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ERC supports the transition to a global bioeconomy



Europe and the rest of the world must urgently reconcile the challenges of securing food, water and energy supplies with the un-sustainability of biological and non-biological resources and the need to reduce emissions.

During the economic crisis, these challenges have been made more arduous, as pressures to improve the short-term economic situation tend to put resource sustainability and the environment further down the political agenda.

In this context, the bioeconomy field of research has emerged which aims to promote sustainable production and the conversion of biomass (biological resources from the land and the sea) into a range of food, health and industrial products and energy sources. Research into bioeconomy should allow us to:

- redefine the roles of agricultural and natural resources in addition to sustainable energy production
- identify the commercial drivers and areas of greatest potential impact for future research (e.g. improved land management practices and environmental services)
- implement sound policies to address land and water use trade-offs.

The advancement of bioeconomy and innovation by research is essential to allow Europe to improve the management of its renewable biological resources, and to open new and diversified markets in food and bio-based products. Research into the bioeconomy should therefore ensure the long-term competitiveness of European agriculture, food, materials and energy industries. The new [Bioeconomy Strategy and Action Plan](#) [1] adopted by the European Commission on 13 February 2012 is part of its efforts to obtain sustainable growth in Europe.

In this regard, frontier research [2] funded by the ERC is deemed imperative. Described below are several striking ongoing projects that aim to identify future biodegradable materials, improve the understanding of the role of African rain forests in fighting climate change, develop cleaner waste water treatments, work on alternative energy sources to fossil fuels and assess social anxiety surrounding consumer choice relating to health and food safety.

Some examples of ERC-funded projects on bioeconomy

Future biodegradable materials for a better quality of life



In these times of economic crisis, eco-friendly plastic bags could be key in reconciling economic and industrial growth with sustainability. Supported by a European Research Council's Advanced Grant 2009, Professor Ann-Christine Albertsson aims at creating a new generation of materials that mimic nature's structural organization and that biodegrade in a controlled manner without leaving any long lasting debris. She will study the materials, surfaces and molecular bonds using the most up-to-date characterization techniques to observe how the structures are created and

how they interact with the surroundings. Her research will ensure that the materials degrade in a manner that does not have an adverse effect on the environment in which they are used. These versatile customized structures will help our understanding of the way polymeric materials should be designed and how they could contribute to enhancing our quality of life in two main areas: sustainable commodity plastics; and tissue engineering applications (thus involving safer biomaterials for the human body). New sustainable materials would finally revolutionize the way traditional plastic-like materials have behaved until now and could have direct applications in many sectors of activities (agriculture, medical research...).

ERC grantee: Ann-Christine ALBERTSSON

Host Institution [3]: KTH Royal Institute of Technology, Stockholm (Sweden)

ERC project's title: New Paradigm in the Design of Degradable Polymeric Materials - Macroscopic Performance Translated to all Levels of Order (Paradigm)

ERC Call: ERC Advanced Grant 2009

ERC Funding: € 2.5 million for five years

Links:

<http://www.nature.com/news/2011/110421/full/news.2011.255.html> [4]

<http://www.kth.se/en/che/divisions/polymer-technology/staff/senior-scientists/ann-christine-albertsson-professor-1.19627> [5]

The role of African tropical forests in climate change



It is increasingly recognized that Africa is very vulnerable to climate change. However, until now it has not been clear whether it is a net carbon absorber or emitter because of the lack of studies on the carbon cycle in representative African ecosystems, notably tropical forests. A project funded through an ERC Advanced Grant and led by Professor Riccardo Valentini, is trying to tackle this issue. As one of their objectives, the researchers are trying to determine the impact of forest degradation and deforestation on carbon and other greenhouse gas (GHG) emissions, in the continent with the highest deforestation rate in the

world. They also aim to achieve a better understanding of the role of the African tropical rainforest on the GHG balance (especially on the global methane and N₂O emissions). In this very innovative project, methodology will include in-situ measurements and the estimation of large scale, continental GHG dynamics using remote sensing techniques and advanced modelling - taking advantage of the researcher's previous experience in the studies on European forests, and of gas measurement towers throughout the world.

ERC grantee: Riccardo VALENTINI

Host Institution [3]: Centro Euro-Mediterraneo per i Cambiamenti Climatici, Lecce (Italy)

ERC Project's title: The role of African tropical forests on the Greenhouse Gases balance of the atmosphere (AFRICA-GHG)

ERC Call: ERC Advanced Grant 2009

ERC Funding: € 2.41 million for four years

Links:

<http://www.cmcc.it/about-cmcc/prof.-riccardo-valentini> [6]

<http://gaia.agraria.unitus.it/> [7]

Biotechnology at the service of waste water treatment



As water resources are under severe pressure, there is a need to develop smart sustainable systems to clean waste waters for instance. The project conducted by ERC grantee Michael Jetten is about studying the diversity and activity of micro-organisms in their natural environment, their mutual interactions and their survival and adaptation strategies. His research focuses on the microbial ecology of freshwater systems and in particular on the microbial processes at the very interface between the sediment and the water column. Researchers have

isolated the microbes responsible for the anammox reaction (i.e. the removal of ammonium in environments lacking oxygen like e.g. wastewater) in freshwater sediments in Dutch drainage ditches and studied their complete genome. The anammox are unique microbes with many unusual properties. Understanding their metabolism and ecological importance is essential. By using those lab-grown bacteria, the research's team investigated how the bacteria broke down nitrites, using oxygen to consume the ammonium and releasing nitrogen that is harmless for the environment. The team is now trying to understand which enzyme is produced that enables oxygen production. This discovery may not only improve our understanding of the biogeochemical nitrogen cycle but also pave the way for developing cheaper technology with lower CO₂ emissions to clean waste water plants for instance.

ERC grantee: Michael Jetten

Host institution [3]: Radboud University Nijmegen (The Netherlands)

ERC Project: Anaerobic ammonium oxidizing bacteria: unique prokaryotes with exceptional properties (ANAMMOX)

ERC Call: ERC Advanced Grant 2008

ERC funding: € 2.5 million for 5 years

Links:

<http://tnw.tudelft.nl/en/about-faculty/departments/biotechnology/people/environmental-biotechnology/profdr-msm-jetten/> [8]

<http://www.microbiology.science.ru.nl/people/mjetten/> [9]

Poplars, a promising alternative to fossil fuels



In the post-Kyoto era, bio-energy is expected to play a crucial role in the development of renewable and sustainable energy sources for the EU. With his ERC Advanced Grant 2008, Prof Reinhart Ceulemans, a leading expert from the University of Antwerp in forest ecosystems and bio-energy crops, has chosen to focus on the potential of poplars to substitute for fossil fuels, thereby reducing greenhouse gas emissions. The project will involve work on a short rotation coppice plantation (SRC) field of poplars in Lochristi, East Flanders (Belgium) called « POPFULL » that is the biggest bio-energy plantation of Belgium (18 ha). SRCs are highly dense plantations of fast-growing trees grown in rotations of less than 5 years, which provide many benefits in terms of energy balance, CO₂ emission, protection and purification of water, maintenance of biodiversity, landscape preservation and decrease in erosion. Prof Ceulemans and his team aim to establish a full balance of the uptake and release of the most important greenhouse gases (CO₂, CH₄, N₂O, H₂O and O₃) and a complete energy accounting of an SRC of poplars and willows. The project will combine a Life Cycle Analysis of the global warming contribution of the plantation with an assessment of its energy efficiency. The site has been harvested entirely for the first time on 3 February 2012 and transformed into bio-energy (heat and electricity). A second harvest is planned for early 2014. This project should serve as a pilot to assess the value of bio-energy production via SRCs and the corresponding net reduction of greenhouse gas emissions.

Principal investigator [10]: Reinhart Ceulemans

Host institution [3]: University of Antwerp

ERC project's title: System analysis of a bio-energy plantation: full greenhouse gas balance and energy accounting (POPFULL)

ERC call: ERC Advanced grant 2008

ERC funding: € 2.5 million for five years

Links:

<http://webh01.ua.ac.be/popfull/> [11]

Exploiting the potential benefits of enzymes



This ERC-funded project focuses on enzymes - the biocatalysts that make the chemistry of life run smoothly. Enzymes perform biological tasks with high efficiency and specificity, and are extremely valuable in medical therapy or nutrition. However, a comprehensive understanding of the enzyme actions is still lacking, as well as methods to create synthetic enzyme-like biocatalysts for a variety of applications. Dr Hollfelder's research team carries out experiments to investigate the enzyme actions within droplets, a very efficient high throughput method (as opposed to the classical test tube). Since this droplet technology is more resource-efficient, it would contribute to reducing environmental impact of industrial processes. With the help of a recently awarded ERC Proof of Concept grant, the "Hollfelder Group" will aim to develop a directed protein evolution based on the droplet technology, hence making biotechnology a pillar of a sustainable future in modern societies.

Principal investigator [10]: Florian HOLLFELDER

Host institution [3]: University of Cambridge, UK

ERC Project: Exploring mechanism in chemical biology by high-throughput approaches (CHEMBIOMECH)

ERC Call: ERC Starting Grant 2007 & ERC Proof of Concept 2011

ERC Funding: € 563,848 for five years

Links:

<http://www.bio.cam.ac.uk/~fhlab/index.html> [12]

Impact of social anxieties about food on policies and businesses



Food safety and security are high priority issues for the European Union at present and are also at the core of current concerns of citizens, media and academics. With few exceptions, academic research on food has been fragmented, with too little interaction between food scientists, health researchers and social scientists. With the support of a European Research Council's Advanced Grant, Professor Peter Jackson aims to take forward previous findings regarding the socially embedded nature of contemporary food choice and to better understand contemporary consumer anxiety. The first phase of this ERC-funded project aimed at explaining the extent to which consumers' anxieties shape all points of the contemporary food systems along the supply chain ("from the farm to the fork"). This includes taking various issues into account, from international food security, domestic food hygiene to public health and doing so at a range of geographical scales, from international food markets to individual households. The "proof of concept" grant he received from the ERC in October 2011 will help Prof Jackson to go a step further in making recommendations on a wider range of topics, from quality and provenance of food, to innovations in food labelling, marketing and consumer practice (see press release). The project will test the market for these new ideas with a view to providing consultancy services to various groups (manufacturers, retailers, food service organisations and agencies) so that they are better equipped to interpret and respond to consumers' concerns about health and food safety when developing new products. It could eventually also lead to tangible effects in terms of public health, including the reduction of obesity, diabetes and coronary heart disease.

ERC grantee: Peter JACKSON

Host Institution [3]: University of Sheffield (UK)

ERC Project's title: Consumer culture in an age of anxiety: political and moral economies of food (CONANX)

ERC Call: ERC Advanced Grant 2009

ERC Funding: € 1.68 million for five years

Links:

http://www.sheffield.ac.uk/geography/staff/jackson_peter [13]

Source URL: <http://erc.europa.eu/success-stories/erc-supports-transition-global-bioeconomy>

Links:

[1] http://ec.europa.eu/research/bioeconomy/news-events/news/20120213_en.htm

[2] <http://erc.europa.eu/glossary/term/267>

[3] <http://erc.europa.eu/glossary/term/276>

[4] <http://www.nature.com/news/2011/110421/full/news.2011.255.html>

[5] <http://www.kth.se/en/che/divisions/polymer-technology/staff/senior-scientists/ann-christine-albertsson-professor-1.19627>

[6] <http://www.cmcc.it/about-cmcc/prof.-riccardo-valentini>

[7] <http://gaia.agraria.unitus.it/>

[8] <http://tnw.tudelft.nl/en/about-faculty/departments/biotechnology/people/environmental-biotechnology/profdr-msm-jetten/>

[9] <http://www.microbiology.science.ru.nl/people/mjetten/>

[10] <http://erc.europa.eu/glossary/term/317>

[11] <http://webh01.ua.ac.be/popfull/>

[12] <http://www.bio.cam.ac.uk/~fhlab/index.html>

[13] http://www.sheffield.ac.uk/geography/staff/jackson_peter