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Abstracts



Olanike Adeyemo, Nigeria

BEYOND RESOURCE SHARING: SUSTAINABLE MANAGEMENT OF TRANSBOUNDARY POLLUTION AND DISEASES

The plants, animals, microbes, waters, climate systems, and other elements that constitute the environment, human being inclusive, do not remain within geographical boundaries. More often than not, they cross the political boundaries between nations. When this occurs, the environmental issues of communal concern that arise from the shared area, resource, system, or migratory species are called “transboundary”. Worldwide, there are 263 international transboundary river basins, and beyond water resources, the spate of human movement has been linked to the increase in emerging and re-emerging transboundary diseases. An infectious disease in one country is a hazard to all because an epidemic in one country can spread rapidly across national borders and become a regional or global concern.

Currently management of transboundary resources and diseases is driven by national priorities. Additionally laws and regulations usually differ on either side of the divide and there are many institutional players with different agendas and mandates. Whereas, for a shared resource there is a need to effectively manage the quality of transboundary waters and adjust priorities to ensure equitable management. It is also necessary to collaborate in order to sustainably prevent and manage transboundary diseases.

Integrated transboundary water resources and disease management including policy-making to address issues of mutual concern is hereby advocated.



Christian Agyare, Ghana

MEDICINAL PLANTS AND NATURAL PRODUCTS AS SOURCES OF ANTIPARASITIC AGENTS

Infectious diseases caused by parasitic agents are a major threat for most people, especially in the tropical regions of the world. More than 1 billion people world are directly exposed to parasitic agents such as the causative agents of leishmaniasis, trypanosomiasis, lymphatic filariasis, schistosomiasis and onchocerciasis, which represent a major health risk to people in the developing countries. About 70 to 80% of people in the developing countries depend on medicinal plants and traditional medicine. Unlike most antimicrobial agents, there is virtually no antiparasitic drug with minimal side effects even if available. Some of the currently available drugs are chemically de novo synthesized, however, the majority of drugs are derived from natural sources such as plants which have subsequently been chemically modified to warrant higher potency against these human pathogens. We present some of findings of our evaluation of some Ghanaian medicinal plants and compounds isolated against some parasitic agents responsible for trypanosomiasis, schistosomiasis, lymphatic filariasis and onchocerciasis.



Amal Amin Ibrahim S. Nada, Egypt

MANUFACTURING OF NEW NANOSTRUCTURED POLYMERS/NANOCOMPOSITES FOR NEW INDUSTRIAL APPLICATIONS OF NANOTECHNOLOGY

Nowadays, we are living in the age of new materials to cope with the increasing demands for new efficient and functional materials for the new challenging applications in different fields. Nanostructured polymers and consequently their nano-composites as well take distinguished position with that respect where they act efficiently more than the traditional structural polymers in low loading contents saving environment to some extent from the hazards of the traditional polymeric structures. Several polymeric materials were used such as dendrimers, hyperbranched polymers and others. Versatile applications were tried such as dielectric materials, cement and construction materials, and drug delivery systems.



Antonio Andreoni, United Kingdom

ON MANUFACTURING DEVELOPMENT UNDER RESOURCES CONSTRAINTS

Manufacturing development and resources constraints are linked by a complex array of structural relationships, which have been unfolding in a variety of ways in different countries since the industrial revolution. Resource constraints are sector specific and affect production tasks within each sector in more or less deep ways according to the production units involved and relative levels of aggregation at which economic systems are operating. This implies that, at each stage of structural change and according to the countries' different patterns of specialisation, resources constraints (or abundance) will affect economic systems differently. Ultimately problems of resource scarcity tend also to acquire an international character and as such become a geopolitical and multi-polar issue, to the extent countries become integral parts of the increasingly modularised global manufacturing system.

Within this complex and inherently dynamic architecture, the interdependencies between inter-sectoral value chains are the main channels through which resource constraints affect countries' manufacturing development patterns. The aim of this paper is to show firstly how multi-sectoral models of production, in which resource constraints are structurally integrated, offer critical analytical tools to disentangle such complexity. In disentangling the relationships between manufacturing development and resource constraints, the paper then focuses on the way in which the 'manufacturing apparatus' transforms the nature of scarcity by making it a 'relative' phenomenon functionally linked to incremental as well as disruptive technological changes. Through an analytical-historical reconstruction of countries' structural learning trajectories, the essay provides evidence of the inter-sectoral nature of 'technological scarcity' but also how scarcity-induced technological innovations may trigger cumulative technological transformations across sectors.

An understanding of these resource-led structural dynamics provides fresh lenses to investigate the 'political economy of resource management' at the national and international level. Going beyond the dominant 'resource curse' debate, the paper concludes by sketching a number of specific policy implications. In particular, the lack of alignment of manufacturing, technology and resource policies



(and, thus, the missed opportunity of creating and capturing value through resource-triggered complementarities over time) is identified as the main constraining factor for countries at both initial and more advanced stages of manufacturing development.



Abdeslam Badre, Germany

TOWARDS A TRIANGULAR SCIENTIFIC SYNERGIES FOR GLOBAL SUSTAINABLE DEVELOPMENT POLICY

Environmental changes have drastically reduced the availability of cultivable land, green forests, fresh water, clear air, and fish resources. While these changes reduce the availability of resources, population growth and changing consumption behavior exacerbate the stress on these resources. Conflict over renewables have grown more potent as demand for essential commodities increase day by day and as the supply-side looks more and more insecure. Most states depend greatly on renewables - soil, water, fish, forests, and energy - that sustain much of their economic activities. However, when one state strives for development by acquiring or exploiting more than its share; it often affect the interests of other states, which leads to dramatic and often long lasting political conflict and social animosity which is already reaching its peak in most part of the world

More than ever, today academia and scientific research communities worldwide are invited to devise a cutting-edge global sustainability platform to coordinate scientific research which is veered toward a triangular partnership with governments, business and, more broadly, society. The objective of this paper, accordingly, is to address a new approach to the critical challenges of global environmental change and sustainable development. The focal argument of this paper revolves around the premise that if environmental changes and risks transcend geographical and geopolitical boundaries, an academic and scientific approach to innovative solutions can only be reached if it is holistic, inter and trans---disciplinary, and multidimensional that scales up regional and international collaboration on research and brings together natural scientists, social scientists, engineers and the humanities with funders and policy makers to align research agendas, understand and anticipate environmental change, and inform solutions and transformations towards sustainability.



Yusuf Baran, Turkey

DRUG RESISTANCE IN CANCER AND ITS REVERSAL

Chemotherapy is the most widely used treatment strategy for cancer which is the highest second reason for human being deaths after heart related diseases. However, cellular resistance mechanisms developed by cancer cells and tissues in the beginning or proceeding times to applied anticancer agents is a significant problem preventing successful therapy. Resistance developed by cancer cells to structurally and functionally different cytotoxic agents is called as multi drug resistance. The possible mechanisms of multidrug resistance in cancer are; I) Decrease the intracellular concentrations of drugs to sublethal levels resulting from increased export or decreased import; II) Structural changes in anticancer agent binding site; III) Increases in the numbers of drug targets or complete removal of the target from the cells; IV) Changes in expression levels of the apoptotic pathways controlling genes; V) Aberrant ceramide metabolism; VI) Increases in DNA repair mechanisms and VII) Problems related with drug metabolism.

Understanding the mechanisms that guide multidrug resistance provide a vital opportunity to reverse the resistance by targeting these mechanisms by biochemical and genetical approaches.



Felipe Barra de la Guarda, Chile

NON-EQUILIBRIUM QUANTUM SYSTEMS

Nowadays, due to technological progress towards miniaturization, we encounter more and more quantum systems in out-of-equilibrium situations. Nevertheless our current understanding of classical or quantum non equilibrium systems is poor. I will present a physical picture that describe some simple out-of-equilibrium quantum systems successfully and comment on the difficulties with more general schemes.



Julia Baum, Canada

MARINE BIODIVERSITY IN A CHANGING WORLD

Our view of the ocean has been transformed in recent decades from limitless and hostile to vulnerable and impacted. Yet, despite a multitude of studies documenting anthropogenic disturbances to oceanic ecosystems, we still lack a synthetic understanding of how marine biodiversity is changing. Here, I present new analyses examining how the biomass, size structure, and turnover (β diversity) of oceanic communities are changing. My focus is coral reefs, the most diverse marine ecosystems. Treating the Pacific Ocean as a natural factorial experiment, I combine a standardized regional-scale monitoring data set with high-resolution population and biophysical data to model the relative importance of human disturbance, biogeography, and environmental factors on coral reef fish diversity. While most coral reef studies have occurred on moderately- to highly-impacted reefs, the present data set encompasses some of the world's remaining intact coral reefs, facilitating new insights into the changing nature of ocean diversity.



Abdullah Shams Bin Tariq, Bangladesh

ACADEMIA AND ACADEMIC PUBLISHING

Academia and academic publishing are two partners in the same boat that are not always rowing in the same direction. Here it is attempted to present how business interests of some elements of the publishing industry can act contrary to the interests and expectations of the academia. A few current issues, e.g. predatory publishers abusing the 'gold' version open access, author charges becoming discriminatory against economically weak sections of academia, (semi-)vanity publishers luring academics into print-on-demand publishing of theses etc. are identified and an attempt is made to study their impact on naive and often young members of the academia. Some preliminary suggestions presented on roles that (young) academics can play to protect the academic interests of scientists and scholars in general.

Preliminary References

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Francisca Bronfman and Claudia Escudero, Chile

DEATH SIGNALING ENDOSOME IN NEURONAL AXONS CONTAINING THE COMMON NEUROTROPHIN RECEPTOR. IMPLICATION FOR NEURODEGENERATIVE DISEASES

During development of the sympathetic nervous system it is well established that survival signaling competes with death signaling to modulate the number and connections of sympathetic neurons (SCGs) and their target innervation. This process is achieved by the interaction of specific growth factors, the neurotrophins NGF and BDNF, with their cognate receptors TrkA and p75 respectively. The aim of our work was to study the relevance of the retrograde axonal trafficking of the common p75 neurotrophin receptor (p75) in the apoptotic response induced by axonal-applied BDNF and to analyze whether the c-Jun amino terminal kinase (JNK) is involved in this process in SCGs. JNK is a downstream kinase activated by BDNF and is required for BDNF-induced apoptosis. We used SCGs in compartmentalized cultures (axons are in different chambers than the cell body), in addition to immunocytochemistry and confocal and real-time fluorescence microscopy techniques. Our results indicated that the retrograde apoptotic response triggered by p75 requires the molecular motor dynein. Suggesting that dynein transport a p75-positive endosome in the axon back to the cell body. Inhibitors of JNK blocked p75 internalization and retrograde transport, in addition to the apoptotic retrograde signaling induced by BDNF. Expression of a dominant negative mutant of Rab5, a key GTPase regulating early endosome function, inhibits the retrograde transport of p75 and BDNF-induced retrograde killing. Our results suggest a model where increased activity of Rab5 mediated by p75 would sort p75-signaling endosomes to the retrograde transport pathway, process that promotes apoptosis in the cell body. These results indicate for the first time that, in the axon, p75 increases the activity of stress-activated kinase JNK, which in turn induces p75 internalization and retrograde transport of a signaling endosome that causes neuronal death. Our research sheds new light on the molecular mechanism underlying neurodegenerative disease where p75 retrograde signaling is increased.

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Kai Chan, Canada

TIME FOR A NEW BRAND OF ENVIRONMENTAL SCIENCE ENGAGEMENT

Background/Question/Methods: Many environmental scientists see the concept of ecosystem services (ES) as a vehicle and forum for integrating their research more effectively into public discourse and decision-making. The concept's popularity has been rising dramatically, with uptake in a wide diversity of fields and contexts, extending the reach of natural resources. But for all the hoopla, what substantial changes in management and policy have been accomplished through ES research, and what hope is there that that such research will yield the kinds of transformative changes needed for sustainable trajectories?

In this talk, I will review the major approaches that ES researchers have taken to engaging with management and policy, and analyze these along the following dimensions: (1) the feasibility of science to provide the knowledge needed; (2) the approaches to engagement required, and the extent to which researchers are taking these; (3) the feasibility of policy and management to integrate science in the way imagined (given social, political, and economic realities illustrated via anecdotal examples); and (4) the implicit locus of responsibility for social-ecological stewardship. Synthesizing across these, I assess the opportunity for each approach to foster sustainable trajectories.

Results/Conclusions: I found four broad classes of ES engagement: intended contribution to (a) diffuse awareness-raising, (b) cost-benefit analysis, (c) spatial planning, (d) payments for ES. Analyzed across the four dimensions above, each of these approaches faces substantial—and perhaps insurmountable—obstacles to fostering sustainable trajectories. Most researchers are only pursuing outreach and scientific engagement with ES in superficial and opportunistic ways, and even the deeper engagement efforts face key obstacles relatively absent from the literature.

Based on this analysis, I argue that it's time to develop substantively different approaches to engagement about ES. I propose one such possibility, which may offer novel opportunities for tangible changes. Through a case study called "Project Beef," I will illustrate an approach to scientific engagement involving whole supply chains, which bear the responsibility for resource-use and so for



degradation and conservation of ES. I will discuss several obstacles facing the supply-chain approach and reflect on its opportunities to foster large-scale transformative changes toward sustainability.



Kok-Keong Chong, Malaysia

NON-IMAGING DISH CONCENTRATOR FOR THE APPLICATION IN CONCENTRATOR PHOTOVOLTAIC SYSTEM

Solar concentrator plays an important role by making use of optical technology in the design, which can be either reflector or lens to deliver high flux of sunlight onto the Concentrator Photovoltaic (CPV) module receiver ranging from hundreds to thousand suns. To be more competitive compared with fossil fuel, the current CPV systems using Fresnel lens and Parabolic dish as solar concentrator that are widely deployed in United States, Australia and Europe are facing great challenge to produce uniformly focused sunlight on the solar cells and to reduce the cost of solar concentrator. The concept of non-imaging optics is not new, but it has not fully explored by the researchers over the world especially in solving the problem of high concentration solar energy, which application is only limited to be a secondary focusing device or low concentration device using Compound Parabolic Concentrator. With the current advancement in the computer processing power, we has successfully invented the non-imaging dish concentrator using numerical simulation method to replace the current parabolic dish as primary focusing device with high solar concentration ratio (more than 400 suns) and large collective area (from 25 to 125 m²). Various innovative and creative ideas to minimize the cost of renewable energy in power generation are very important to guarantee a good future of the next generation.



Martin Dominik, United Kingdom

NATURAL RESOURCES IN A FINITE (?) UNIVERSE

Asteroids could provide a supply of many metals that are key for modern industry, but could be exhausted on Earth within about 50 years. Some projects for commercial exploitation of asteroid mining are already shaping up. The proposed business models however raise several issues with regard to both the economic feasibility as well as the legal framework. In particular, Article I of the Outer Space Treaty governs that "The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." Similar questions not only arise on exploiting resources of the Deep Sea and Antarctica, but competing national interests on the access to natural resources are likely to continue being a major source of conflicts. What are the solutions?



Cristina Dorador, Chile

MICROBIOLOGY OF HIGH ALTITUDE CHILEAN LAKES: FROM DESCRIBING THE LIMITS OF LIFE TO EXTENDING HUMAN LIFE

Microbial Complexity and Functional Ecology Laboratory, Antofagasta Institute, Department of Biotechnology, University of Antofagasta, Antofagasta, Chile

High altitude wetlands in the Chilean Altiplano are unique, remote aquatic ecosystems considered as part of the cold biosphere. Typically, these ecosystems contain organisms with a high level of endemism that thrive under extreme environmental conditions (e.g. broad range of daily temperatures; high solar radiation; aridity).

Microbial diversity in different salares (saline closed evaporitic basins) is notably high and characterized by the frequent presence of previously undescribed clusters of Archaea and Bacteria. Using different techniques, it has been demonstrated that a large proportion of microbial sequences originating from high altitude wetlands in the Chilean Altiplano have no analogous cultured microbial species: furthermore, most of this diversity is distributed across different microbial taxa at relatively low abundances, being part of the 'rare biosphere'.

The bacteria isolated from these environments exhibit a wide range of adaptations with potential application in biotechnological industry, including bioactive compounds with different activities ranging from cosmetics through to anti-cancer compounds. Our work covers a range of activities from the description of the systems themselves and their microbial communities through to the characterisation of new molecules with the potential to enrich and even extend human life.



Sherif F. El-Khamisy, Egypt

CHROMOSOMAL STRAND BREAK REPAIR AND HUMAN DISEASE

The human genome is under continuous threat from environmental genotoxins and endogenous sources generated during normal metabolic activities. Failure to repair these breaks results in human disease, such as cancer, neurodegeneration, and immunodeficiency. It also contributes to complications associated with diseases with high social impact such as diabetes, reproductive, and cardiovascular disorders (El-Khamisy, *EMBO Mol Med*, 2011). One type of these breaks features a protein covalently linked to DNA termini. This class of DNA damage arises during the enzymatic cycles of DNA topoisomerases to overcome torsional barriers ahead of many DNA transactions. Beside their implications in the aetiology of human disease, these protein-linked DNA breaks underlie the clinical utility of an important class of anticancer topoisomerase 'poisons' that is widely used in Egyptian clinics.

Removal of the covalently linked topoisomerase (Top) from DNA termini is mandatory prior to subsequent repair steps. This is achieved by Tyrosyl DNA phosphodiesterase-1 (TDP1) that hydrolyses the 3'-phosphotyrosyl bond between Top1 and DNA (El-Khamisy et al., *Nature*, 2005). Recently we have identified the corresponding activity that removes Top2 from the 5'-terminus of a DNA strand break and it was subsequently named TDP2 (Ledesma & El-Khamisy et al., *Nature*, 2009). Here, I will give an overview of our recent understanding of these pathways and ways to exploit them as novel biomarkers and drug targets to improve the clinical outcome of anti-cancer strategies in Egypt.



Jauad El Kharraz, France/Morocco

IMPROVING WATER USE EFFICIENCY AND REDUCING THE COSTS OF POWER IRRIGATION SYSTEMS

The agriculture sector is accountable for around 30% of the total water consumption in Europe, but reaches up to 70% of total water consumption in several European southern countries. In the past recent years, most of the efforts have focused on water efficiency improvement. Traditional surface irrigation methods where the entire field floor is flooded have been replaced by drip irrigation techniques where only 20-30% of entire soil surface is irrigated. As a consequence, soil evaporation is drastically decreased and therefore lower water applications can be achieved. However, these water efficiency efforts have been carried out without taking care of energy aspects, resulting in a significant increase in energy consumption, both per irrigated surface and per volume unit of water, due to the fact that many traditional irrigation areas have been transformed into pressurized irrigation, and the increasing use of groundwater from deep soil layers. In parallel, we are living a fast increase in terms of energy prices all across Europe, due to many different factors, and impacting on the main energy sources (oil, natural gas, electrical power). Moreover, renewable energy sources (mainly wind and solar), not manageable according to demand, are quickly growing in Europe and generating some new challenges and imbalances in electrical net management, as well as making more difficult the match between offer and demand. Energy, mainly electrical power, is a very relevant production input in irrigation in agriculture. In terms of total energy consumption, it reaches up to a 3% of total national electrical power consumption in countries like Spain. From the economical point of view, electrical power consumption accounts for up to a 30-40 % of gross production value in certain areas and crops. This is damaging competitiveness and even putting into question the viability of certain irrigated agriculture subsectors and regions. As stated before, energy costs are one of the main concerns for the irrigation sector. Moreover, irrigation is one of the few economical activities where energy use can be adapted to energy offer, because of the capacity to store water in reservoirs, in groundwater, and the fact that the soil fields can buffer the current demand, acting as well as small reservoirs for water. Thus, the main concept to be developed is the water demand-side management according to available energy offer. The project aims at developing an innovative water & energy smart grid for irrigation,



introducing demand-side management and matching with available energy offer, thanks to the water storage capability and the 'near-almost elastic' demand from users, demonstrating innovative techniques for resource efficiency at local level, and developing an innovative integration approach.



Daniel Escaff, Chile

A SELF-ORGANIZATION MECHANISM TO EXPLAIN THE FORMATION OF STRANGE BARREN STRUCTURES IN VEGETATION DYNAMICS

The emergence of self-organization in out of equilibrium systems has received much attention in the last decades. These self-organizing systems have the fascinating common property that, in spite to be formed by many interacting constituents, they are capable to exhibit a coordinated dynamics.

On the other hand, vast landscapes extending from southern Angola, Namibia, and South Africa exhibit mysterious barren patches of vegetation called fairy circles. They consist of isolated or randomly distributed circular areas devoid of any vegetation. Although several hypotheses have been proposed, the origin of this phenomenon remains unsolved.

In this talk, it is proposed a self-organization mechanism that explains the formation, shape and the response to aridity of fairy circles.



Javier Garcia-Martinez, Spain

THE GLOBAL EXPERIMENT OF THE INTERNATIONAL YEAR OF CHEMISTRY: CREATING ON-LINE COMMUNITIES FOR LEARNER-DRIVEN EDUCATION

Online social media is a great platform to share content, initiatives and experiences among people with similar interests. What a better opportunity for learner-driven education. Herein we report the design, implementation and main results of the Global Experiment of the International Year of Chemistry, and how we went from posting experiments in the web to having a community of hundreds of thousands of students from over 80 countries doing chemistry experiments, sharing their results online, and creating their own activities in a way that surprised even to the organizers of this global IYC initiative.

In an online survey, organized by the US National School Board Association, in which 1200 students, ages 9 to 17, participated, 96% of the students with online access reported that they used online social media. One may think that this is a waste of their time while they should be doing their homework, but in fact, nearly 60% of those students use these online tools to discuss education-related topics and more than 50% reported that they use them to discuss schoolwork to support their education. Schools and universities are seeing the opportunity that online tools represent and many are embarking in really ambitious open-access educational initiatives, some with great success.

The International Year of Chemistry has been a great opportunity to increase public awareness and understanding of Chemistry, but also a major challenge, especially when designing a major global activity with a strong educational component. How to make the activity attractive while maintaining the highest standards of educational and scientific content so we could reach millions of students from all around the World? The answer was making the students the main actors of their own learning by creating the online tools that allow them to perform the activities that were designed by a team of experts but more importantly, to share their results, new ideas, and experiences online; in a word, to create their own online communities.



The theme of the Global Experiment of Water: A Chemical Solution, was chosen not only because of the central role of water in Chemistry, but because its interconnections with health, climate change, and energy, among others. The activities which consist of four component experiments were: acidity, salinity, household purification and solar still challenge. The first goal was to provide students with an appreciation of chemical investigation and data collection validation.

In the first activity (acidity), students learned about one of the most common chemical properties encountered around the home, acidity of the water. By measuring the acidity of the local water, they also learned about different experimental techniques and the consistency of their results. The second activity consists on the measure of the conductivity of local water samples by using either a homemade or commercial meter. In this activity, students discovered about one of the most common physical properties of water, salinity, as well as to determine concentrations of salts in solutions. The third experiment is related to water purification. Students used household materials to build a water filtration unit and learned about the efficiency of different filtration materials to finally carry out a treatment of the water. The last experiment consists in building its own solar still. Thanks to this activity students learned about distillation as a way of purifying water and the different states of matter. All these experiments were carefully selected and adapted in order to ensure they are suitable for implementation in schools across the world. Before being posted on line, they were tested in small groups to ensure their workability, especially in developing countries.

As by the closure of the website on 31 March 2012, the Global Experiment has more than 128,330 students from over 82 countries, from the 5 continents, and 4,804 classes have been submitted their results to the global map.

The web site water.chemistry2011.org, done and maintained with European Schoolnet, is available in 5 languages: English, French, Spanish Chinese, and Russian, including state-of-the-art interactive tools, 2D and 3D map showing the data, and pictures, videos and news on the Global Experiment. The four activities of the Global Experiment are currently available in 11 languages: English, French, Spanish, Russian, Hebrew, Portuguese, Arabic, Catalan, Slovak, Polish, and Chinese. The Twitter account of the Global Experiment has 500 followers and more than 550 people follow the Global Experiment in Face- book. The Global Experiment has been extensively featured in TV and Radio shows, news articles, and blogs, including BBC's "The One Show" and the BBC Radio show "Science in Action".



These data are only the tip of the iceberg as many students that performed the Global Experiment did not submit their data using the website. For example, on June 22nd, hundreds of schools and thousands of students took part in Global Experiment in UK during the national launch of this activity.



Jan-Christoph Heilinger, Germany

COSMOPOLITANISM AND RESPONSIBILITY

Given the globalised nature of our current world, it seems natural to take a “cosmopolitan” stance with regard to questions about moral and political responsibility. The word “cosmopolitan” is a compound of the Greek words “kosmos” and “polites” and means *citizen of the world*. Cosmopolitanism assumes that all human beings are, from a moral perspective, equally important and deserving of concern and that all humans form a community that is morally relevant. With this egalitarian and universalist view, cosmopolitanism stands in opposition to various alternatives that limit claims about justice and responsibility to statist, nationalist and other particularist frames.

In my short presentation I will introduce the idea of cosmopolitanism and spell out some of its implications for collective and individual agents. I will focus on some prominent criticisms of cosmopolitanism (mainly that its demands are excessively demanding and will hence not motivate agents to follow them) but argue that we should endorse cosmopolitanism nevertheless, for example when thinking about an intelligent use of finite natural resources.



Muhammad Manjurul Karim, Bangladesh

PROBIOTIC TECHNOLOGY FOR SUSTAINABLE DISEASE MANAGEMENT OF PRAWN AQUACULTURE IN BANGLADESH

Background/Introduction: *Macrobrachium rosenbergii*, the giant fresh water prawn is one of the most important commercially-produced crustaceans in Bangladesh. A significant limitation to the industry is loss of productivity owing to the emergence of a large variety of pathogenic bacteria and viruses, and their resistance to chemotherapeutic drugs resulting in mass mortality and consequent crop failure. Finding a public health and environment-friendly alternative is therefore a burning question to ensure sustainability of this industry in Bangladesh.

Objective: Molecular fingerprinting of randomly selected pathogen that were associated with huge prawn mortality was addressed for their identification. Probiotics – the friendly bacteria with a host of benefits that work by competitive exclusion of pathogenic bacteria can be a suitable alternative. This study aims to test probiotic bacteria able to inhibit growth of pathogenic bacteria that caused prawn mortality.

Methods and materials: Following a disease outbreak in prawn hatcheries of Sathkhira and Khulna regions during May 2012, samples were collected immediately from dead prawn larvae, rearing water and fish feed in order to isolate and characterize the pathogenic bacteria. Subsequently, their identification at the molecular level was conducted after amplifying their ribosomal DNA to do amplified rDNA restriction analysis (ARDRA) followed by sequencing and phylogenetic analysis of the isolates. The antibiogram of the isolated pathogens was conducted before they were challenged to compete with probiotic bacteria, *Lactobacillus* spp isolated from curd.

Results: The bacterial count on animal samples was found significantly higher ($p < 0.05$) than that of the water and fish feed samples, indicating the mortality was due to bacterial infections. The dead animals harbored heavy loads of pathogenic bacteria; sixteen of them were identified as *Enterobacter* spp., *Klebsiella pneumoniae*, *Enterococcus* spp. and an extremophile *Exiguobacterium* spp. Twenty six



antibiotics were tested to study the drug-resistance pattern of the isolates. Virtually all the tested isolates (thirty six) showed moderate to resistance state to the drugs tested, and the highest sensitivity of the isolates (85%) was recorded to Oxytetracycline. In an in vitro attempt to control pathogen's growth, the cell-free supernatant (CFS) of *Lactobacillus* spp produced a dose- and age-dependent reduction of bacterial count.

Conclusion: The inhibition of bacterial growth could be attributed to some extracellular substances released from *Lactobacillus* spp, demonstrating its potential to be an excellent probiotic candidate against the isolates associated with prawn mortality, a possible applications in prawn aquaculture. If successfully translated in culture ponds, this will be an eco-friendly approach to counter bacterial infections without compromising the prawn quality, thereby ensuring food safety in prawn industries of Bangladesh.



Andrew Haddon Kemp, Brazil

WAR ON SCIENCE AND ACTIVE HOPE

This year's conference on Natural Resources in a Finite World focuses on an important challenge to scientists, policymakers, and politicians and represents a topic of major concern to the survival of humanity. A critical first step is to better understand the extent to which the broader community accept the challenges that we face, without which, any attempts to address these challenges will be wasted effort. In this regard, the Royal Society and US National Academy of Sciences recently released their consensus statement, stating: "it is now more certain than ever, based on many lines of evidence, that humans are changing Earth's climate". However, at the same time, we are facing a simultaneous "war on science" and increasing "climate denial" from the general public. I have been shocked by the extent to which the average person on the street ignores important findings from scientists when it goes against what they want to believe or what future they would like to have. There are also increasing reports of cyber-bullying, public abuse and legal threats towards scientists bearing bad news. Another troubling development is news of non-scientists seeking to undermine the integrity of the scientific process by bullying journal editors acting on manuscripts thought of as 'inconvenient'. A global survey is needed to determine the extent to which people throughout the world accept the science of climate change and its consequences. This is an important and critical task to provide us with more information on how best to manage the psychological consequences of the global emergency we are facing. Psychology has identified seven categories of psychological barriers to mitigation of and adaptation to climate change. I will argue that psychology (my own discipline) has a critical role to play in overcoming these barriers and managing the psychological 'trauma' one faces when trying to process the endless reports of bad news on the state of our planet. I will also discuss the concept of active hope, an idea from ecopsychology, which provides a means to respond to the crisis of sustainability.



Shamsun Nahar Khan, Bangladesh

ASPECTS OF 7SK snRNA IN HIV1 DRUG DISCOVERY

RNA plays crucial roles in many disease pathogenesis and has gained a lot of interest as a tool for functional genomics and equally important as a promising therapeutic approach for the treatment of various diseases e.g. HIV, diabetes etc. (Bumcrot et al. 2006; Castanotto and Rossi 2009; de Fougerolles et al. 2007).

In the present study we focused on the 7SK small nuclear RNA (snRNA), which is abundant with 331-nucleotide. Its one of the important functions as a transcriptional regulator during the elongation phase of HIV-1 virus.

Immunodeficiency virus (HIV) exploits host's cellular proteins during its replicative cycle and latent infection. The positive transcription elongation factor b (P-TEFb) is a key cellular transcription factor critical for these viral processes. 7SK RNA binds to HEXIM1 regulatory domain and promotes the binding of the HEXIM C-terminal domain to cyclin T1/T2 of P-TEFb. P-TEFb shows little CTD kinase activity during its sequestering with 7SK and HEXIM1, it indicates that 7SK snRNA in collaboration with HEXIM1 function as an inhibitory factor of P-TEFb. HIV-1 successive viral replication requires recruitment of P-TEFb by HIV-1 TAT protein for the completion of the viral RNA transcription process. Thus one of the burning hypotheses is 7SK snRNA and HIV-1 protein Tat interaction.

In my presentation, I will present evidence of strong binding interaction of 7SK snRNA and HIV-1 protein Tat with promising data of 2D NMR spectroscopic studies and ITC (isothermal calorimetric analysis) and future direction of drug designing of HIV-1.



Jero Maze, Chile

MAGNETIC SENSING WITH COLOR CENTERS IN DIAMOND

Defects in solid state systems have emerged as leading candidates for high precision measurements and quantum computing applications. In this talk, I will present a sensor based on the spin degree of freedom contained on the nitrogen-vacancy defect in diamond able to detect nanotesla magnetic fields with nanometre spatial resolution. This sensor might enable powerful applications, ranging from the detection of magnetic resonance signals from individual electron or nuclear spins in complex biological molecules to readout of classical or quantum bits of information encoded in an electron or nuclear spin memory. Recent progress and challenges in understanding the properties of defects in solids and their environment will be presented as crucial steps to successfully implement these applications.



Stephen A. Miller, USA

SUSTAINABLE POLYMERS: HOW TO COMPETE WITH TRADITIONAL PLASTICS

Expanded worldwide efforts have identified polymeric building blocks that are not derived from fossil fuels and have employed these monomers to create polymers that readily degrade in natural environments. The Miller Research Group has developed novel methods for synthesizing linear thermoplastic polymers from a variety of biogenic feedstocks, including sugars, triglycerides, lignin, and C1 feedstocks obtained from trees. This presentation will describe our efforts to employ vanillin, ferulic acid, and other bio-based aromatics for the synthesis of thermally robust polymers. Efficient, commercial pathways for synthesizing these polymers from inexpensive agricultural waste will be described. These novel thermoplastics will be discussed in the context of replacing traditional fossil fuel-based plastics - in particular polyethylene terephthalate (PET) and polystyrene (PS). Central to commercialization is the symbiosis between academic innovation and a recent start-up company, U.S. Bioplastics (<http://usbioplastics.com>).



Javier M. Moguerza, Spain

INTEGRATED FRAMEWORK FOR STAKEHOLDERS DIALOG WITHIN ENERGY SYSTEMS

Energy Systems Optimization is increasing its importance due to regulations and de-regulations of the energy sector and the setting of targets such as the European Union's 20-20-20. An integrated framework has been developed, providing an environment that enforces the necessary stakeholders dialog, along with the demonstration of the usefulness of Stochastic Optimization for energy systems planning under uncertainty. The proposed framework includes innovative features and provides a flexible environment that can be implemented in usable Decision Support Systems (DSSs) through the appropriate interfaces. Such a framework allows robust decision making to face rising economic and environmental global challenges.



Milica Pešić, Serbia

DEVELOPMENT OF SCIENCE IN THE SERVICE OF HUMANITY

Do today's young scientists have a vision? What drives their curiosity? What are the reasons for their success? Why is the success postulated as a measure of the scientific contribution? What describes the quality of young scientists: (i) pervasiveness, (ii) persistence or (iii) the ability to see further than other people could? Have we forgotten that doing the science, whether it is social or natural, means to discover the secrets of God to humankind? Should science serve the both, development of humankind and humanity?

If science does not turn out from the current path to serve the daily political needs, easier life and making a profit, it will inevitably degrade and turn into its dark side, which threatens to destroy humankind for decades. Service of science for military purposes, and the dominance of the minority over the majority is the global problem. In addition, the globalization that is now taking place is not the vision of the famous scientist Nikola Tesla, but the tool of minority to conquer less developed world. Therefore, the main quest for young scientist in global institution such as GYA should be to recover the vision of science to be in the service of humanity.

Why are 20 years of research necessary to recognize a good drug so that people can use it, especially in the case of incurable disease? Why are the pharmaceutical companies driven by their own interests for a greater profit dictating the course of research? Why were the good but cheap drugs redrawn? Is that because they cannot make satisfactory profits for pharmaceutical companies? Instead of old ones, new generations of drugs with the same efficiency but dozens of times more expensive were developed.

Why should a scientist look forward to the realization of a patent, which will bring him/her profit? Scientists that serve humankind and humanity should be satisfied if their work helped to cure at least one person. What is our real motive to do the science: (i) success, (ii) profit or (iii) wellbeing of humankind? Did we forget the real motive?



Federico Rosei, Canada

WHAT TYPE OF ENERGY FOR THE FUTURE OF HUMANITY?

As the age of cheap oil and fossil fuels is coming to an end, humanity will face an energy crisis. Many alternative energy sources have already been identified. However, there is no optimal solution to replace fossil fuels on a short time scale with new energy sources that are economically viable and environmentally sustainable in the long term. History reports disastrous consequences for human societies that exploited their resources in a non sustainable way¹, and arguably this is exactly what is happening today on a global scale. Evidence for climate change is now overwhelming. This presentation aims at describing a general picture of the looming energy crisis, particularly to promote awareness². Some possible solutions are described, involving the use of advanced materials and nanotechnology for energy conversion, energy saving and energy storage. The discussion will also be framed in the context of the newly established UNESCO Chair MATECSS, which is designed to foster North/South partnerships and capacity building on sustainable energy technologies.

¹ Jared Diamond, 'Collapse' Viking Penguin (2005).

² N. Armaroli, V. Balzani. "The Future of Energy Supply: Challenges and Opportunities", *Angew. Chem. Int. Ed.* 46, 52 (2007).



Francesco Stellacci, Switzerland

10 BILLION PEOPLE TO FEED 35 YEAR FROM NOW: HOW?

Food, together with energy and materials, is one of the three pillars of sustainability. Often it is the forgotten one.

In 2050 the world population will be close to 10 billions but the most optimistic prediction of industrial food production indicated that there will be food for no more than 8 billion. Can we live with 20% of the population malnourished? Can science do something about it? How should regulators handle this rapidly approaching point?

In this talk I will present known data and develop my own personal view of the problem.



Ramesh T. Subramaniam, Malaysia

SOLID COPOLYMER ELECTROLYTE REPLACEMENT IN DYE-SENSITIZED SOLAR CELLS

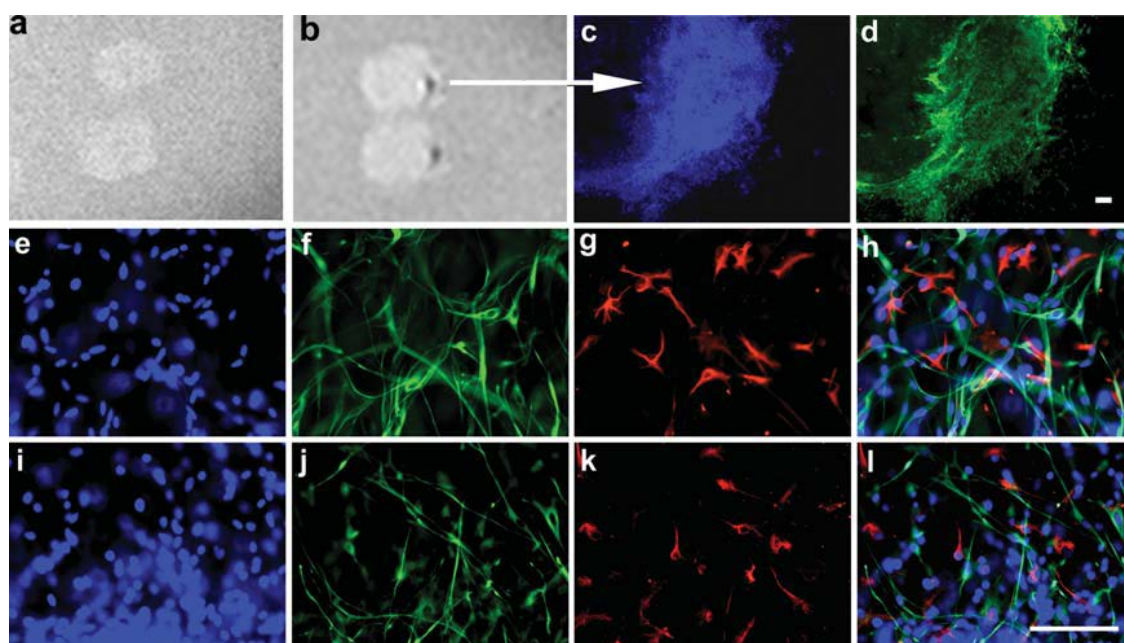
Series of triblock acrylate copolymer electrolytes for the application of Dye Sensitized Solar Cell (DSSC) were formulated with incorporation of iodide based compounds and binary mixtures of plasticizers. The triblock acrylate copolymer is synthesized using emulsion technique with the mixtures of methyl methacrylate (MMA), butyl acrylate (BA) and acrylic acid (AA). This study reports the performance of the developed series upon addition of sodium iodide (NaI) at concentration varied from 5 wt. % to 30 wt. %, with the rest of the additives content being constant. The solid copolymer electrolyte performances were evaluated by the analytical means of electrical, structural and thermal. Several formulated compositions from the series are found to exhibit the ionic conductivity values as high as $10^{-4} \text{ S cm}^{-1}$. Those samples were tested on its efficiency to work as the electrolyte material for DSSC and highest efficiency of 4.0 % was noted at low exposure of sunlight, which is as low as 40 mW cm^{-2} (or 0.4 sun). This evidences a good possibility of the reported copolymer electrolytes to replace the conventionally focused gel polymer electrolyte (GPE), owing to the excellent performance even under not optimal lighting conditions (which more generally occurs in real outdoor applications). An appreciable high performing DSSC is able to be developed using MMA-co-BA-co-AA copolymer in the presence of trace amount of monomers within the matrix that gives rise to an alternative pathway for the transportation of charge carriers. In addition, the mechanically high elastic copolymer electrolytes promises good electrode-electrolyte interfacial contact and at the same time the space separation between the two active electrodes in DSSC can effectively being minimized. The imposed structural disorderliness upon increasing salt addition is found to generate more free volume within the matrix and this eases the transportation of charge carriers along the copolymer backbone. This versatility allows more electrons to reach one of the electrode and flows to another via the outer connecting circuit. The high transportation of electrons allows the DSSC to perform well even upon using solid type of polymer electrolyte.

Nguyen T. K. Thanh, United Kingdom

NANOPARTICLES AS DIAGNOSTIC AND THERAPEUTIC AGENTS

Nanoparticles have shown some of their potential in biomedicine, which can be further realised when the core materials have exceptional physical properties together with much needed stability and functionality in biological environments. This will be achieved by the design, synthesis of nanoparticles with novel optical, magnetic, electronic and catalytic properties readily functionalised in a controlled manner.

Noble metal gold nanoparticles were made by Michael Faraday, and they are studied now for detection of diseases based on their unique optical properties. Magnetic nanoparticles (MNPs) are interesting, as they have many potential applications in physical and biomolecular sciences, such as ultrahigh-density recording media, contrast enhanced agents for magnetic resonance imaging, targeted therapeutic drug delivery and hyperthermia treatment for cancers. MNPs are synthesised with designed chemical composition, size, shape and surface functionalities. They have huge potential in diagnostics, treatment of cancers, as well as markers to track stem cells in organ transplants.





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* Lead and corresponding author

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James Tickner, Australia

MORE FROM LESS:

NEW TECHNOLOGIES TO IMPROVE MINING AND MINERALS PROCESSING EFFICIENCY

Mining and mineral processing consume huge amounts of energy and water. In Australia, for example, approximately 20% of the country's energy usage goes into mining and processing coal, metals and minerals. In the boom years of the early 2000's, the industry focus was mainly on increasing production volumes. This scale-up has made very low grade deposits economic. A copper mine, for example, may produce only a few kilograms of metal for every ton of rock extracted, and a gold mine less than one gram of metal per ton. Extracting these metals requires the rock to be ground to a fine powder, which is enormously energy intensive.

In recent years, with falling commodity prices and rising input costs there is a shift towards improving efficiency. Of course, technologies that lift efficiency also reduce the embodied energy and water costs in the metals and industrial minerals that we all use.

In this talk, I will introduce the emerging concept of grade engineering, a holistic approach that combines geology, computer modeling and rapid material sensing to identify high and low-value ore at the earliest possible stage. By identifying barren rock and either leaving it in the ground, or discarding it before the most energy and water-intensive processing stages, huge efficiency gains are possible.

I will introduce some of the novel techniques being developed by my organization to map rocks under the ground, measure trace metals at high speed and sort ore at rates of thousands of tons per hour.



Vicente A. Torres, Chile

ROLE OF RAB5 IN FOCAL ADHESION DYNAMICS AND TUMOR CELL MIGRATION

Cancer cell metastasis depends on a cascade of events involving tumor cell migration, invasiveness, intravasation, transport of tumor cells, extravasation and establishing a secondary tumor. Cell migration and invasion are essential steps, whose mechanisms remain to be fully understood. In this regard, the importance of endosome trafficking and membrane dynamics in metastasis has become much evident in recent years. Therefore, identification and characterization of players involved in regulating endocytic trafficking of metastatic cancer cells is required. Increasing evidence has suggested a putative role for the early endocytic protein Rab5 in migration of both normal and tumor cells. Rab5 is a small GTPase that regulates early endosome dynamics. In the active GTP-bound state, Rab5 recruits a variety of effectors that promote vesicle formation, endosome tethering, fusion and transport. In addition to these features, Rab5 has been proposed to function as a critical regulator of cell migration *in vitro* and *in vivo*. Rab5 associates with $\beta 1$ integrins, leading to Rac1 activation and *lamellipodia* formation. Indeed, Rab5 expression was recently associated with high incidence of metastasis. Despite these well-known pro-migratory features of Rab5, mechanisms underlying these effects remain to be elucidated. We have recently shown that Rab5 is activated during cell migration and spreading, and that Rab5 activation is a pre-requisite for metastatic cancer cell migration and invasiveness. Indeed, Rab5 activation was associated with focal adhesion turnover and FAK autophosphorylation, both important events for cell migration. Intriguingly, Rab5-driven tumor invasiveness depends on focal adhesion turnover and FAK phosphorylation. Taken together, these observations indicate Rab5 as an important factor in tumor progression and metastasis.