November 4-6, 2009
Washington, DC

Schedule

Wednesday, November 4

8:00-8:30 Conference registration, coffee and light refreshments

8:30-9:00 Welcome: conference goals and objectives

9:00-9:30 Opening Address

Mihail Roco, US National Science Foundation, Senior Advisor for Nanotechnology: Global Governance of Nanotechnology

"Global Governance of Nanotechnology,"

9:30-11:00 Opening Panel: Emerging Technologies: Prospects for Equitable Development

Noela Invernizzi, Federal University of Parana, Brazil "Nanotechnology in Brazil: assessing potential implications for labor"

Chen Wang, National Center for Nanoscience and Technology, China "Perspectives on nanotechnologies meeting societal needs in China"

Jose Gomez-Marquez,
Massachusetts Institute of Technology

"Nurturing Appropriate Biomedical Innovation in for Developing Countries: A Review of the Innovations in International Health Framework for Accelerated Product Design"

11:00 - 11:15 Coffee Break

11:15 - 12:30 Overview Panel: Applications of Emerging Technologies in Energy, Water, Food Security, and Health

Carlos Henrique de Brito Cruz, State of Sao Paolo Research Foundation; Energy "Energy for development: the case of Bioenergy in Brazil"

Thembela Hillie, Council for Scientific & Industrial Research, S. Africa; Water

"Nanotechnology and water, an overview"

R. Kalpana Sastry, National Academy of Agricultural Research Management, India; Food Security "Nanotechnology as tool in enhancing food security in India"

Jeff Spieler, U.S. Agency for International Development, Health "Health: The Global Initiative"

1:00-2:30 Keynote Address by Aneesh Chopra, Assistant to President Barack Obama and the first U.S. Chief Technology Officer.

Location: National Press Club (lunch provided).

3:00-5:30 Breakout Session: Groups discuss technological breakthroughs in Energy, Water,
Food Security, and Health.

5:30-5:45 Plenary: Quick check-in to review the day’s outcomes and the next day’s program.

6:00-8:00 Group dinner, M&S Grill 600 13th Street, NW

Thursday, November 5

9:00-10:30 Reporting Back: Breakout groups report key outcomes from discussions to full group [5-10 minutes per group followed by discussion].

10:30-10:45 Coffee Break

10:45-12:15 Panel Session: Governing Emerging Technologies: Regulating Risk & Ethical Dimensions in Development

Vicki Colvin, Rice University “Nanotechnology in the Environment: Safety by Design” Barbara Harthorn, Center for Nanotechnology in Society, University of California, Santa Barbara “Constraints on Benefit of New Technologies for the World’s Poor” Richard Worthington, Loka Institute, and Pomona College

Megaprojects and Democracy: Challenges and Prospects in Nanotech Legislation"

Kathy Jo Wetter

“[Nano]Technology for Equitable Global Development: What are the Chances?”
12:15-1:30 Lunch; **brief plenary address:**

Todd Osman, Executive Director, Materials Research Society  "Creating the Future: Materials, Science and the Scientific Community"

1:30-3:00 Panel Session: **Making it Happen: Challenges and new (business) models providing access to beneficial technologies in poor and excluded communities.**

Holly Ladd, Academy for Educational Development  "Expanding Access to Scientific Developments that Change Lives"

David Irvine-Halliday, Light Up the World Foundation and University of Calgary, Canada  "Solid State Lighting can help the Developing World Escape the Poverty Trap – but only by way of the Market Model"

Moses Kizza Musaazi, Makerere University, Uganda  "Innovations for Development; the African Challenge"

Jimmy Yu, The Chinese University of Hong Kong  "Photocatalytic Nanotechnology for Air and Water Purification"

3:00-3:15 Coffee Break

3:15-5:30 Breakout Session: Subgroups addressing market feasibility, commercialization approaches and governance.

5:30-5:45 Plenary: Quick check-in to review the day’s outcomes and the next day’s program.

---

**Friday, November 6**
9:00-10:30 Reporting Back: Breakout groups report key outcomes from discussions to full group [5-10 minute per group followed by discussion].

10:30-10:45 Coffee Break

10:45-12:15 Panel Session: Innovation models for development

Caroline Wagner, Stanford Research Institute
"Managing national policy in the global invisible college"

Guillermo Foladori, Autonomous University of Zacatecas, Mexico
"A social approach to nanotechnology"

Susan Cozzens, Georgia Institute of Technology
"Emerging Technologies and Inequalities: Developing Country Experiences"

Romanus Berg, CIO, Ashoka
TBA

12:15-1:00 Closing Remarks: Where do we go from here?

Conference Organizers

Abstracts

Opening Address
“Global Governance of Nanotechnology”

Mihail Roco

National Science Foundation, National Nanotechnology Initiative, and International Risk Governance Council

The convergence of nanotechnology with modern biology, the digital revolution and other emerging fields will bring about tremendous improvements in tools, generate new products and services, and enable opportunities to meet human potential and social achievements. Nanotechnology has characteristics which provide new issues for science, technology and risk governance. A framework for global governance of nanotechnology is discussed including its transformative, inclusive, responsible and visionary functions in the self-regulating eco-system. An “open source” approach to the development and regulation of nanotechnology in established and emerging economies is suggested. Systems of governance must be transparent and easy to adapt if they are to withstand the rapid pace of research worldwide.

Emerging Technologies: Prospects for Equitable Development

"Nanotechnology in Brazil: assessing potential implications for labor"
Nanotechnology has been characterized as a disruptive technology, since it could make other technologies, products and even productive sectors obsolete. It has also been characterized as a facilitating technology, since almost all productive sectors could use it. Given these traits, it is possible to anticipate that, along with changes in the economy, labor demand and distribution as well as skill requirements will experience significant global and local transformations over the next years. In spite of its importance, particularly for equity issues, labor changes have deserved little attention within the social implications of nanotechnology current discussion.

This presentation will explore the ways in which current goals and tendencies in the development of nanotechnology in Brazil could affect labor. The research is based on: a) the analysis of general goals and specific topics regarding labor in the National Program of Nanotechnology; b) research and development projects in process in 50 companies in diverse sectors that received public funding under the former program; and c) products already in the market, introduced by national and transnational companies. Given the lack of data, the analysis starts from existent final and intermediate products, and possible products arising from current R&D. In spite of the limitations of this exploratory methodology, it is possible to reveal some trends affecting labor such as: reinforcement of automation of productive process, merging of pre-existing diverse products and processes in multifunctional single products/processes, shifts in raw materials demands, and redundant or reduced maintenance occupations in production processes and during the life cycle of the product.
The research activities in the field of nanoscience and nanotechnology have flourished in the past decade in China. The encouraging achievements in both fundamental research and industrial applications lead to public awareness of the important potentials of nanotechnology. In addition to the continued endeavors on pursuing excellence in academic research and economical impacts, the growing expectations of meeting societal needs have become evident for developing nanotechnologies in China. The multidisciplinary nature of the nanotechnology leads to abundant opportunities for providing technical support to improve quality of life of general public. Observable progress in this perspective could be found in the dedicated efforts toward promoting nanotechnologies in environmental remediation, public health care, sustainable agricultural development, etc. The emerging technologies in the areas of national and societal needs are crucial for gaining continued public support as well as identifying key technological breakthroughs. It can be envisioned that the nanoresearch community in China could make beneficial contributions to the quest of nanotechnologies in developing economies and international academic communities.

“Nanotechnology and the developing world”

Murali Sastry

Tata Chemicals Innovation Centre, Pune, India

New technologies have often been responsible for increasing the economic gap between
developed and developing nations. With the interest that nanotechnology is evincing world-wide, it is tempting to ask whether nanotechnology would be any different. In this talk, I will try and discuss this issue by first analyzing the current state of affairs in this field with particular emphasis on developing nations such as India. I will use a variety of data such as government funding, corporate funding, research and patent output, citation analysis, HR development efforts, number of startups etc. to paint a realistic picture of where we stand today.

Given the fact that resources for emerging areas such as nanotechnology are more limited in developing economies, there is a need to prioritize areas for support. I will discuss the results of a global study carried out on determining which areas are of priority to countries such as India and close with a discussion on efforts in India to harness nanotechnology for the benefit of the economically disadvantaged section of the population.

"Nurturing Appropriate Biomedical Innovation in Developing Countries: A Review of the IIH Framework for Accelerated Product Design"

Jose Gomez-Marquez
Massachusetts Institute of Technology

The Innovations in International Health (IIH) program at the Massachusetts Institute of Technology has created a model of innovation for accelerating the development of global health technologies across a wide array of disciplines. The resulting collaboration between researchers, users, and health practitioners has launched a growing portfolio of inventions that are at different stages of deployment. These include smart diagnostics TB compliance, inhalable vaccine delivery technology, RFID-enhanced disease surveillance systems, and low-cost incubators for rapid tuberculosis detection. We have recently expanded that model to empower local innovators in developing countries to increase their biomedical invention capacity. The MEDIK Project is being co-developed with our Nicaraguan global health partners and the participation of MIT students and staff. We introduce lessons in appropriate medical devices strategies with policy frameworks that stress distributed point of care solutions that do not require large healthcare infrastructure investments.

Each biomedical innovation kit informs our research with lessons about the speed of technology transfer and how local innovation is shaped. Advances in diagnostic technology, including smart lateral flow and microfluidic technology illustrate two case examples of the importance of transferring solutions that will see short- to medium-term impact for patient care. At the same time, such as the case of in-country microfluidic manufacturing, we see the importance of blending high-end lab-on-a-chip technology with appropriate manufacturing methods as a vehicle for changing paradigms and notions of diagnostics research. By skipping expensive clean room technology and using simpler approaches to microfluidic fabrication such as cutter-plotters, double sided adhesives, and open
source CAD software, we are able to teach multidisciplinary teams that are closer to the global health challenges than our own labs at MIT. The project illustrates the importance of strong long-run community partners, a willingness to understand each other’s opinions about healthcare development, and the cultural, regulatory, and economic ramifications that result in the promotion of health care workers above their traditional professional requirements, and into the role of a technology innovator.

Applications of Emerging Technologies in Energy, Water, Food Security, and Health

"Energy for development: the case of Bioenergy in Brazil"

Carlos Henrique de Brito Cruz

Physics Institute, University of Campinas (UNICAMP) and The São Paulo Research Foundation (FAPESP), Brazil

In Brazil, sugarcane ethanol supplied, in 2007, 16.3% of the energy for land transportation (excluding railroads) and 37.6% of the total energy supplied by liquid fuel for Otto cycle engines, a percentage that has reached 51% in 1988. Besides the lower production costs ethanol produced from sugarcane in Brazil has another important advantage: in Central-South Brazil only 1 unit of fossil energy is used for each 8-9 units of energy produced by ethanol from sugarcane. Carbon emissions reduction also benefits from sugarcane ethanol: for each cubic meter of ethanol used as fuel, there is a saving of 2.1-2.4t of CO$_2$ not emitted to the atmosphere while, at the same time, no SO$_2$ is emitted.
In addition to fuel ethanol, sugarcane is burned to power the ethanol and sugar mills and also to sell electricity back to the grid. The total energy generated from sugarcane in Brazil amounted in 2007 to 15.9% of the energy produced in the country making sugarcane the second most important source of energy for Brazil, following oil and overcoming hydroelectricity. Adding sugarcane and hydroelectricity, 45% of the energy used in Brazil comes from renewable sources.

Sugarcane was introduced in Brazil in 1532. The "Brazilian model" of producing concomitantly sugar and ethanol, brought important technical benefits and made possible an outstanding increase in the competitiveness in the international market for sugar and ethanol. Today about 50% of the sucrose of sugarcane produced in the country is directed to the production of sugar while another half is used to produce Ethanol. Industrial and academic R&D has helped to increase the productivity of ethanol steadily over the past 33 years, at a rate of 3.2% per year. Productivity gains implied savings of planted area by a factor of 2.6.

In 2007 the area planted with sugarcane for Ethanol production was 3.4 MHa, amounting to 1% of the total arable land available in Brazil. 63% of the Ethanol produced in Brazil comes from the State of São Paulo, where the productivity is the highest. Most of the recent expansion is happening in the center-west region of the country, in degraded pasture lands.

The São Paulo Research Foundation (FAPESP) organized and supports a broad program for research in bioenergy. FAPESP’s Program for Research on Bioenergy, BIOEN, aims at articulating public and private R&D, using academic and industrial laboratories to advance and apply knowledge in fields related to ethanol production in Brazil. The BIOEN Program has a solid core for supporting academic exploratory research activities that will generate new knowledge and form scientists and professionals essential for advancing industry capacity in ethanol related technologies. On top of this, BIOEN includes partnerships with industry for cooperative R&D activities between industrial and academic laboratories, which are to be co-funded by FAPESP and industry. Federal agencies, such as CNPq, will also participate.
“Nanotechnology and water: an overview”

Thembela Hillie

Council for Scientific & Industrial Research, South Africa

In the 21st century, many countries are entering an era of severe water shortage. Increasing competition among agricultural, industrial and domestic users will lead to clashes and significant increases in the real cost of water and the poor will be the most affected.

This presentation brings together a unique set of information that demonstrates the range of complex issues that need to be considered and addressed in applying nanotechnology for improving access to clean water. These will include but not limited to: risks, technology transfer, community uptake and sustainability.

“Nanotechnology as a tool in enhancing food security in India”

R. Kalpana Sastry * H. B. Rashmi, and N. H. Rao

National Academy of Agricultural Research Management, Hyderabad, India

In the recent past, reports of the increasing vulnerability of large population to hunger and malnutrition similar to the food crisis that occurred during the 1960s are being confronted by all nations. There are also dire warnings of bigger challenges of food insecurity by 2025 and 2050 when the present population of 6.7 billion is projected to
reach 9.5 billion before it stabilizes at about 10 billion by the end of the 21st century. There are 854 million food-insecure people globally, of which 70% live in Asia, predominantly in India and China. It is widely recognized that food security will remain a major global concern throughout the 21st century, and the Millennium Development Goal of reducing hunger by half by 2015 may be difficult to attain. Food security has also been linked to national security, global peace and political stability. Increasing risks of food insecurity are related to increase in global energy demand, decrease in worldwide per capita availability of arable land, decrease in renewable fresh water supply, and the projected climate change.

India is also facing food insecurities amidst the growing populations, fragile governance models of access to food to the poor, climate changes and uncertain economic scenario. Agriculture research system now faces more formidable challenges of meeting growing demands of the large population for nutritionally safe foods, with limited availability of land and water resources which are threatened by environmental and climatic pressures. Addressing these challenges requires increasing productivity and incomes per unit of the scarce natural resources, which is possible only through understanding, integrating and deploying new advancements in science and technology in agricultural production. Among the recent advancements, nanotechnology is fast emerging as the new platform for the next wave of development and transformation of agri-food systems, as well improve the conditions of the poor. Applications of nanotechnology have the potential to change the entire agriculture sector and food industry chain from production to conservation, processing, packaging, transportation, waste treatment and even redefine the food habits of the people.

This paper analyses the implications of current trends in nanotechnology for the agri-food sector in India which can help the policy makers to address some issues for enhancing food security. Using published literature and patents data, a model to organize the information was developed through a specially designed database. Through this database research themes in nanotechnology to specific sectors in the agricultural value chain were mapped, thus enabling a rational assessment of the potential applications of nanotechnology in the agri-food sector. The assessment includes identifying and prioritizing research needs across the agricultural value chain, along with the environmental and societal implications of this tool. It is concluded that such an approach can help devise sustainable food security strategies for the country and mitigate the decreasing rural incomes.
“Health: The Global Health Initiative”

Jeff Spieler

Senior Advisor for Science and Technology, Bureau for Global Health, U.S. Agency for International Development

“... That is why I am asking Congress to approve my Fiscal Year 2010 Budget request of $8.6 billion -- and $63 billion over six years -- to shape a new, comprehensive global health strategy. We cannot simply confront individual preventable illnesses in isolation. The world is interconnected, and that demands an integrated approach to global health.” President Barack Obama, May 5, 2009

The President’s 2010 Budget begins to focus attention on broader global health challenges, including child and maternal health, family planning, and neglected tropical diseases with cost-effective interventions. It also provides robust funding for HIV/AIDS. The GHI adopts a more integrated approach to fighting diseases, improving health, and strengthening health systems. While American leadership has helped to save millions of lives from HIV/AIDS, malaria, and tuberculosis, much more needs to be done to reduce further under 5 child mortality (26,000 children around the world die every day from extreme poverty and preventable diseases) and maternal mortality (530,000 women die annually from pregnancy-related causes).

The Administration’s funding plan can leverage support so that the world can come closer to fulfilling the health-related Millennium Development Goals. A comprehensive approach, with leveraged support from other nations, multilateral partners and foundations, can yield significant returns by investing in efforts to:

- Prevent millions of new HIV infections;
- Reduce mortality of mothers and children under five, saving millions of lives;
Avert millions of unintended pregnancies; and

Eliminate some neglected tropical diseases.

While a significant proportion of HIV infections, child and maternal mortality, and unintended pregnancies could be prevented with existing technology, if they were widely accessible to the populations most in need most, new cost-effect technologies are still required to yield the above-mentioned “significant returns.” The presentation will review some of these new technologies and include the potential role of nanotechnology.

**Governing Emerging Technologies: Regulating Risk & Ethical Dimensions in Development**

“Nanotechnology in the Environment: Safety by Design”

**Vicki Colvin**

*Department of Chemistry, Rice University*

Nanotechnology-enabled systems offer much promise for solving difficult environmental problems ranging from water purification to waste remediation. These solutions must not
only be cost-effective and sustainable, but they must also be safe for people and the environment. Our emerging understanding of the interface between nanomaterials and biological systems gives us the critical ability to approach the latter issue early in the development of nanotechnology. This talk will discuss in some detail how the chemical and physical properties of engineered nanomaterials impact their biological effects in model systems. Three case studies, ranging from fullerenes to metal oxides, illustrate the vast diversity of nanomaterial features and biological response. The composition of a nanomaterial is the primary factor in describing acute biological effects, and among the different examples nanoparticle charge and surface coating can be of equal importance. Interestingly, the size of the inorganic material itself – such an important feature for applications development – in these three examples is secondary in defining the materials’ acute biological effect. In all cases, the biological and environmental compartments experienced by nanomaterials lead to substantial modification of their hydrodynamic size and charge. The bio-modified material that results is the central element to understand and characterize in order to detect the underlying correlations between the inorganic nanomaterial phase, composition and size with biological outcomes. These correlations form the basis for guidelines that permit researchers creating new nanoparticles to focus their energy on materials that are ‘safe by design’.

“Constraints on Benefit of New Technologies for the World’s Poor”

Barbara Herr Harthorn

Center for Nanotechnology in Society, University of California, Santa Barbara

What are the barriers to realizing benefits of emerging technologies aimed at the poor, and what risks do emerging technologies pose for the poor? Responsible development includes issues of equitability in terms of access to technological benefits but also needs to fully incorporate efforts to assess and control risks and potential harm and to establish genuine 2-way communication with members of the public about their
concerns. Better understanding of both publics’ and experts’ risk perceptions and beliefs will allow anticipation of the behavior of key stakeholders and is critical to this project. This presentation draws on environmental, health, and social risk perception research conducted by the Center for Nanotechnology in Society at UCSB (CNS-UCSB) and the UC Center for Environmental Implications of Nanotechnology (UC CEIN) on global industry EHS practices, public deliberations in the US, UK and Canada, and public risk perception research in the US and other countries. Key issues center on the importance of cultural values that underlie risk perceptions and beliefs and include need for information and education (by experts and publics), desires for regulation by industry and various publics, trust enhancing and trust diminishing factors, and public deliberation and participation as pathway to safe and responsible technological development.

"Megaprojects and Democracy: Challenges and Prospects in Nanotech Legislation"

Richard Worthington

Professor of Politics, Department Chair, Pomona College

Megaprojects are big infrastructure developments, such as dams, highways, and major downtown renovations, that require large scale and long term mobilizations of money, personnel and equipment. Research-based megaprojects are a specific variant that is advocated by powerful coalitions of government, corporate and academic elites to advance new science-based industries. The original example is the Manhattan Project to design and deploy an atomic bomb. Subsequent research-based megaprojects include space exploration, genetic engineering, digital technology, and currently nanotechnology.

All megaprojects are vulnerable to the erosion of the public acquiescence that is needed to launch them, because the relative benefits and costs predicted by their advocates are subject to the uncertainties of complex interactions over long time horizons.

This can contribute to changing political capacities of competing interests.
Research-based megaprojects are even more vulnerable because of their reliance on scientific breakthroughs and the profitable commercialization of them, both of which are hard to align with project timelines and financial exigencies.

This dance of powerful interests with nascent social concern is particularly evident in the recent history of U.S. legislation on nanotechnology. The 21st Century Nanotechnology Research and Development Act of 2003 embodies all the conventional assumptions about science in society that permeate Western culture and political-economic practice (e.g., the idea that scientific advancement automatically yields social and economic improvement), yet it also includes provisions calling for meaningful public involvement in the program.

The bill for reauthorizing this legislation that was introduced in Congress during 2008 (and is still pending) represented an even more aggressive assertion of conventional technological optimism, and the legislators were less open to calls to strengthen social and environmental elements than they had been in 2003.

With the change in Presidential administrations, however, the relative capacities of competing interests have shifted, if only at the margins.

Two main issues are addressed in this paper. First, the changes that could be made in the nanotech reauthorization bill to better align it with concerns for public participation and social and environmental performance are presented and analyzed. Second, the interactions of advocates for these changes with the House and Senate committees considering the reauthorization bill are analyzed in order to better understand the dynamics of research-based megaprojects.

The implications of these two lines of analysis are then explored in order to describe the current landscape for the governance of nanotechnology.

* It is likely that the reauthorization bill will be passed and signed by the time of the “Emerging Economies” conference, in which case the analysis will be retrospective rather than real-time.
"[Nano]Technology for Equitable Global Development: What are the Chances?"

Kathy Jo Wetter

ETC Group, 331 W. Main Street, Suite 307, Durham, NC 27701

Will emerging technologies, including nanotechnology and synthetic biology, usher in an era of clean water, cheap and renewable energy, safer and more nutritious foods, more effective medicines and “greener” manufactured goods, as we’re being told? Will emerging technologies revive the global economy and fulfill the dream of material abundance, sustainable development and profit? We are told that emerging technologies will benefit people living in the developing world, but these assertions largely ignore the realities of technology transfer, the effects of privatization and other issues related to the ownership and control of technologies. Control and ownership of nanotechnology is a particularly vital issue for all governments because a single nano-scale innovation (in materials, processes and/or devices) can be relevant for widely divergent applications across multiple industry sectors. In recent decades, we have witnessed increased privatization of science and a staggering concentration of power in the hands of multinational enterprises. With nanotechnology, the reach of exclusive monopoly extends beyond life to the fundamental building blocks of all of nature. By some counts,[1] more than twelve thousand nanotech patents have been granted over the last three decades (1976-2006) by the three patent offices responsible for most of the world’s nanotech patenting – the U.S. Patent & Trademark Office, the European Patent Office and the Japan Patent Office. The United States accounts for more that 60% of the total. While the World Intellectual Property Organization continues to work out its “development agenda,” patent offices in leading “nano-nations” are making it more likely that researchers in the developing world will find participation in nanoscience and technology highly restricted— with access dependent upon royalty payments and licensing fees. While the scientific uncertainty surrounding the safety of nanotechnology has gained prominence in recent months (justifiably so), the issue of ownership and control is still getting short shrift. Any new technology – no matter how promising – that is introduced into society in the absence of a transparent and democratic assessment involving those who are potentially adversely affected will fail to narrow the gap between rich and poor.

References:

"Creating the Future: Materials, Science and the Scientific Community"

Todd Osman

Materials Research Society

The Bronze Age, the Iron Age and the Silicon Age all testify that materials and innovation advance society. Material technologies alone cannot impact society. Socioeconomic factors affecting the adoption of new technologies must also be considered as society addresses its current challenges. Successfully addressing societal challenges, such as alternative energy sources and access to clean water, depends on the interdisciplinary engagement of the global scientific and engineering communities.

And professional scientific societies must engage in the process, providing an infrastructure for scientific advancement, enabling social entrepreneurship and promoting truly sustainable endeavors.

Making it Happen: Challenges and new (business) models to provide access to beneficial technologies to poor and excluded communities.
"Expanding Access to Scientific Developments that Change Lives"

Holly Ladd

AED-SATELLIFE Center for Health Information and Technology

The places most likely to suffer the greatest impacts of climate change, the countries with the highest burdens from known diseases, and the sites most likely to see the emergence of new animal and human diseases are all located in regions with the poorest access to information to identify and manage these events and the least resources to deal with the potential problems. Medical scientists and practitioners in developing countries have little access to published research or generated knowledge and have little or no opportunity to develop their own investigations, participate in the studies of others, or publish their findings.

In addition, this information gap hinders their ability to practice evidence-based medicine and/or implement public health programs that incorporate the latest research findings.

Every day, people in poor countries die unnecessarily from malaria, tuberculosis, HIV/AIDS, pneumonia and diarrhea as health workers do not have access to reliable and current health knowledge.

Efforts aimed at expanding participation in a global scientific community have been greatly bolstered by advances in information and communications technology.

This presentation will discuss the impacts of lack of access to information and participation in scientific enquiry. Various projects, training programs, mentoring opportunities, and policy developments underway to address challenges and remove some of the barriers will be outlined.
"Solid State Lighting can help the Developing World Escape the Poverty Trap – but only by way of the Market Model"

David Irvine-Halliday

Light Up The World Foundation and University of Calgary, Canada

The work of Light Up The World Foundation (LUTW) over the last decade has demonstrated that Renewable Energy based Solid State Lighting (SSL) is arguably one of the most important Agents of Change available to the Developing World. It is however clear that though SSL can help those at the base of the economic pyramid (BOP) escape the poverty trap, it will not be accomplished by way of the donation model. It will be shown that only a judicious and fair minded use of the market place will allow SSL to reach the majority of the BOP, such are the staggering numbers involved. LUTW's fundamental goal is to improve the quality of life of those, who through no fault of their own, find themselves trapped in a cycle of poverty.

"Innovations for Development; the African Challenge"

Moses Kizza Musaazi

Makerere University, Uganda

The rate at which innovations are churned out far exceeds the number that actually reaches the market and survives the forces of demand by the end users. Clearly, all innovations have the
primary aim of satisfying a critical need and hence are expected to stay on the market for as long as that need exists.

In the Third World/Developing Countries, particularly in the African context, innovations are primarily for development. In the Developed Countries, innovations may range from satisfying a Summer craze for a particular colour to an appliance to be used by a space astronaut.

In the case of Developed Countries, the price or elaborative instructions for use are not critical factors while in Developing Countries, the price, ease of use (no Instructions Manual) and low maintenance are critical. The three factors take into account the high poverty, high illiteracy and low modernization levels.

The biggest challenge to an innovator/inventor in Africa is to take into account the three factors (poverty, illiteracy and modernization) and in the end have a product that is acceptable, adaptable, reproducible and affordable but at same time meeting appropriate (e.g. health and safety) standards.

In order to keep the price affordable and the production process sustainable, obvious automations (with their implications of skilled labour, fuel and low human involvement) have to be avoided and sacrificed to low production (with what may termed as inefficiency) due to high manual labour inputs. However, when the full evaluation of the innovation reveals success in social-economic terms, its promotion for development is self-driven.

This paper discusses the successes, challenges and experiences of an African inventor/innovator as his innovations reach the local and wider markets. It gives an insight into possible solutions to the challenges that are faced by innovators particularly for the African market.

The paper draws attention to use of local materials, taking into account culture and environment.

In order that the innovations enjoy a wider market and quick acceptance, cooperation across
Nanomaterials, with interesting chemical and physical properties, are being explored for their potential in environmental applications. When a photocatalyst is illuminated, it triggers an energetic response that can oxidize pollutants to environmentally acceptable products. For example, volatile organic compounds are degraded to carbon dioxide and water on illuminated titanium dioxide nanoparticles. TiO2 is an attractive photocatalyst because it is inexpensive and chemically stable. There is a serious limitation, however, that titanium dioxide requires excitation by UV and the process has a relatively poor quantum yield. Development of more effective photocatalysts is therefore crucial in the commercialization of this pollution treatment technology. Our research group has been working on photocatalysts modification and enhancement since 1996. A variety of approaches have been developed for improving the efficiency of titanium dioxide-based photocatalysts. These include metal and nonmetal doping, thermal and acid treatments, and sonochemical and microwave-assisted preparation.

The enhanced photocatalysts show much improved activity but these powdered materials are still difficult to recycle in treatment facilities. To solve this problem, we have developed methods for coating photocatalytic thin films on inert substrates. These nanometer thin films have immense potential for water purification and air pollution cleanup. The strong oxidizing environment on the coatings also provides additional benefits such as anti-bacterial and superhydrophilic properties. To capitalize on these desirable properties, we work closely with industrial partners. Our NanoPCO™ technology was commercialized and has been licensed for use in high-end water treatment and air purification systems.
References:


**Innovation models for development**
"Managing national policy in the global invisible college"

Caroline Wagner

Stanford Research Institute, George Washington University

Creating an equitable space for developing countries in which to innovate requires a strategy where companies are linking at the global level and sinking locally. Even though the dominant system for science operates at the global level, it is still mediated by nations, and nationally-based institutions. Each nation-state needs to learn to manage a global system at the national and local level—a truly challenging proposition, but one that can be made more effective by understanding network dynamics. Governments provide specific parts of the scientific infrastructure and rather than casting this as a national system, it is imperative to examine the scale required for successful science relative to population and budget. Functions are laboratory space and equipment; research funding; standards, metrology, and regulatory environment; extension services and technology transfer; and intellectual property protection. Each function does not need to be offered by each government—indeed it would be highly inefficient to do this, but each function must be made locally available. The role of the nation-state in providing access to services and collaboration can be critical to local success in this part of the scientific process.

"A social approach to nanotechnology"

Guillermo Foladori

Autonomous University of Zacatecas, Mexico
There are three conceptions that shape the design and implementation of nanotechnology policy. One endorses nanotechnology development by itself in the search for an increase in competitiveness to promote economic growth. Another goes beyond the conception of “competitiveness = development” and encourages the development of nanotechnology to change things for the better in specific sectors (i.e. energy, water, health). The third conception, is a combination of the previous two, but suggests the implementation of policies (financial and regulation) to guarantee the equitable distribution of the potential benefits brought about by nanotechnologies.

These three conceptions represent technical approaches. All three conceptualize development as a matter of obtaining more, better, or better distributed “stuff”. Although this is important for developmental purposes, it is not enough, especially in the context of developing countries.

A social approach is needed; one that goes beyond technical conceptions. This approach should recognize that the current development trajectory of nanotechnology is embedded in a pre-established technical and social division of work and inequitable trends; and unless socio-political forces disrupt those tendencies, nanotechnology will, more likely, end up deepening inequalities.

This approach should empower social organizations to increase the chances of driving nanotechnology towards social ends. Social organizations are keen in identifying socio-economic barriers, and they are also the force that can change pre-existing inequality trends. We have to remember that it was an NGO the one who raised the alarm in the world about the potential risks to health and the environment associated with the use of nanotechnologies; it was not a government, a company or an academic association. Today, Trade Unions and NGOs are raising the awareness about the implications of nanotechnology on the division of labor and employment. This issue is still not in the agenda of governments or businesses.

"Emerging Technologies and Inequalities: Developing Country Experiences"

Susan Cozzens
The innovation systems approach to societal development includes a critique of the common focus on high technologies in the development process. Even in affluent economies, directing resources exclusively to high technologies neglects the broader innovative processes undertaken by doing, using, and interacting. In developing economies, with fewer resources, too strong a focus on high technologies is unlikely to produce as much benefit as a more inclusive concept of innovation.

Emerging technologies are defined as those that are new, science-based, and of potentially broad impact (Cozzens et al., forthcoming). They are a particular subset of high technologies, located at what some call the technological frontier. Affluent countries compete for leadership in emerging technologies like bio- and nano-technologies, and some less affluent countries have in the past found significant opportunities in the wide-open spaces of the technology emergence process.

This paper looks at five examples of emerging technologies from the viewpoint of several developing countries, with particular attention to their distributional consequences. None of the examples represents the kind of dramatic opportunities that get so much attention in the innovation studies literature – there are no Koreas, Taiwans, or Singapores here. Precisely because of this, these cases may be more representative of the dilemmas emerging technologies present for countries that are trying to achieve inclusive growth.

The paper presents some of the results from a cross-national, cross-technology study of the distributional effects of emerging technologies. The five technologies studied were: genetically modified (GM) maize, mobile phones, open source software, plant tissue culture, and recombinant insulin. The eight countries included were: Argentina, Canada, Costa Rica, Germany, Jamaica, Malta, Mozambique, and the United States. Half are high-income and half are low or middle income countries. This paper focuses on the results of the study in the four low and middle income countries.

* This paper draws in particular on case studies done as part of Project Resultar on Argentina, Costa Rica, Jamaica, and Mozambique, by Isabel Bortagaray, Lidia Brito, Roland Brouwer, Mario Falcao, Sonia Gatchair, and Dhanara Thakur. The Mozambican case studies were done
as Work Package Four of ResIST, a project funded by the European Commission (see http://www.resist-research.net/home.aspx). Mark Knell is co-leader of that work package with Susan Cozzens. The case studies in the Americas were funded as Project Resultar by the U.S. National Science Foundation under Grant SES 072-6919. All opinions, findings, conclusions and recommendations are those of the author and do not necessarily reflect the view of the sponsors.

Webcast

Panels and plenary sessions at the conference will be recorded and posted online for viewing. Sessions held during days 2 and 3 will be webcast live; footage from all three days of the conference will be archived online within a few days.

Day 1: Wednesday, Nov. 4

Day 2: Thursday, Nov. 5

Day 3: Friday, Nov. 6