnegie Mellon University, Pittsburgh, PA
How the Public Is Helping the Web To Learn
David Baker, University of Washington, Seattle
Foldit: Discovery Research Through Public Participation in Biochemistry
Alex Pentland, Massachusetts Institute of Technology, Cambridge
How Science-Based Social Networking Helped Find 10 Red Balloons
Janis L. Dickinson, Cornell Lab of Ornithology, Ithaca, NY
Citizen Science at the Cornell Lab of Ornithology
Chris Lintott, Adler Planetarium, Chicago, IL
Lessons From Galaxy Zoo: Citizen Science for Astrophysics and Beyond
Martin Storksdieck, U.S. National Research Council, Washington, DC
Citizen Science and Science Education: What Do People Learn When They Do?

Security

New START and Nuclear Winter: Climatic Consequences of the Nuclear Weapons Agreement

Friday, 18 February 8:00AM-9:30AM

Organized by: Alan Robock, Rutgers University, New Brunswick, NJ; Richard Turco, University of California, Los Angeles

SPEAKERS

Georgiy Stenchikov, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia
Regional Simulations of Stratospheric Lofting of Smoke Plumes from Urban Fires
Luke Oman, NASA Goddard Space Flight Center, Greenbelt, MD
Climatic Effects of Regional Nuclear War
Michael Mills, National Center for Atmospheric Research, Boulder, CO
Effects of Nuclear War on Ozone Depletion

Reconciling National Security Requirements with Research and Education

Friday, 18 February 10:00AM-11:30AM

Organized by: Kavita M. Berger, AAAS Center for Science, Technology, and Security Policy, Washington, DC; Tobin L. Smith, Association of American Universities, Washington, DC

SPEAKERS

Ambassador Joseph DeTrani, National Counterproliferation Center, McLean, VA
Science, National Security, and the Intelligence Community

Graham Spanier, Pennsylvania State University, University Park
Current Efforts To Engage Academic Leadership and National Security Experts
David Korn, Harvard Medical School, Boston, MA
Impact of Current National Security Policy Debates on Academic Education and Research

Science and Policy for Environmental Security in the Asia-Pacific Region

Friday, 18 February 1:00PM-2:30PM

Organized by: James Scott Hauger, Asia-Pacific Center for Security Studies, Honolulu, HI; Virginia Watson, Asia-Pacific Center for Security Studies, Honolulu, HI

SPEAKERS

Tao Wang, Cold and Arid Regions Environmental and Engineering Research Institute, Lanzhou, China
The Impacts of Climate Change and Human Activities on Desertification in Northern China
Virginia Watson, Asia-Pacific Center for Security Studies, Honolulu, HI
Water and Conflict: Securitization Processes
Dave Mouat, Desert Research Institute, Reno, NV
Land Degradation, Climate Change, and Human Security: A Futures Perspective

Using Quantitative Content Analysis To Assess the Likelihood of Terrorist Violence

Friday, 18 February 3:00PM-4:30PM

Organized by: Allison G. Smith, U.S. Department of Homeland Security, Washington, DC

SPEAKERS

Lucian Gideon Conway III, University of Montana, Missoula
The Complexity of Terrorist Rhetoric
James W. Pennebaker, University of Texas, Austin
Using Computerized Text Analysis Methods To Assess Threats
Antonio Sanfilippo, Pacific Northwest National Laboratory, Richland, WA
Framing Words of Violence

Promoting Security and Sustaining Privacy: How Do We Find the Right Balance?

Saturday, 19 February 8:00AM-9:30AM

Organized by: Christopher Hankin, Imperial College London, United Kingdom; Benn Tannenbaum, AAAS Center for Science, Technology, and Security Policy, Washington, DC

SPEAKERS

Bruce Schneier, BT (British Telecom), Minneapolis, MN
Security, Privacy, and the Generation Gap

Usama Fayyad, Open Insights, LLC, Bellevue, WA
Data Mining: Is Anything Still Private?
Stephan Lechner, European Commission, JRC Institute for Protection and Security of the Citizen, Ispra, Italy
A European Perspective on Security and Privacy

Atomic Detectives: Science Behind International Efforts to Combat Nuclear Terrorism

Saturday, 19 February 10:00AM-11:30AM

Organized by: Klaus Mayer, European Commission, JRC Institute for Transuranium Elements, Karlsruhe, Germany; Geraldine Barry, European Commission, JRC, Brussels, Belgium

SPEAKERS

Klaus Mayer, European Commission, JRC Institute for Transuranium Elements, Karlsruhe, Germany
Nuclear Forensics Science as Border Crossing Support: Experience and Perspectives
Benjamin Garrett, Federal Bureau of Investigation, Quantico, VA
From Domestic to International Nuclear Forensics
Anita Nilsson, International Atomic Energy Agency (IAEA), Vienna, Austria
The Role of the Nuclear Watchdog: IAEA Efforts To Enhance Global Nuclear Security

Space Weather: The Next Big Solar Storm Could Be a Global Katrina

Saturday, 19 February 1:00PM-2:30PM

Organized by: Thomas J. Bogdan and Terrance Onsager, NOAA, Boulder, CO; Stephan Lechner, European Commission, JRC Institute for Protection and Security of the Citizen, Ispra, Italy

SPEAKERS

Thomas J. Bogdan, NOAA, Boulder, CO
Space Weather Forecasting Comes of Age
Nicolas Bobrinsky, European Space Agency, Darmstadt, Germany
European Space Weather Prediction Capabilities in Support of Space Situational Awareness
Stephan Lechner, European Commission, JRC Institute for Protection and Security of the Citizen, Ispra, Italy
Can the Sun Black Us Out? Space Weather Vulnerabilities and Weaknesses

International Neighborhood Watch: Citizen Scientists and International Security

Sunday, 20 February 10:00AM-11:30AM

Organized by: Gerald L. Epstein, AAAS Center for Science, Technology, and Security Policy, Washington, DC

SPEAKERS

Stephan Lechner, European Commission, JRC Institute for Protection and Security of the Citizen, Ispra, Italy
Intelligence by Open Source Information: It's All on the Internet
Raymond J. Willemann, Incorporated Research Institutions for Seismology, Washington, DC
Comprehensive Test Band Treaty: Monitoring by Independent Scientists and Seismic Stations and Networks
Jeffrey G. Lewis, New America Foundation, Washington, DC
Many Eyes on the Prize: Building a Community of Independent Security Analysis

White-Blue Arctic: Promoting Cooperation and Preventing Conflict in the Arctic Ocean

Monday, 21 February 9:45AM-12:45PM

Organized by: Paul Arthur Berkman, University of Cambridge, United Kingdom; Oran Young, University of California, Santa Barbara

SPEAKERS

*Peter Wadhams, University of Cambridge, United Kingdom
Environmental State-Change in the Arctic Ocean
James McCarthy, Harvard University, Cambridge, MA
To Be Determined
Lars-Otto Reiersen, Arctic Monitoring and Assessment Program Secretariat, Oslo, Norway
Monitoring and Assessment Activities and Results in the Arctic Ocean

Sustainability

Data Cocktails for Biodiversity: Protected Area Management Without the Hangover

Friday, 18 February 8:00AM-9:30AM

Organized by: Alan Belward, European Commission, JRC Institute for Environment and Sustainability, Ispra, Italy; Geraldine Barry, European Commission, JRC, Brussels, Belgium

SPEAKERS

Gary Geller, NASA Ecological Forecasting Program, Pasadena, CA
Parks from Space: The Big Picture and New Indicators Help Manage Protected Areas
Jon Hutton, UNEP World Conservation Monitoring Center, Cambridge, United Kingdom
Assessing the Contribution of Protected Areas to Conservation and Development Goals
Alan Belward, European Commission, JRC Institute for Environment and Sustainability, Ispra, Italy
Digital Observatory for Protected Areas: Helping Earth's Beleaguered Biodiversity

Mapping and Disentangling Human Decisions In Complex Human-Nature Systems

Friday, 18 February 8:30AM-11:30AM

Organized by: Li An and Stuart Aitken, San Diego State University, CA; Janet Silbernagel, University of Wisconsin, Madison

SPEAKERS

Xiaodong Chen, Harvard University, Cambridge, MA
Agent-Based Modeling of Complex Social Interactions
Sarah Wandersee, San Diego State University, CA
Multi-Level Modeling To Understand Complex Human-Environment-Policy Dynamics in Fanjingshan
Alex Zvoleff, San Diego State University, CA
Modeling Human-Environment Interactions and Their Ecological Implications in Chitwan National Park
David L. López-Carr, University of California, Santa Barbara
Examining Proximate and Underlying Causes of LUCC
Stuart Aitken, San Diego State University, CA
Development Theory, Marginalized Populations, and Participatory Mapping
Li An, San Diego State University, CA
Overview of Agent-Based Modeling in Handling Complex Human-Nature Systems

Telecoupling of Human and Natural Systems

Friday, 18 February 1:30PM-4:30PM

Organized by: Jianguo (Jack) Liu and William McConnell, Michigan State University, East Lansing; Thomas J. Baerwald, NSF, Arlington, VA

SPEAKERS

Ruth DeFries, Columbia University, New York City
Tropical Deforestation Driven by Urbanization and Agricultural Trade
Peter Gleick, Pacific Institute for Studies in Development, Environment, and Security, Oakland, CA
Peak Water, Virtual Water, Real Water: Exploring the Connections
Eric F. Lambin, University of Louvain, Belgium
Land-Use Changes in the Globalization Era
Jianguo (Jack) Liu, Michigan State University, East Lansing
Global Telecoupling of Remote Places
William D. Nordhaus, Yale University, New Haven, CT
Integrated Assessment Models in Economics and the Geosciences
Peter Raven, Missouri Botanical Garden, St. Louis
Biological Invasions Elevating Ecological and Socioeconomic Challenges

Research Frontiers in Sustainability Science: Bridging Disciplines and Practices

Saturday, 19 February 8:30AM-11:30AM

Organized by: William C. Clark, Harvard Kennedy School of Government, Cambridge, MA; Simon A. Levin, Princeton University, NJ

SPEAKERS

Stephen Polasky, University of Minnesota, St. Paul
Natural Capital and Human Well-Being
Simon A. Levin, Princeton University, NJ
Complex Adaptive Systems and the Challenge of Sustainability
B.L. Turner, Arizona State University, Tempe
Change in Tropical Forests: Challenges Addressing Its Complexity
Edward L. Miles, University of Washington, Seattle
Responses to the Challenge of Multiple Stresses in the Ocean Environment
Amy Poteete, Concordia University, Montreal, Canada
Political Competition, Natural Resource Policy, and Political Development in Africa
Thomas Graedel, Yale University, New Haven, CT
Human Use of Resources: Quantification and Prospects

Resource Use and Ecological Resilience in a Tropical Socio-Ecological System

Saturday, 19 February 10:00AM-11:30AM

Organized by: Jose M.V. Fragoso, and Oskar Burger, Stanford University, CA

SPEAKERS

Jose M.V. Fragoso, Stanford University, CA
Complex Interactions Between Biodiversity and Indigenous Amazonian Cultures
Kirsten Silvius, The Gordon and Betty Moore Foundation, Palo Alto, CA
Animals that Hide and the Challenges of Accurate Assessment
Jeffrey Luzzar, State University of New York, Syracuse
Locally Based Wildlife Monitoring by Indigenous Communities of the Amazon

If a Culture of Growth Is Unsustainable, What Should Change?

Saturday, 19 February 1:30PM-4:30PM

Organized by: Paul H. Reitan, University at Buffalo, NY; Ward Chesworth, University of Guelph, Canada

SPEAKERS

Peter Raven, Missouri Botanical Garden, St. Louis
Biodiversity as a Basis for Sustainability
Ward Chesworth, University of Guelph, Canada
Chakula Kwanza: Food First
Robert Costanza, University of Vermont, Burlington
Flourishing on a Biophysically Limited Planet: Creating a Culture of Sustainability
William Rees, University of British Columbia, Vancouver, Canada
Has Humanity Become the Maggot in Earth's Apple?

Eric Reitan, Oklahoma State University, Stillwater
Carrying Capacity, Conceptions of the Good Life, and Advertising
 Herman Daly, University of Maryland, College Park
Policies for Ending Addiction to Growth and Achieving a Steady-State Economy

The Challenge of Measuring Sustainability

Sunday, 20 February 8:30AM-11:30AM
 Organized by: Eugene A. Rosa, Washington State University, Pullman; Thomas Dietz, Michigan State University, East Lansing

SPEAKERS
 Mathis Wackernagel, Global Footprint Network, Oakland, CA
The Ecological Footprint
 Jay Emerson, Yale University, New Haven, CT
Environmental Performance Index
 Kirk Hamilton, World Bank, Washington, DC
Genuine Savings
 Nic Marks, New Economics Foundation, London, United Kingdom
The Happy Planet Index
 Marina Fischer-Kowalski, Alpen Adria University, Vienna, Austria
National Material Flow Accounting

Estimating Earth's Human Carrying Capacity

Sunday, 20 February 1:30PM-4:30PM
 Organized by: Kenneth G. Cassman, University of Nebraska, Lincoln; Ruth Cooper, The Royal Society, London, United Kingdom; David Tilman, University of Minnesota, St. Paul

SPEAKERS
 Joel E. Cohen, Rockefeller and Columbia Universities, New York City
Estimating Earth's Human-Carrying Capacity
 John Sulston, University of Manchester, United Kingdom
Carrying Capacity: Should We Be Aiming To Survive or Flourish?
 Jonathan A. Foley, University of Minnesota, St. Paul
Land Resources for Nature and Global Food Production
 Jason Clay, World Wildlife Fund, Washington, DC
Feeding 9 Billion and Maintaining the Planet: The Challenge of 2050
 John Bongaarts, Population Council, New York City
Stabilization then Gradual Decline in the Human Population in the 21st Century?
 John B. Casterline, Ohio University, Columbus
Pathways to Population Stabilization: Contribution of Family Planning Programs

How Can the World Feed 9 Billion People by 2050 Sustainably and Equitably?

Sunday, 20 February 10:00AM-11:30AM
 Organized by: Kate Von Holle, British Embassy, Washington, DC; Jon Parke, Foresight Program, Government Office of Science, London, United Kingdom

SPEAKERS
 Charles Godfray, Oxford University, United Kingdom
How Can the World Feed 9 Billion People by 2050 Sustainably and Equitably?
 Nina Fedoroff, Pennsylvania State University, University Park
Why Do We Need GMOs? Who Will Benefit from GMOs?
 Shenggen Fan, International Food Policy Research Institute, Washington, DC
Food Security in Emerging and Developing Economies

Social Networks and Sustainability

Monday, 21 February 9:45AM-11:15AM
 Organized by: Thomas Dietz, Michigan State University, East Lansing; Adam D. Henry, West Virginia University, Morgantown

SPEAKERS
 Helen Ingram, University of California, Irvine
Advocacy and Stakeholder Networks
 Ken Frank, Michigan State University, East Lansing
Natural Resource Management Networks
 Adam D. Henry, West Virginia University, Morgantown
Networks and Policy Learning for Sustainability

Japan Pavilion



2011 AAAS Annual Meeting
 Science Without Borders

ROOM 159AB

FRIDAY, 18 FEBRUARY
 8:00AM-9:30AM Data Cocktails for Biodiversity: Protected Area Management Without the Hangover
 10:00AM-11:30AM Measurements as a Cornerstone of Global Trade and Quality of Life
 1:00PM-2:30PM Networks and Culture of Scientific and Technological Communities in Global Policy
 3:00PM-4:30PM Solving the Weight of Evidence Problem: A Way Forward?

SATURDAY, 19 FEBRUARY
 8:30AM-11:30AM Research Integrity in the Global Perspective
 1:30PM-4:30PM The Digitization of Science: Reproducibility and Interdisciplinary Knowledge Transfer

SUNDAY, 20 FEBRUARY
 8:30AM-11:30AM Design Thinking To Mobilize Science, Technology, and Innovation for Social Challenges
 1:30PM-4:30PM Bringing Innovation to International Development: New Actors, New Mechanisms

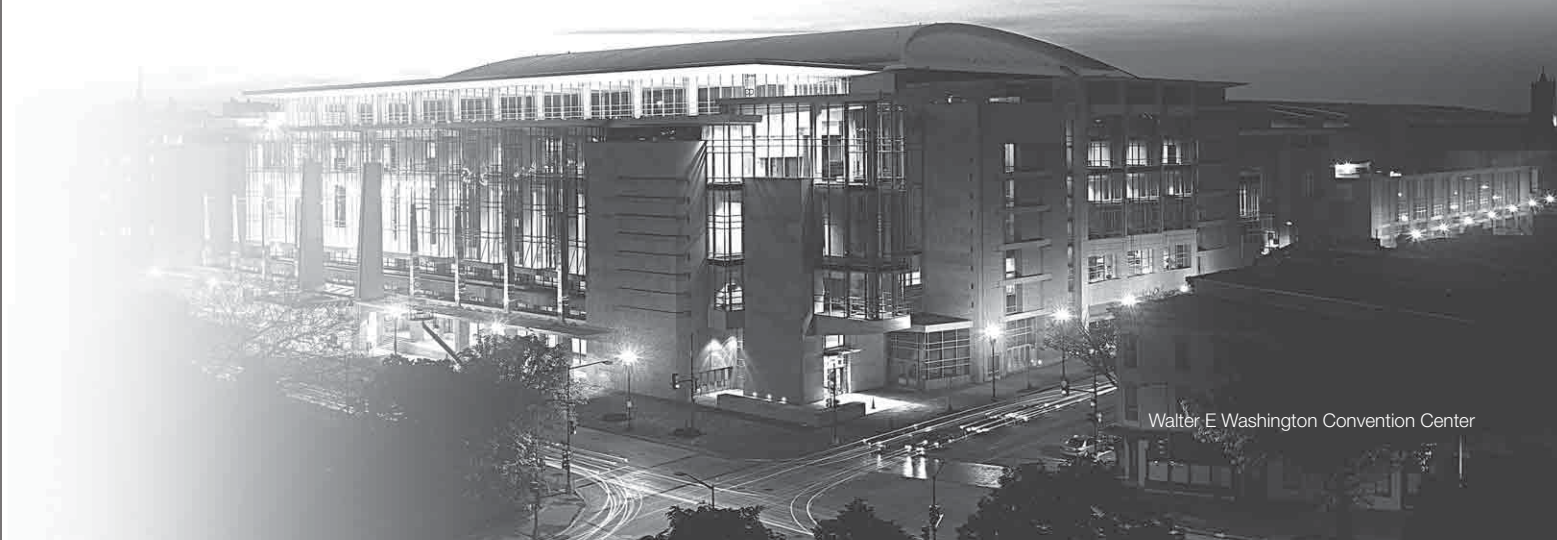
MONDAY, 21 FEBRUARY
 9:45AM-11:45PM Reaching a Global Standard in Research Integrity

Please silence cell phones and pagers

AAAS
 AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Panel Discussion on RISTEX session



Walter E. Washington Convention Center

**Report on the outcome of the AAAS 2011 session on
“Design Thinking to Mobilize Science, Technology and Innovation for Social Challenges.”**

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