Dublin: City of Science
Ireland: Island of Enterprise
Date: 11th - 15th of July 2012
Authors: Christoph Furtschegger
         Stefan Vetter
         Maria Keuschnigg
         Marlene Milan
         Floor Ten Hoopen
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Foreword

The Euroscience Open Forum (ESOF) is Europe’s largest general science meeting and is held in a leading European city every two years. The ESOF 2012 was held in Dublin from July 11th - 15th. During these five days, more than 4000 participants had the possibility to contribute to a wide range of seminars, workshops and debates on the latest developments in science, research and technology. In more than 150 different sessions they discussed topics ranging from upcoming challenges regarding food security and energy supply to environmental issues and medical innovations. On behalf of the BMLFUW Mr. Stefan Vetter, Mr. Christoph Furtschegger and Ms. Maria Keuschnigg had the opportunity to take part in this exceptional event. With this following report we would like to give you an insight into the atmosphere of ESOF 2012.

A further objective of this report is to increase the level of awareness about the ESOF Conference and to give an overview of the European Research Area with its numerous Experts.

Additionally we would like to challenge you to give us your highly appreciated feedback and valuable thoughts, opinions and inputs on this report and send them to stefan.vetter@lebensministerium.at. This should give us the chance to steadily improve our knowledge management as well as the ways and means of our knowledge dissemination methods.
Short summaries

Wednesday, 11th of July 2012

Opening Ceremony: Cèad Mile Fàilte

The first event of the 5th ESOF 2012 in Dublin started with a row of welcome speeches held by Michael D. Higgins, President of Ireland, Prof. Patrick Cunningham from the Trinity College Dublin, Prof. Enric Banda, President of Euroscience, Maire Geoghegan-Quinn, European Commissioner for Research, Innovation & Science and Richard Bruton, Minister for Jobs, Enterprise and Innovation of Ireland.

Initial statements referred to the uniqueness and historic successfulness of the ESOF, taking place every two years since 2004, starting in Stockholm and then coming to Munich, Barcelona and Turin. The ESOF is the biggest event of its kind in Europe, bringing together people from all the various fields of science. Especially in times of the current economic crisis, in which science is seen more as a luxury rather than a necessity, all the speakers emphasized the importance of ‘re-invented’ science and innovation in order to meet the global challenges humanity is facing. It’s simply crucial to not fall behind regarding global competitiveness by cutting funding for research, although budgets are of course tight, but as the perfectly timed discovery of the Higgs-particle in CERN last week showed, the boundaries are steadily pushed outwards and hold promising developments for possible beneficiaries for humankind.

Nevertheless, science and innovation still have to be brought closer to the public and as Mr. Higgins pointed out, be globally balanced - especially taking into account ethical concerns. Therefore, with its great wealth and broad span of knowledge, the ESOF would offer a great opportunity to discuss topics of most burning relevance, he argued. Last but not least the first session was concluded by an impressive video presentation and an astonishing show including Irish dancers, singers and musicians.

Keynote Address: Jules Hoffmann (Nobel laureate) “From insects to mammals: reflections on a European journey through basic research on immune defenses”

Nobel laureate Jules Hoffmann was the first to give a keynote address to the audience at the ESOF 2012. He started with his personal history, when his father made him curious about insects, and then presented some of the many colleagues along his way.

After the discovery of the first antimicrobial peptide in insects, he and his group were able to find TLRs (toll like receptors) having evolved in many other organisms. These findings
resulted in a number of therapeutic potentials such as vaccinations, autoimmunity, and treatments for inflammations, allergy, immunotherapy, and infectious diseases.

In his conclusions he presented some of his personal reflections. First, he smiled about his “blissful time”, when curiosity was the only justification for research, not networks, industry links and time of outputs. He emphasized the responsibility to get young people interested in science and to ask proper biological questions. He closed his lecture by pointing out that working in the field of science is a privilege.

**Quote of ESOF DAY 1:** “I know the price of everything, but the value of nothing.” Richard Bruton, Minister for Jobs, Enterprise and Innovation (Ireland) on the current economic paradigm.
**Energy that works: Practical solutions to our energy and climate crisis**

Henrike Rau, Jamie Goggins, Karyn Morrissey, Mark Foley, and Rory Monaghan were the five persons representing the different views and concerns about future energy supply modes. Each of them highlighted some aspects of behavioral changes, energy efficiency, fossil fuels, nuclear power plants and renewable energies. They concluded their talks with statements like to “invest in people”, “the focus on meeting the energy needs is energy efficiency”, “work out of the situation [of energy demand by fossil fuels]”, “nuclear is part of the solution”, and “energy system needs a holistic approach”. Finally, a TED poll allowed each one to invest 100 million EUR for energy supply modes. It revealed that participants like to see 19 million invested in behavior change, 26 million in energy efficiency, 5 million in fossil fuels, 18 million in nuclear energy, and 31 million in renewable energy.

**CONCLUSION: From final TED Poll one can conclude that the mix of energy systems will be part of our future and that advocates of one or the other energy system need to clearly address weaknesses of their industries.**

**Planting the seed of genetically modified trees**

Christina Vettori opened the session by presenting the Cost Action (FP0905) which aims tries to counteract the widespread deforestation and to achieve improved production and processing properties of trees as a response to the increasing global demand for paper and biomass. In addition, the Cost Action aims to identify the genetic variety of trees, taking into account also an environmental impact assessment for the use of GMTs (Genetically Modified Trees) and the reflection of their socio-economic implications. Currently, due to their small genome and their wide geographic spreading, poplars would be the best models for testing. Already 27 European countries have joined this Cost Action exchanging their knowledge and experiences worldwide with New Zealand, Australia, Canada and the US.

Following Ms. Vettori, Dr. Mathias Fladung outlined that trees are ‘wild’ plants and that breeding is achieved via cross-pollination systems. This system is slow due to the long generation periods. Besides, also the vegetative period as well as the mutation breeding needs its time. However, their goal is to domesticate trees in a relatively short time and to increase the yields by creating herbicide, insect and fungal resistant species and to tailor wood properties to specific user needs (i.e. energy production or mechanical properties).

After that, Jeremy Sweet from the Environmental Working Group of the EFSA (European Food Security Agency) GMO Panel and Prof. Rosie Hails gave some thoughts on how a risk assessment regarding GMTs could look like. They underlined the importance of surveillance
of gene flow, changes in fitness and invasiveness, impacts on non-target organisms and the effects on human and animal health.

According to Prof. Hails, there are two monitoring elements, the CSM (Case specific monitoring) and GS (General Surveillance) which together with Environmental Surveillance Networks are considered as a useful and applicable tool for GMTs risk assessment in order to interpret any ‘non-significant’ effects. Besides that, they could also help to be proportionate to the level of risk and scientifically defendable.

Finally Klaus Minol from Germanys Genius Gmbh criticized the current communication strategies on GMOs. Even if biotech would not want to stress GMO acceptance – a statement that everybody has to evaluate for him/herself - the discussions within the public would simply not be science based. Results would be misinterpreted and the media would only take up the negative outcomes of GMO cultivation. To him there is a lack of biosafety communication strategy as many people have a lack of knowledge and base their opinion on values and feelings. This would leave many people with an unclear and doubtful position towards GMOs. From his point of view, the potential benefits of GMOs should be outlined more.

CONCLUSION: The overall conclusion of the event was that we have to improve our knowledge about tree species. Nevertheless, the personal impression remains that the risk assessment of GMTs can only be done properly after the commercial cultivation. There is always a certain level of uncertainty, trying to assess the risk before. This leaves us with the uncomfortable feeling that once again we first have to take the risks and to neglect the precautionary principle. Only after a while we will be able to see whether there are some negative and unexpected side effects.

Keynote Address: Eric Karsenti “TARA-OCEANS: A world-wide study of oceanic plankton ecosystems”

Dr. Eric Karsenti told an impressive story about the 632 day long TARA expedition at sea with a crew consisting of 6 sailors and 6 scientists on a 36m schooner. During that period they took samples of plankton at 35 stations across the oceans. The samples were fractionated according to their size of, 0,1 up to 600 micrometers, and the biodiversity was analyzed. The diversity detected was mostly unknown and the viral diversity was entirely unknown. Finally he gave time to the audience to watch some movies, to get a clearer image of the tasks the team had to face. Above all, the TARA adventurers had invited 5000 children among the globe on the board of the schooner.

Link: http://oceans.taraexpeditions.org/
Keynote Address: Mary Robinson "Equity and Climate Science"

One of the major inputs on the second day of the ESOF came from former UN-high commissioner for human rights, former president of Ireland and initiator of her own foundation Marie Robinson who held a sweeping and impressive speech on the role of science, equity and climate change. The following remarks reflect some of the most important aspects she mentioned:

Science is the essence of human history, the search for the questions of human life that all of us are so deeply interested in. Questions such as who we are, where we’re from and how we physically or mentally work, all these encourage science. It is just too often that we forget that our earth is the “Goldilocks” planet of our universe, providing us with everything we need to live. We know that the earth has always undergone many changes throughout its eras in the last hundred thousands of years, but it is now, that only within one or two centuries, we have become a major driver of our climate. Many complex issues are involved in these processes. Nevertheless, we are on a course on which we have put ourselves and now it is on us to guarantee, that climate change is a critical earth process we should better keep within safe boundaries. Therefore our duty is to communicate science in a better way, to have a broader reach and to look at climate change from a human rights perspective. To achieve this doubtlessly challenging aim, we need to bring into peoples’ minds that our actions have implications for future generations. Furthermore we have to stress the fact that never before local actions had such an impact of global importance. However, be it emissions reductions or an economic change towards low carbon climate resilience, developed countries need to step ahead and act first. They hold the technological ability to react properly and take a leadership role.

That is why the Rio+20 summit is a real disappointment, but made clear at least one thing. Science is not able to solely provide the solutions to all problems on its own. Politicians and - if not even more - the public, play an equally important and influential part. When will we all understand that our resources are finite and that we have to undertake bold decisions now? 2050 with its estimated summit of 9 billion people on earth is approaching even faster. This is a world we are not yet prepared for. Solutions need to be found within our limits and boundaries. We have to set up ethical parameters in order to ensure a fair sharing of natural resources between developed and developing countries.

It should not be possible that politicians come back from climate conferences such as Rio+20 without achieving any real effort. The public needs to ‘force’ them to. Demand actions from your leaders and change the mind of the people around you, promote inter- and transdisciplinarity, create platforms of exchange and motivate others. All these points are interlinked, it’s not one or another, it’s all of them. We urgently have to move forward,
that’s what Rio+20 showed us. We need a coalition of the committed. Young scientists, don’t be afraid to lead and don’t be afraid to defend the vulnerable.

**Can we use genomic tools to select healthier livestock?**

Chaired by Martina Daly (European Commission) the panel of Alain Vanderplasschen of the University of Liège, Anne-Sophie Lequarre from DG Research and Innovation, Mary Poss and Nicole Mideo, both Pennsylvania State University, Donagh Berry of TEAGASC and Stephen Bishop from the Roslin Institute reflected the topic of this session from different points of view. Ms Lequarre opened the session with an overview on the recent call under FP7 regarding the use of genomic tools to select healthier livestock.

Mr Vanderplasschen pointed out that the key drivers for the intensification of this business are population growth, decreasing number of farmers, increasing demand in food quality and cost pressures. Based on his statement that any selection on phenotypes would completely ignore the immunodefence capacities of individuals selected, he explained that host defenses could be strengthened either by selection or vaccination. Mr. Berry shed light on diverging breeding approaches and performance records, e.g. milk yield and fertility decline.

Stephen Bishop gave the question of ‘breeding of resistance’ a clear ‘yes’, if there are no other ways of control available, the disease is important and scientist could get the data. Reflecting her initial statement that pathogens will always win the race Ms. Poss pointed at the high population diversity of pathogens and argued for serious caution regarding selection.

At the beginning of the discussion most people in the audience were in favour of the question asked in the title of this meeting. It became clear that two main roads are supportive: diversity to increase resistance, and to focus on the few principle mechanisms by which viruses target individuals.

Finally, focus of future research should be given on the phenotype records, computational biology, and variety of breeding tools.

“Pathogens will always win the race.” (Mary Poss)

**Exploding myths on nuclear security, harm reduction and GMOs**

The sessions started with an explanation of a problematic divergence of scientific results and their communication and utilization by politicians and public media. Dr. Roland Schenkel (Nuclear Energy Consultant) focused his presentation on the following questions: ‘Did Fukushima change the reputation of nuclear energy?’, ‘Did the media report in a rational
and objective manner?` and ´Are citizens adequately informed about nuclear power issues?´. His conclusion was that stakeholders involved in the Fukushima catastrophe made many mistakes. It started with an inadequate tsunami protection, the neglect of some security issues and a media-hyped overestimation of the radiological impact as ‘only’ 4 people died and 6 persons were exposed to radiation higher than 250 bigger millisievert. Furthermore he listed some social impacts of the Fukushima accident followed by the statement that the integration of lessons learned, safety improvements and a commitment to international benchmarks could prevent us from future nuclear accidents.

Hence in Dr. Schenkel’s opinion, the accident would have been avoidable. The risk of nuclear power to him is thus not higher than those of other energy producing technologies. His suggestion would be to invest as much as possible in new reactors. According to him they would have included the lessons learned and would have implemented a better protection against multiple failures and nuclear waste management programmes. Finally he stated that nuclear energy will continue to play a leading role, emphasized its economic benefits, talked about innovative waste management solutions recently developed in the US and in this context about the necessity of new safety requirements.

Dr. David O’Reilly, Group Scientific Director of British American Tobacco spoke about controversial issues regarding tobacco. From his point of view the most common myths about Tobacco are that: (a) ´smoking will disappear in the future`, (b) ´all tobacco products are equally harmful` and (c) ´nicotine causes cancer`. He mentioned several studies, which falsify these assumptions, e.g. a study that proved that not nicotine but the mixture of toxins and tobacco is the reason for cancer. He emphasized the importance of an adequate support for scientific research, focused on tobacco harm reduction.

Finally, Prof. Anne Glover, Chief Scientific Advisor to the president of the European Commission, spoke about myths on GMOs. She described herself as being pro evidence, not pro GMO. However, the comparison of GM food with conventional food led her to the conclusion that there were no differences to be found. She admitted that GMOs would often lack solid evidence, but stated that the technological progress and the spreading of GMOs would definitely be about to continue in the future.

Despite the arguments of Prof. Anne Glover that humans have always tried to improve crop varieties and from her point of view GMOs themselves were subjects of evolution, she confessed that GMO free zones are nearly impossible but stated that EU- GMO Safety is assured. This fact however would not prevent her from the mission to better inform citizens about GMOs in the future.

After the given key notes, a discussion about the interaction between science, media and the public opinion started. The question about the creation of the public opinion or what public
opinion in fact is was raised. In general, media would reflect the public opinion. As an example Austria was mentioned, where no pro nuclear power reporting would exist.

Some people of the audience remarked that the media however shouldn’t just be ‘the loudspeakers’ of science. Some people of the audience even criticized that scientists sometimes would treat citizens like nasty children and just tell them what to do. But is science always right? The given answer to that was that there is always just a certain degree of evidence but no 100% scientific facts, so scientists of course can fail. Another question of the audience was ‘why not deliver nicotine without tobacco and toxins’. The answer to that was that it is not just about the nicotine but many other attributes that make up the attraction of cigarettes. So in order to find a solution it first seems necessary to find out how to present nicotine in such appealing ways that the public would accept it as cigarette substitutes. Many other questions such as ‘do scientists sometimes fail to include a common human perspective into their reflections?’ and ‘how do you make people want the technological achievements and developments?’ contributed to a high level of visitor inclusion and therefore a very vivid discussion.

CONCLUSION:
Including as many stakeholders as possible into scientific discussions increases its dynamic, helps to encourage a mutual understanding and therefore closes the gap between science and society. This inclusive character is a key factor for efficient knowledge exchange which in turn facilitates real progress.

Africa: A scramble for natural resources or knowledge economy partnership?

“Africa’s geological resources are a key to its future, as the demand for minerals and metals that are so crucial for our daily lives is steadily increasing”, Dr. Patrice Christmann (BRGM - Office for Geological and Mining Research) mentioned opening the session. According to estimated numbers, 80% of these rare earth minerals and metals are located in poor countries with an average capita of 10$ per day. Hence Africa’s fastest growing economies are also the poorest countries in the world. Nevertheless, investments in Africa’s mineral exploration – compared to the US, Latin America or Australia – would still be relatively small. The EU however has initiated a cooperation called AEGOS – African European Geosources Observation System to monitor and map resources in order to support local governance structures, enhance data sharing, advice decision makers and to contribute to capacity building and geological and mining information systems. However, an absolute precondition to him is that companies and industries working in this sector comply with ethical and sustainability standards.

Afterwards, Alan Belward from the European Commission’s Joint Research Centre referred to the population growth in Africa as being the biggest problem, resulting in a massive
demand and competition for land as well as in economic, environmental and societal pressure. Almost 90% of the wood removals in Africa would be used for energy. Another crucial question for him is who is able to gain access to the data of the resource mapping which is currently done by already 60 satellites. Not even 20 years ago there have just been a few. This shows the worldwide increased interest in Africa’s resources. “The advantage of mapping these resources is the assessment of areas with ideal conditions for cultivation and the possibility to exclude areas that are too high, wet and saline or covered by cities or roads” Belward said. But still it is of utmost importance that the EU passes the collected data along to local policy makers in order to share the knowledge and to build a knowledge base.

Then Roseanne Diab from the Academy of Science of South Africa pointed out that it has to be seen more critically that Africa is only catching up with the developed countries due to a radical exploitation of their own resources. Another problem to her is that we have to question the knowledge generation progress in Africa, as one major problem is the very low rate of online publications. For instance only 1% of Africa’s journals are available via the internet at Thomson/Reuters.

John Mugabe from the University of Pretoria finally pointed out that Europe, according to Article 16 of the Convention on Biological Diversity, is obliged to provide access to and transfer of technology. As the areas of technology and knowledge transfer as much as conflict and resource management also contain issues of security political relevance, it would be crucial to foster stronger cooperation and joint working in these fields.

Last but not least, in contrast to the invited speakers during the discussion, people from the audience outlined not only the burdens but also the great potentials that lie in Africa’s enormous population growth with its upcoming huge amount of young people. Of course they will have to be well trained, highly skilled and stronger involved in joint efforts in order to achieve future benefits for Africa.

**Water challenges for a changing world**

Water is worth a EUR 500 billion turnover per year, providing jobs to up to 600,000 persons a job (Durk Krol, Water Supply and Sanitation Technology Platform). Its research is funded by approximately EUR 500 million p. a. in Europe including the three-fourths coming from the member states. According to Luisa Prista (European Commision) under FP6 and FP7, the European Comission has granted research in more than 800 research projects.

‘Immense challenges’ are driven by scarcity and decreasing biodiversity, says Michael Depledge from the European Centre for Environment and Human Health in the UK. Damia Barcelo, of the Catalan Institute for Water Research raised awareness on the ageing population, which will accumulate more chemicals in their bodies than any other generation
before and the dramatically increasing complex mixtures of artificial compounds and materials, including chemicals, persistent organic pollutants and nanos. It became obvious during the discussion that other driving forces such as agriculture, the latest debate on fracking and its consequences on groundwater, and the development of ‘lower medium income countries’ have not been touched. Laura Burke, Director General of the Irish Environmental Protection Agency, chaired this session.

“Humans are changing the world without knowledge of the system.” (Damia Barcelo)

**Keynote Address: Marcus du Sautoy “The Secret Mathematicians”**

With this pretty nice lecture the speaker drew the attention to mathematics covering music composed by Messiaen, architecture, paintings of Salvador Dali, literature of Luis Jorge Borages and choreography of Rudolf Laban.

He was able to explain the audience the hidden secrets of prime numbers, the golden ratio, the finite universe without boundaries, and ended up with the conclusion that maths is for making choices possible.

**Keynote Address: Renée Schroeder "RNA as a key molecule for the origin of Life"**

In her very fascinating keynote speech, Renée Schroeder from the Max F. Perutz Laboratories of the University of Vienna made a presentation on RNA as the key molecule for the origin of life. If one wants to understand life, she said, one has to study the simplest living bodies and the single and smallest structures and shapes.

In her presentation she then elaborated on what characterizes a cell. Each cell has two crucial functions. One function is the metabolism, the other is providing information for its own reproduction. Besides that, she outlined the main differences between DNA and RNA and the potentials inherent to RNA-research.

The classical dogma is that DNA gets translated into RNA which then carries the information for the protein synthesis, and that DNA only functions as a mere ‘information keeper’, whereas the RNA unifies several functions.

Another unique aspect of RNA is its folding into three-dimensional structures and its catalytic activity whereas DNA only provides ‘one dimensional information’. This leads to new findings of RNA with novel functions which makes it especially exciting as we currently only know 3% of the functions of our DNA.
Long time it has been believed that the rest is only junk DNA, but with the discovery of the RNA this became more than doubtful. Therefore her laboratory currently works with the new SELEX-Technology (Systematic Evolution of Ligands Exponential Enrichment) in order to reconstruct RNA and screen whole genomes.

Is science journalism dead or does it just smell funny?

The discussion amongst the panel (Elisabetta Tola, Formicablu, Vesa Niinikangas, President of the World Federation of Science Journalists, Wolfgang Goede, P.M./Knowledge Matters magazine) and its chair (Brian Trench, Irish Science and Technology Journalists Association) could be summarized by the following statements:

- public relation has become an industry - even in science - with less time to prove news and messages
- science journalism should do a lot of explaining
- media have to be critical
- as science journalism is for the public, it seems worth considering respective public funding
- the economy related to funded research has to be discussed
- the Higgs boson celebration was criticized

Sleep and Depression

Actually, what is sleep? It is a behavioral state in which we do not communicate and remain motionless. Nevertheless, the brain is active during sleep. This can be observed for example during the REM (rapid eye movement) period that varies in its depth and duration from person to person. But why is sleep so important to us? As Dr. Meerlo from the University of Groningen put it, sleep is necessary because it resets our neuronal connections, our hormonal and energy balance - factors that correlate with our mood and memory. In addition it is crucial to our brain functions and the maintenance and regulation of connections between nerve cells.

The regulation of our sleep depends on homeostasis (a basic principle of sleep regulation), neurotransmitters (i.e. serotonin), hormones (i.e. cortisol) and the circadian rhythm, consisting of the day/night cycle and the inner biological clock. Whoever once experienced the effects of a jetlag might have an idea why for our body it is important to keep them in synchrony.

Usually a human being needs about 7 to 8 hours of sleep. In Europe, currently about 7% of the population suffer from insomnia caused by for instance stress, workload, shift work, homework, parenthood or recreation. One result of experiencing restricted sleep for a
longer time is that it leads to a decrease of the serotonin level, gradual changes in the brain and often precedes and predicts the onset of depression and increased sensitivity.

Besides Dr. Johannes Beck of Basels Clinical Psychatric University presented how we can positively affect our sleep. He undertook a study on the correlation between physical activity, stress hormone regulation in depression and the REM density. The study revealed that people who went for example jogging not only had a better mood in the morning, but also fell asleep more quickly in the evening. So sport positively affects the quality of our sleep, our mental health, our cognitive performance and the stress hormone regulation. Nevertheless it would be decisive to associate the physical activity with pleasure.

Finally Dr. Axel Steiger from the Max Plank Gesellschaft Munich gave some explanation on his sleep study on interdependences between growth hormones, EEG (Electroencephalogram), cortisol and the REM-phase, but had to admit that although in the last years there has been done a lot of research, sleep still remains a complex field and holds a lot of undiscovered areas to be explored.
How can technology transfer drive innovation

‘How to get technology into use?’ has been the central question of the discussion of this session. Erik Arnold from the ‘Technopolis Group Twente’ said that nowadays we would have a too ‘linear model’ of innovation instead of regarding its complex systematic and influences. In addition he highlighted the role of business and PROs (public research organizations - whose role is not necessarily to make profit) in innovation and the importance of their mutual exchange of knowledge. Especially as the latter is, compared to other competing countries, a particular asset of the European Union.

Mr. Gernot Kotz from the European chemical industry council also put much focus on these aspects by explaining that Europe simply cannot compete with the US and China in most sectors an therefore would have to rely on its own strengths. He underlined, that that would be the ability to work together on complex topics based on cross-disciplinary and multidisciplinary approaches. Higher investment in funding programmes would not provide a solution per se. It would have to reinvent itself, create startups and new businesses, but also to build upon existing achievements namely a broad research and innovation landscape.

Giancarlo Caratti from the Joint Research Centre of the European Commission, in this regard, presented the Innovation Union as a good example of an adequate landscape and way of promoting technology findings. He mentioned for example, that one of its aims would be in the future to better help young students in to gain access to the market and turn their innovative ideas into products.

At the end, Salvatore Tatarolia - spokesmnan of the Science and Technology Options Assessment - stressed the importance of knowledge transfer from research centers towards society in order to achieve a ‘knowledge based society’. In this regard particularly southern and eastern European countries would have to avoid the brain drain they are experiencing. The most educated are attracted to northern European countries, making them even richer, as they’d receive more funding while leaving the southern and eastern European countries with a lack of high level research and skilled scientists. So, according to Mr. Tatarolia, knowledge would move from the poorer countries to the already most industrialized and rich ones.

The session finished with some policy recommendations (i.e. documenting and building on good practices, maximizing learning, monitoring and reviewing industrial participation in Horizon 2020, Open Access to Horizon 2020, etc.) as the efficiency of knowledge and innovation transfer would very much depend on the guidance provided by the European Commission.
Scientific advice for European policy

In this lecture, 4 scientific advisors and policy makers discussed the role of scientific advice for Europe and debated its challenges. There is always an uncertainty regarding scientific validity, even though the check (through publication) is huge.

This uncertainty is not highlighted, and scientists could be better at talking about uncertainty and guide the public how to deal with it. To have a body to increase public knowledge and give scientific advice is thus important, but the members should advise independently in the areas they know and lobby for the integrity of science, not for their own functions.

There is a central importance to research and innovation. Previously, only economists were advising in decision making processes, now there is a more direct reporting from science, giving a different flavour to the advice. Political philosophies change, but scientific evidences remain the same. Evidence is independent and it is important that scientific advisors help policymakers understand to highlight and explain the evidence and the validity of the evidence, to do technology forecasts and risk assessment to avoid uneducated decisions and help using evidence in policy making and debate. The policymakers have then to explain if they do not use the evidence.

Scientific advisors should also assist in building relationships across member states and analyze new science that arises. They need to know the full scale and enhance the public confidence in science and technology. In this respect they should earn trust and there should be discussions, but it is curcial that the scientific advice is honest. It is important to talk about risk and award since life is full of risks. If people have the feeling they are in control, they feel much safer. It is thus important not to be a lobbyist for one thing or another, but to explain the consequences of activities.

Two subsequent important messages from this discussion were that Europe is doing very well with respect to science, but it is also very modest. It cannot remain to be like that and has to express more confidence, using metrics. In comparison to Europe, where 27 members need to be convinced about something, things happen slower than in smaller research/policy areas, where everyone knows everyone.

Keynote Address: Màire Geoghegan Quinn "Collaboration, competition, connection - evidence of intelligent design in European science policy?"

Commissioner Geoghegan Quinn highlighted three points in her keynote address, starting with the convinced remark on the importance to respect the rational method of science. This method forces us to think and obviously gives evidence to politics.
Secondly, she stressed the importance of underlining both types of science, curiosity and challenge driven research and concluded that Europe should be at the heart of science and science at the heart of Europe. As the next framework programme HORIZON 2020 is under construction, the Commissioner set out the cornerstones for this next period of European funding, highlighting that the budget of approximately 80 billion € is far from being settled and that the ERA (European Research Area) aims at excellence, but that it is also difficult to build an equal research area, including weaker countries.

For the panel she came forward with three statements: Knowing that both competition and collaboration are necessary, the question remains when to cooperate and when to collaborate.

Secondly, as the cooperation between industry and academia increases she asked how to protect the integrity of academia? Lastly she stated that concerns cannot be dismissed, that it is important to achieve an informed and properly judging public, - and therefore potential risks have to be addressed.

**Gas fracking session**

The meeting room was closed for the late comers as too many ESOF participants wanted to get in. Consequently, we tried to follow the discussion via twitter, which proved to be a less rewarding way to take part in the session. Apart from this we want to mention that at the beginning of the day, a small group of students distributed “The scientists manifest” outlining their concerns about fracking. However, here the tweets collected:

*Jon Tennant: #fracking Styles: Gas pipelines are leaky - global losses from pipelines are c1.5% which is methane going into the atmosphere*

Pearson: best estimate is that we have 200 trillion cubic meters of unconventional gas.

*Ruth Francis: We think we have 425 trillion cubic meters of conventional gas so this COULD add 50%. Pearson*


*Ruth Francis: UK and most of Europe are net importers of gas*
Jon Tennant: For #ESOF2012 delegates – paper in press shows that there's almost no risk of aquifer contamination

Jon Tennant: Peter Styles also gave a talk here recently on the risks of induced seismicity
http://www.geolsoc.org.uk/page11919.html (vidlink)

Ruth Francis: But... beware of anyone who stands up and gives you discreet numbers. There is uncertainty.

Jon Tennant: #fracking increased use of shale gas rather than coal has helped US CO2 emissions to drop to 1991 levels

Ruth Francis: Free advice is rarely seen as valuable.

Jon Tennant: Tony Grayling of the Environmental Agency talks about the regulatory framework wrt #fracking here http://www.geolsoc.org.uk/page11921.html (recent)

Shipton: #fracking UK regulations don't need to change - but regulators need more resources to regulate effectively

RT Anne Glover: if politicians ignore the evidence, they must be transparent and explain the reasons why

Jon Tennant: http://geolsoc.org.uk/page11920.html

Ruth Francis: Bringing gas in from Russia is a major climate change issue

Ruth Francis: Loving Styles' demonstrations of stress using elastic bands.

Ruth Francis: Ok @markruddy the 200tcm was just shale gas that's technically recoverable. For coal bed it's 25tcm and tight is 45tcm

Paul Stevenson: "Deputy PM of Greenland happy about climate change - because of mining opportunities"

**Modelling the impact of innovation and knowledge**

In the policy-session ‘Macro-Modelling the impact of innovation and knowledge’ Werner Roeger (European Commission), Raffaele Paci (CRENoS, University of Cagliari), Xabier
Goenaga and Andries Brandsma (both Joint Research Centre, European Commission) tried to answer the question why there is a need for economic modeling of innovation and knowledge and presented different models and frameworks of analysis, respectively.

Due to its relevance not only for macro-economy in general, but also for rural development, one presentation, held by Raffaele Paci, will be described in more detail in the following. Raffaele Paci faced up to the question how knowledge can affect the regional level:

Once there is a useful framework on the national or the macro-level available, it is necessary to look closely at the inequalities that are present within countries in Europe. Raffaele Paci was facing up to the question how knowledge assets in R&D could affect the regional performance. He was particularly focusing on two issues: The first one was to recognize that economic performance of a region is not just an internal process that drives performers. In fact, it is necessary to consider what happens around the regions. Recent research in economic geography shows that there are several special connections. Therefore it is important to have a comprehensive picture about what is going on in a region. Research also shows that human capital endowments are definitely very effective.

There is a lot of evidence about the importance of local spillover. A region is not a closed system, but it is influenced. There are strong geographical clusters at the regional level, meaning, that if you are surrounded by other well performing regions, your probability of doing well in terms of innovation is higher.

We must be aware of the fact that there are other ways of exchanging knowledge and technologies. These channels of exchange go through institutional, technological, social or organizational relationships. For instance, if you share a similar value, language or cognitive basis of your production structure, it is easier to exchange knowledge and technology with other agents.

A second issue deals with the endowment of a specific area with skilled and highly educated people. According to Raffaele Paci, R&D by itself is nothing. The essential of R&D is human capital embodied in people.

Knowledge spillover, defined as, absorbing knowledge from outside’, requires human capital, comprising of ideas and knowledge. Human capital is even more important in regions, that are trying to catch up and absorb and imitate technology.

Using different kinds of models - regional performance, labour productivity, GDP, total factor productivity, or looking at the capacity of a region to produce new innovation – research results show that the elasticity (the impact or influence) of human capital is always higher than the one of the technological capital.
Some basic policy implications: It is important to encourage the formation of dense networks among regional innovation systems that go beyond geographical clusters. Encourage the formation of connections between e.g. a region in Northern Italy and a region in Sweden, because they can share the same knowledge and some policy in order to help each other.

Human capital endowment is the most important policy measure. So, even in a situation like the current one with its financial problems, we have to allocate resources and money to increase human capital, especially in less developed regions, in order to support the creation of knowledge, and, even more importantly, the absorption of external knowledge.

**Soil, land and food security: The challenges for science, economy and policy**

It appears to be all about the fight on soil degradation. It is going to be of utmost importance that we find ways to secure soil quality, as within the next 40 years, we will have to produce as much food as in the last 8000 years, Joachim von Braun from the University of Bonn mentioned at the opening of this very interesting lecture, highly decorated with speakers from Stanford and Ohio State University as well as from IFPRI (International Food Policy Research Institute).

At the beginning of the session, following some more general implications showing numbers on deforestation and soil degradation, Ratten Lal of Ohio’s State university outlined that in nature nothing is permanent, absolute, universal, nor to be taken for granted, but that everything is dynamic. In this perspective, he presented his 10 basic laws of sustainable soil management, an issue on which according to him everything depends on, as healthy soil, besides reforestation, would not only hold the most effective options for reducing and storing CO₂, but would be the precondition to face challenges like climate change, degradation, food security and biodiversity.

After that, Ephraim Nkonya, representative of IFPRI/USA explained, that “the global trends of land use are changing and the expansion of agricultural land has increased. In tropic countries for example, the expansion is achieved only on the expense of forests which to 80% are the source of new agricultural land, causing severe problems. As the economic growth increases, the forests decrease, even though 77% of increases in food production derive from increase in yield”. So for him, closing the yield gap holds the biggest potential for LDCs (Least Developed Countries). Some like Brazil, Indonesia and the DRC (Democratic Republic of Congo) would have finally recognized that and started launching first countermeasures. For example Brazil managed to reduce its deforestation by 74% in only five years, in the DRC poor infrastructure and insecurity have led to limited logging and other forms of forest harvesting and even in Indonesia with its huge palm industry and commercial logging they at least started to protect their forests.
In the same directions went also Nicolas Gerber of the University of Bonn presenting a study showing the strong relation between poverty and land degradation baring high human costs for LDCs. 42% of the world’s very poor rely on degraded land. The problem would become even worse due to large scale land grabbing, a result caused by the globally rising competition for farmland that’s becoming increasingly short. “It is a global paradox”, he said. “On one side we see an increased competition for productive land, increased land prices, an upward trend for future demand for land based goods and services, but on the other also a large underinvestment in sustainable land management.”

Taking into account an economic assessment of land degradation, another result of the study is that the costs and benefits of taking action regarding soil degradation are much lower on the long run than not taking action. Therefore we need to facilitate policy priority settings, enable investment targeting, propose institutional designs (transaction costs) and mobilize stakeholders for broad based actions.

“In addition we have to think about the value of a system in the foreground and balance its socio-economic environmental benefits”, claimed Prof. Gretchen Daily from Stanford University in her speech, presenting her Natural Capital Project that develops tools for quantifying the values of natural capital in clear, credible, and practical ways, and highlights the importance to invest in natural capital for food, water and climate security. Then of course institutional arrangements for the assessment must follow best practices and demonstrate credibility through independent peer reviews.

To conclude with the words of Ephraim Nkonya, “Food security is achievable, but it requires investments in multiple sectors, strong environmental policies and an involvement of institutions that play a key role in land use change, both in high and low income countries”.

The great debate on the battle to feed a changing planet

In the event, organized by the JPI-FACCE (Joint Programming Initiative on Food Agriculture and Climate Change Effects) Rajendra K. Pachauri from the IPCC (International Panel on Climate Change), Louise Fresco from the University of Amsterdam, Lynn Frewer (Newcastle University), Pamela C. Ronald (University of California) and Marie Guillou from the French institute for agricultural research (INRA) discussed about the future challenges to feed a changing planet.

Highlights of the session doubtlessly were on the one hand the several video-contributions that made the session more lively and diversified and on the other hand the innovative ways of including the audience from the auditorium and those following the discussions via the internet live-stream. The possibilities given were to comment and ask questions via twitter and to gather the peoples’ opinions by using an ‘Electronic Response Card Device’.
At the beginning the audience was asked what, according to them, would be the best measures to take in having a positive impact on our global food production system. The points to choose were a) reducing meat consumption, b) reducing thrown away food, c) intensifying agriculture or d) increasing yields. The result was an equal division. An outcome that to Rajendra K. Pachauri is comprehensive as there is no ‘silver bullet’.

We would have to apply a whole range of reactions and set a wide range of different inputs to achieve an impact.

Another remarkable point of the discussion was the assumption that we really have rather a food distribution than a production problem. In the EU and the US enormous amounts of food abundances are produced but thrown away. However it will logistically not be possible to deliver them in time to the people who need them. Thus, food has to be produced and consumed directly where the people live in order to be sustainable.

On the other hand Marie Guillou emphasized that local production would not always be automatically the best solution (i.e. glass house production of tomatoes in winter). In the final round of conclusion she added that even small increases in yield would be enough to feed the worlds’ population and that new weather conditions would demand new and better varieties and more robust systems for plants and animals.

Last but not least Lynn Frewer stated that solutions would have to be ‘tailor-made’ from case to case and that we have to apply new norms for food production and encourage mechanisms that lead to other and new ways of consumption.

Notwithstanding, all the speakers could agree on the urgency to increase productivity and the awareness of policy and consumers. The first could be achieved by fostering research that’s future oriented and by improving intensification and collaboration methods along the whole production chain, the latter by finding better ways of communicating. The difficulty however lies not in living new ideas and habits, but in escaping the old ones.

Frontier Research: An extravagance or a necessity in times of recession?

Dennis McKearin (Howard Hughes Medical Institute, USA), Ernst-Ludwig Winnacker (Human Frontier Science Program Organization, HFSPO, France), Thomas Sinkjaer (Danish National Research Foundation) and Wilhelm Krull (Volkswagen Stiftung, Germany) took up the challenge, to provide input on the following questions:

- What is frontier research and how do we detect it?
- Is it a necessity or an extravagance?
- What are the benefits for society?
- How is frontier research and creativity sustained, developed, and nurtured?
Frontier Research creates opportunities for new research questions that go beyond established paradigms. Frontier Research, in terms of excellence research, has the potential to push boundaries of knowledge, and to address necessary and risky questions, as well as research processes and results, that are difficult to predict.

The practical application of basic results is hereby not excluded. On the contrary, basic questions are often developed into new, more advanced ones, which involve a direct benefit to society. Frontier research is therefore not inconclusively an extravagance, but a necessity as well.

There are different approaches to supporting this type of research; Short and long-term, challenge-driven or more open-ended approaches, which need to be balanced in order to optimize their benefit.

To ensure benefits for society, funders have to guarantee, that research meets society’s expectations. Experience has shown that hierarchical structures are not appropriate for Frontier Research. In this context it was recommended not to support projects, but researchers and not to pick people with super-results only, but also to accept failures in order to learn more for future approaches.

In order to sustain Frontier Research, it is essential to develop high trust, a competitive infrastructure and a right balance of various disciplines as well as intensity of communication.

Moreover it is very important to open doors to international cooperations, as well as cooperations across geographic and scientific borders. Funding agencies are responsible for funding a proper relationship between competition and collaboration; and finally, funders have to be convinced of the value of Frontier Research through careful impact analyses of breakthroughs, career development, prizes and the like.

In addition, it should be noted that governance and institutional frameworks enable scientific freedom and minimal administrative burdens matter, but in the end successful research mainly requires creativity, boldness and impact. Recommendation: Knowledge, network and nations, Royal Society, March 28, 2011.

Keynote Address: Helga Nowotny “The Usefulness of Useless Knowledge - and how to find uses and users”

Helga Nowotny, President of the European Research Council, took the audience out for a walk through history from the 15th century onwards by making clear that it is very difficult – or even impossible – to predict the use of research and innovation. She put the recent mainstream in question that useful knowledge is the source of economic growth as this has
its root in the tacit assumption that we generally know what is useful. On the contrary, she
gave favour to the creation of creative environments based on autonomy. Hence, as the
usefulness emerges in the context of good questions Prof. Nowotny highlighted the
evolutionary model of knowledge production.

She concluded the model of co-invention of users and uses with both the long-term perspective of science and the belief to get things right.

**Debate on Scientific Publishing and Open Access**

A panel of four, chaired by Philip Campbell, Editor-in-chief of Nature, faced the last challenge of the day: Alma Swan, Director of European Advocacy, Jos Engelen, President of NOW, Luke O’Neill, Trinity College Dublin and Maria Leptin, President of the Initiative for Science in Europe, were tasked to consider the issue of Quality Control in Scientific Publishing, both in the context of publication in for-profit journals and also in the context of a future move towards Open Access journals.

The debate never caught fire and so the hot potato remained unveiled. It often remained unclear what the problem is about. The best summary of this session was probably given by Gilles Grenot via twitter: The goal is clear, open access is good, the challenge is the transition. ‘Let’s hope the future is gold,’ have been the closing words by Philip Campbell.
Saturday, 14th of July 2012

What should Europeans eat?

Mikael Fogelholm, University of Helsinki, chaired this particular session which dealt with all the stuff we are eating and the behavior behind it. Demosthenes Panagiotakos, Professor at the Athenian Harokopio University, undertook the task to summarize studies on Mediterranean nutrition, covering a time span of over 40 years. He concluded as clear evidence out of the Mediterranean Diet and the ATTICA studies, the HALE project, the LYON heart, the GREECS studies and the MEDIS project that unsaturated fatty acid, moderated alcohol consumption, vitamins, and less animal proteins are the basis for long and healthy life. This is acknowledged by the UN in setting the Mediterranean diet on the world heritage list.

The representative of the Medical Research Council in the UK, Ms. Toni Steer, picked out some highlights from the “rolling programme” of the national diet and nutrition survey. The authority is undertaking this survey every year on a 1000 person sample, when people are asked to contribute on 24 hours recall during four days on their estimated food intake. Areas of concern are the uptake of saturated fatty acids via milk and cheese mainly throughout the population, whereas the group of 4-18 old kids and teenagers are at risk by consuming too much sugar. The third example was about the salt intake, which exceeded the recommended 6 g per day in 80% of men and 60% of women. Even more than these concerns, the authorities are worried about the strong correlation between low income and trashy food consumption.

Iris Erlund of the National Institute for Health and Welfare told that the food consumption pattern in Finland has changed from traditional to western countries’ pattern. On the contrary, latest trends show the increase of locally produced organic food, which is because wealthy people are willing to spend money on that. She stressed the generally known recommendation of eating fish, wholegrain and vegetables and also the healthiness of having a big breakfast. Typically for Northern countries she put attention to the high consumption of wild berries in this area. Ms. Erlund also provided success stories to the audience. One was about a massive health campaign to reduce fat consumption which resulted in the decrease of heart attacks. The second example was campaigning against obesity by giving children at school a model for good food. She concluded that the ‘network of dietary compounds [of fish, berries, vegetables] is beneficial’, whereas vitamin pills are insufficient. A major point in the discussion was how to get people towards changing their eating behaviors. Looking back in history it was stated that there always have been times with unhealthy food consumption patterns. Finally, one participant made the fruitful remark: Enjoy eating!
**Science meets Poetry III – “Don’t forget the poets.” (J-P Connerade)**

The Science meets Poetry event was scheduled for the entire day and as an example the lecture of Jean-Patrick Connerade about ‘Ecology and Creationism in European Culture’ will be summarized as ‘pars pro toto’. In fact, there is more science in literature and poetry than one normally is assuming. He referred to the famous parts in literature as the Frankenstein story, the Zauberlehrling, and the original Faustus written by Marlowe, and introduced two particular poems reflecting science, E. A. Poe’s poem ‘Science! True daughter …’ and Alfred de Vigny’s lines ‘La Bouteille à la mer’. He concluded that the dialogue between these two was, is and will be of supreme importance.

**Sound and peer-reviewed evidence costs.**

Even though not in the original programme of the ESOF 2012, Anne Glover, Chief Scientific Advisor to the President of the European Commission, emphasized that scientists have to talk about what they know AND what they do not. She encouraged the use of images and languages which are understood by non-scientists and claimed to offer options instead of solutions. Both, opportunities and risks have to be put on the table. On the other hand she invited politicians to be open and to listen and ask questions at the right time. Encouraging them to take evidence as a whole, she was strictly opposed to any kind of cherry-picking. Evidence – sound and peer-reviewed – should be left where it is and it might be helpful to state clearly when evidence might not be used for some reasons.

Science does not attract everybody, but it takes place in everyday life. Even more, democracy needs science to make profound decisions. Arguing this gets support from the facts that science helps to tackle each grand challenge and to create jobs, science expands the frontiers of knowledge and is part of cultural heritage. Simply, science is fun.

But will we value science when it comes to political decisions? She exampled the use of GMOs, which is to 100% – based on the same evidence – refused in Austria, but accepted in Sweden. Further, the public support for science has declined from 78% in 2005 to 65% in 2010.

From these figures she wondered what is going wrong in releasing scientific evidence and looked for possible misunderstandings. Scientific evidence will not change, but the political use of it – and the political action upon it should be held accountable as stated in the following debate. She attributed these tensions to ‘the complex world’ and ‘the contrast between the rapid technological change and the persistence of human behaviour’: We want the latest technologies, but are not willing to take the consequences.
The audience then put fingers on the apparent discrepancy between evidence and assumptions, which could be bridged by scenario thinking. Secondly, evidence costs and tax payers should ask - with probing questions - why obvious scientific results are not used. Thirdly, the role of the media has been characterized by “a lot of fighting dirty” and the advice was given to fight back with evidence. Differences were seen between the news media, led by controversy and conflict and the science media.

**Keynote Address: Regina Palkovits “Biomass - a valuable feedstock of the future”**

Regina Palkovits is an Associate Professor for Nanostructured Catalysts at the RWTH Aachen. In 2010, she was awarded the Robert Bosch-Juniorprofessorship for Utilization of Natural Renewable Resources, the Jochen-Block Award of the German Catalysis Society and the Innovation Award of North Rhine-Westphalia. Her current research focuses on the development of solid catalysts and on processes for the efficient utilization of renewable and conventional resources (cf. programme of the ESOF 2012). In her keynote speech, Prof. Palkovits gave a broad overview of the current energy production, of their advantages and disadvantages and of alternatives research is already dealing with.

In traditional oil refineries 93% of crude oil goes to fuels production, energy and heat. The remaining 7% are used in chemical industry. The current renewable energies are comprising of wind, water and solar power, geothermal energy, fusion and biomass and are used for heat production and electricity, respectively. Since it is the only carbon source, biomass (sugar cane, algae, rape seed, corn, wood, sugarbeet) is currently the only resource that is used for the production of chemical goods and biofuels. All other renewable energies are exclusively used for the production of electricity.

As biofuel will remain the main fuel for transport due to the fact that electricity still has a storage problem, the biofuel-market is expected to be an important driver for technology development. Pushing technology further will become essential, as growing plants for the biofuel-market need energy and are currently far away from being sustainable. Biodiesel, a product from vegetable oils, causes problems occurring from one-crop agriculture that requires a high level of water supply and produces by-products, causes tensions between food and energy production and makes biodiesel less sustainable than expected. Bioethanol is currently produced from sugar. By comparison, biomethanol and biomass-to-liquid are the most efficient contemporary biofuels, whereas vegetable oil, biodiesel and bioethanol are treated as less efficient.

An already existing alternative is to produce gas from wood. Biogas fits to small-scale units, and is less efficient for transport, as the maximum speed is very limited. Besides this, production of synthesis gas (see Fischer Tropsch Synthesis, already developed in the 1920s) is an alternative, which could be done from all carbon sources. According to Prof. Palkovits, a
potential alternative could be the lignocellulosic feedstock (and thereof mainly hemicellulose and cellulose). Unfortunately, to date there is no efficient technology available for cellulose, which makes this resource quite expensive. But nevertheless lignocellulose will be a potential resource for future fuel production.

Research is concerned with a lot of challenges. One of the biggest challenges and aims of research will be the development of pre-treatment technologies, in order to reduce energy use in processing.

**Can we feed 9 billion people or will we starve?**

Harvests are decreasing due to weather conditions, many farmers are experiencing problems with droughts and the challenge of our lifetime will be to feed 9 billion with more than 70% of them living in cities. Forecasts estimate that 3 billion of them will live in poverty and 1 billion will be chronically hungry. We are already seeing a decline in soil fertility and a plateauing effect in the yield increase of major staple crops. For people in the developed world who are taking food for granted, this does not seem like a problem. “He who has bread may have troubles, he who lacks it has only one”, Chris Leaver of the University of Oxford stated, in order to illustrate that the developed countries sometimes have an idyllic perception of agriculture and where food comes from. The perverted situation of global food production would be that on the one hand we’d have enough food for all people, but we can’t deliver it to all of them.

According to Mr. Leaver, until 2050, 70% more food would be required while in the same time we have to adapt to climate change and be sustainable. We would need to grow more with less, use lower inputs but achieve more output. But how will we do it? First of all, those living in the developed world would have to take a significant cut in their standard of living. We all need to shrink and share while implementing sustainable intensification. But, as he puts it, there is neither a ‘silver bullet’ nor a ‘one size fits all’ solution. Instead we’d have to come up with a number of combined approaches. Unless we can stabilize or reduce our population, we need to find the right genes and getting the right gene connections together to produce more food.

Surprisingly, though emphasizing the need to combine a series of approaches, also all the other experts of the panel saw the solutions to the problem to feed 9 billion people mainly in the merits GM technology would be able to provide. “We need to not just discover, but also deploy GM disease resistance traits to feed 9 billion. By using genetics, we can recruit new genes for blight resistance and improve potato varieties. Besides, plant diseases are mostly caused by fungi or oomycetes thus we need a lot of blight resistance genes” argues for instance Jonathan Jones from the John Innes Institute.
And also Bill Davies of Lancaster University, doing research on drought resistance, referred to the same points arguing: “One third of the worlds’ freshwater is used to irrigate rice as 1 kilogram of rice requires 2500 liters of water for its production. The problems deriving from water scarcity will increase dramatically, so we need to exploit the potentials of plant biology, manipulate for example rhizosphere processes, the root systems and soil biology. We can’t afford to rule out any new techniques or technologies”, he concluded.

**Mind the gap: connecting brain research to educational policy**

This session moderated by Mr. Quentin Cooper, BBC, was characterized by two surprises. First, the audience was asked to exchange their thoughts after one or two short lectures around the table before presenting particular questions to the panel. Second, one speaker presented a ‘silent presentation’ and participants were invited to read the slides themselves.

Bruno della Chiesa, Centre for Educational Research and Innovation, OECD, critically acclaimed that the media as part of the economy is interfering with the decision processes of more or less all sectors of life, either ethics, politics, policies, practices, emotions, ideas, arts, or science.

Public funding in sectors like education or population ageing shows that 80% of the budget available is used for 30% of the population. Such ‘equity gaps’ were highlighted by Maria Slowey, Dublin City University.

Paul Howard-Jones, University of Bristol, put the pathway ‘research – evidence – practical use and resources – teaching – policy uptake – impact’ into question concluding that we have to take this long route as other fair options are missing.

In this context he demolished some of the outrageous ‘neuromyths’ and legends: learning styles (audio, visual, ...) are based mainly on commercial interests, and ‘learning begets learning’ is not supported by neuroscience.

Catherine Odora Hoppers, University of South Africa, fed the discussion by bringing in the aspects about indigenous knowledge and cognitive justice. Towards politicians the panel stated that scientists do not write papers about what should be done.

Finally, it was concluded that neuroscience will support teachers, but there is no evidence for brain based education.

**The brain, a life-long learning device: You can teach an old dog new tricks. (Bruno della Chiesa)**
Science for Economic Development – Africa/European Partnership Symposium

The five different speakers, Ismail Serageldin of the Bibliotheca Alexandria, Grace Naledi Mandisa Pandor from the South African Ministry of Science and Technology, Lidia Brito of the UNESCO, Robert-Jan Smits representing the European Commission and Romain Murenzi from TWAS (The academy of sciences for the developing world), all more or less listed food security, water quality, disease control, biodiversity loss, renewable energies, common fellowship structures (i.e. exchange in PhD programmes etc.) and supporting knowledge in general as the most urgent challenges for Africa.

In this regard, the two key aspects of most relevance are ‘urgency’ and ‘opportunity’, taking especially into account that localized decisions have never had such a global impact. Currently we would not be dealing quickly enough with current challenges, the speakers argued. Thus we should seek new perceptions of responsibility, set new goals of global sustainability, install a planetary stewardship, foster investments in increased global sustainability and concentrate on research capacity building.

Therefore, they all see the need for an even stronger and more successful African-European Partnership that promotes science and technology policy worldwide with Africa building up its own capacities, maintaining and deepening the collaboration between south-south and north-south states and moving towards greater use of renewable resources.

Moreover, Robert-Jan Smits elaborated on what shapes the EU-Africa cooperation. Currently, he mentioned, there would be a number of cooperation programmes like the EDCTP (European and Developing Countries Clinical Trials Partnership) or the Joint EU-Africa strategy to implement concrete joint flagship initiatives as best practice examples. Nevertheless, it is necessary to increase coordination and guarantee a multi-stakeholders implementation approach to foster reinforced synergies. Finally, it will be to Africa to put in the effort, but - and that’s the decisive point - with European support.

What does art bring to science?

Close collaboration between art and science is more than just providing an alternative way of disseminating research results. It is also more than giving scientists PR by art. On the contrary, art helps to wake up science. Creativity, both in art and science, means provocation, critics and experimentation. Beyond that, the speakers of the session expect to create something new that is neither art nor science.

Josep Perelló (University of Barcelona), Michael John Gorman (Science Gallery, Ireland), Clare Matterson (Wellcome Trust, UK), and Andrea Bandelli (Après Tendance, NL) presented some interesting, innovative examples of cooperation between science and art:
- Bee-Path, an experiment on human mobility; following visitors of science festivals via GPS, in order to map the movement of visitors; [www.bee-path.net](http://www.bee-path.net).
- Project FuturiICT, a multidisciplinary international scientific project with a focus on techno-socio-economic-environmental systems; living earth simulator; [http://www.futurict.eu/](http://www.futurict.eu/).
- Experiment on the vision of bees, visualizing the learning curve of bees; at Science Gallery, Trinity College, Dublin; [http://sciencegallery.com/](http://sciencegallery.com/).
- Art illustrates, what phantom limb pains could look like; input to medicine.
- Self-portraits: What does it look like, to get older or sick, and to make the experience of losing oneself?

**Keynote Address: Kari Stefansson "Understanding the Heel of Achilles"**

Kári Stefánsson, CEO of deCODE Genetics, gave a presentation on the genetics of the Icelandic population, which has been isolated for more than 1000 years. As the genetics of this population is pretty well known on an individual basis – but unknown on a personal level – some extraordinary results could be published by him and his team. They revealed genetic linkages to a number of phenomena such as an old age and thyroid gland disease. They found a correlation of the paternal age when conceiving a child and the risk for the descendants of suffering from schizophrenia. The research team was able to reconstruct the origin of the Icelandic population, which could be told that Vikings once robbed Celtic women to settle down in Iceland. Within the Icelandic population they found a mutation, which provides almost complete protection against Alzheimer’s disease and gave evidence that lung cancer in Iceland is purely due to environmental factors.

**Keynote Address: Rolf-Dieter Heuer "The search for a deeper understanding of our universe at the Large Hadron Collider: the World's Largest Particle Accelerator"**

Due to latest developments at the world's largest particle physics laboratory on the 4th of July 2012, this was probably the best attended event of the whole ESOF conference. Generally the mission of CERN is to perform research and innovation on highest level, to educate leading scientists and engineers of tomorrow, to examine questions like how the universe started and steadily push forward the frontiers of our knowledge. And recently they made a big step forward.

The state of the art now is that the Higgs-Boson most probably has been discovered, though scientists can’t tell yet with 100% certainty that it’s actually what they were looking for. At least it has the characteristics (i.e. like self-interacting) of the particle they were searching,
but it could also be only part of a similar family. But how did they even find such a tiny particle? The basic idea is to accelerate and then collide particles with each other at an incredibly high speed. During this process this leads to occurring temperatures between as low as -271 degree Celsius and as high as 1000 million times hotter as it is in the center of the sun.

So far scientists already achieved remarkable progress in the search for the biggest macro-perspective view on things (i.e. Hubble telescope) towards the smallest particles (super-microscope) but there are still huge areas of potentials for research and new knowledge. Now the most probable discovery of the Higgs-Boson could help us understand the very first moments after the Big-Bang. What we know so far is that at a certain point in the history of the universe, the equilibrium between matter and anti-matter got distorted because a perfect balance between them would have annihilated everything and there’d be nothing. We and our whole environment only exist due to the occurrence of a small imbalance of initially one 1 tiny part of a billion more matter than anti-matter.

Nevertheless, finding a particle with features like the one that was found allows extraordinarily new research like gaining insights on dark matter and bringing us - as mentioned before - closer to more concise examinations of the Big-Bang. Hence to underline the breakthrough of this event, Dr. Heuer stressed the following illustrative and appropriate comparison. Finding the Higgs-Boson, he said, is like finding a needle in a haystack, only that it is not just one haystack you are searching, but millions of them and that the haystacks themselves consist out of needles. The recent developments, he finished, will change the understanding of our universe and could have substantial impacts on discovering the rest of the universe, as more than 90% of our universe are still unexplored.
We will cope with big cities - China & Europe Partnership Symposium: Science and the City of the Future

The panel under the chair of the architect Duncan Stewart was made up of two scientists from China, Rusong Wang, Chinese Academy of Sciences, and Shi Nan, Urban Planning Society, and two from Europe, Lisa Amini, IBM Research Ireland, and Denise Pumain, University Paris I Panthéon-Sorbonne.

The most striking, but well known fact is the enormous dimensions China is facing in giving home to its citizens. From the urban planning point of view the challenge starts with the individual dimensions and ends up with city clusters around China. From an ecological point of view the urban networking is supportable by applying the Chinese five elements to the scenery, and in a more western jargon eco-city and eco-polis are the desireable goals.. Before that background examples of completely re-structured cities have been given: Yangzhou, a 2500 year old settlement, was overall restored and transformed into an eco-city with 25% of energy consumption in comparison to the average of other regions only due to energy efficiency.

In that context urban modeling based on urban systems as multi-level territorial systems is promoted as a helpful tool, covering the micro-level of individuals, the meso-level of the city itself, and ending up on a macro-level with the system of cities.

Being asked about the necessity of such a rapid development it was stated that China indeed is rather more driven than driving. The panel concluded that a combination of local processes, collective intelligence, bottom-up processes, conversations with local initiatives; awareness of crisis and collapses, the need of new technologies, the inclusion of eco-system services, social learning, the exchange of knowledge, and a drive into early education is needed to coping with big cities worldwide. The issue of feeding 50% of the world population living in cities has not been touched.

Adaptation or Extinction: Responses to Radical Climate Change

How will we respond to climate change and its manifold characteristics – will living creatures and organisms adapt to climate change or will they become extinct? Three outstanding scientists funded by the European Research Council discussed these questions from their particular research perspective. Siwan Davies (Swansea University, UK) faced up to the question, why climate changes abruptly, and why it matters. Her previous studies on rapid climate events (rapid warming and cooling) in marine, ice-core and atmospheric records as well as records on ash layers, dealt with the following problem: Is the ocean responding to
the atmosphere, or does it happen the other way round? Is the ocean an amplifier or a driver? Is there a link between volcanic eruptions and rapid climate changes?


Heather M. Stoll (University of Oviedo, Spain) engaged herself in ‘Learning about the living from the dead - Post and future adaptation of marine algae to changing CO₂ and climate’. Marine algae regulate carbon concentration in our atmosphere. Algae store CO₂ they need for photosynthesis. Through their sinking process into the deep ocean carbon is kept away from the atmosphere for thousands of years.

Starting from the conventional process, we have to question how a high CO₂ concentration affects algae and how they will adapt to a higher carbon deposit. High carbon concentration in oceans means high activity of increasingly more acid algae, which are producing less mineral, which in turn effects the sinking to the ground. Today, algae pump bicarbonate into their cells, if acidity or CO₂ concentration requires it.

Heather Stoll looks at CO₂ changes in the past and the accordingly adaptation of algae. She tries to conclude, how algae will react on increasing CO₂ now. Her research should lead to a better understanding of the carbon cycles of the atmosphere and the ocean. The impact of environmental changes on algae, and their status in the carbon cycle, has implications for how changes will interact in the future.

The last presentation by Valentina Bosetti (Fondazione Eni Enrico Mattei, Italy) covered a wide area of sustainable energy, mitigation options, and the competition between water, biodiversity and agriculture. She presented an Integrated Assessment Modelling, in order to better understand future energy scenarios, their linkages to stabilizing greenhouse gas concentrations as well as to climate policies.
Furthermore Valentina Bosetti elaborated on the close relationship and interaction between institutions, innovation and behaviour. In her research she looks into the reasons why it is that difficult to change habits of people as well as technologies.

**Sustainable green infrastructure: in seas and forests, from fields to cities**

At the moment we have an economy and an infrastructure that poses a threat to biodiversity and ecosystem services and thus we need high quality green spaces that protect species. Starting from this statement Isabel Sousa Pinto from the Centre of Marine and Environmental Research-Portugal, Ikka Hanski (University of Helsinki), Kinga Krauze from the SWITCH-project (Sustainable Water Management Increases Tomorrow’s Cities’ Health) and Maria Luísa Parachini of the Joint Research Centre of the European Commission discussed current issues of green infrastructure.

At the beginning, Mrs. Sousa-Pinto gave some inputs on marine area planning and how the concepts of green infrastructure could be applied for the sea. First we’d need to distinguish the coastal areas and the open ocean, as there’d be many differences between terrestrial and the tridimensional marine environment, she said. The better use of the marine areas however would hold big potentials to release a bit the pressure from land. Restoring and keeping alive for instance the mangrove forests is therefore of utmost importance as they are one of the earths’ greatest und diverse suppliers of ecosystem services (i.e. coastal protection, food production, carbon sequestration etc.). Of course we also have to protect and rebuild the coral reefs, sea-grass and kelp beds. Marine ecosystems would be manageable in the same way as on land, and they could also be restored and protected by activities that are comparable. This requires well-informed users, a planned infrastructure and targeted knowledge dissemination. For the implementation of these goals, the EU already has already set in place a marine strategy framework directive in 2008.

Ikka Hanski (University of Helsinki) on the contrary talked about habitat conservation and the positive correlation between the global decline of biodiversity and the increase of allergies. The new targets (Nagoya 2020) are, that 17% of all areas of land are protected, and 10% of coastal and marine areas. In Finland, almost 17% of land is protected, but these areas lie mostly in the ‘unimportant’ area of the north. In the rest of Europe, there’d be a high degree of fragmentation, which reduces the capacity of protected areas to support biodiversity. With a high degree of fragmentation, many species get extinct. Land use causes fragmentation, whereas it would be optimal when protected areas were organised into a network of clusters (Natura2000). The role of microbiota which influence our immunology is currently under investigation. The loss of biodiversity is like taking antibiotics. Children have been investigated in different environments, and there turned out to be a correlation between the land use types, the composition of microbiota on their skin and the anti-
inflammatory molecules in their blood as well as allergies. Especially in bigger cities, green infrastructure is needed to counteract these megatrends.

Afterwards, Maria-Luisa Parachini (Joint Research Centre of the European Commission) reflected on the question ‘What kind of green infrastructure supports recreational needs in Europe?’ This led her to the conclusion of introducing the new term of cultural ecosystem services that would also include non-material benefits (i.e. recreation, aesthetic aspects etc.). The decisive question would be: Who has access to them and to which extent? There is of course quite a difference regarding on the one hand the time and distance one has to overcome to be in nature and on the other hand type and level of nature quality. Comparing for instance a park in the city with wild forests or the mountain regions, reveals two totally different levels of recreation. Another factor to her is the accessibility of fresh and high quality water. That is and will become even more another topic of raised concern even in Western Countries, when just like Kinga Krauze from the SWITCH project mentioned, by 2020 80% of Europeans will live in cities. New planning of how healthy cities should look like will become inevitable giving the fact that already nowadays more and more people in cities would complain about and suffer from lacking access to ‘high quality nature’. Therefore cities will need to create stronger linkages with real landscapes.
General Impressions and ‘Lessons-Learned’

At the end of this report, we would like to reflect on what our general impressions of the conference were and what remains in our memories.

Initially it was our intention to provide a daily report in order to immediately spread the news. After the first day however, we realized how difficult it is to summarize all the events of one day as we totally underestimated the time required to actually write such short report. Nevertheless it was a good experience to learn how to plan a report and how to communicate and organize things within a team. Beside this was a good learning experience of how important a good preparation phase and a reasonable time management is.

The emphasis of the conference however was that we met old colleagues, got to know exciting people and established new contacts. Another result was that we got the chance to listen to experts of numerous research fields and to deepen and broaden our knowledge about topics concerning our own work as well as gaining insights into completely new science fields.

Additionally, it was a good opportunity to see how such a big conference is organized and what it takes to successfully host such an event. After all, it must be said, that it was very well organized. There were always sufficient staff members available to guide you around, there was the possibility to use wireless internet in the whole area of the conference and, due to the tight structuring of the lectures, there never occurred any complications visiting several consecutive sessions.

Moreover it was very tempting to see the various technical possibilities to communicate and participate within the different sessions. From commenting and asking questions live on twitter, which gave people from outside also the possibility to actively participate in the discussions, towards providing a live-stream via the internet, the organizers spared no expenses to actively integrate the audience. For instance with the tool of an electronic response card device, it was even possible to collect data on the current public opinion in the auditorium. However, to mention at least one critical point, it would have been nice to offer a catering service.

Nevertheless it has been a stunning event, full of lively discussions, fascinating speeches and interesting conversations.

Finally we are now looking forward to receiving your comments, feedback and thoughts on this report. The ESOF 2014 in Copenhagen is already waiting and we hope to be able to participate again and - with your help and contribution - report in a maybe even better way.