European Commission

Biotechnology 2012

An insight into ERC projects

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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 use nitrite to convert 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 CO_2 emissions to clean waste water plants for instance.

Principal Investigator: Prof. Michael Jetten

Host Institution: Radboud University Nijmegen, The Netherlands

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

ERC Call: Advanced Grant 2008

ERC Funding: €2.5 million for five years

Researcher's webpage:
http://tnw.tudelft.nl/en/about-faculty/departments/biotechnology/people/environmental-biotechnology/profdr-msm-jetten
http://www.microbiology.science.ru.nl/people/mjetten

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: Dr Florian Hollfelder

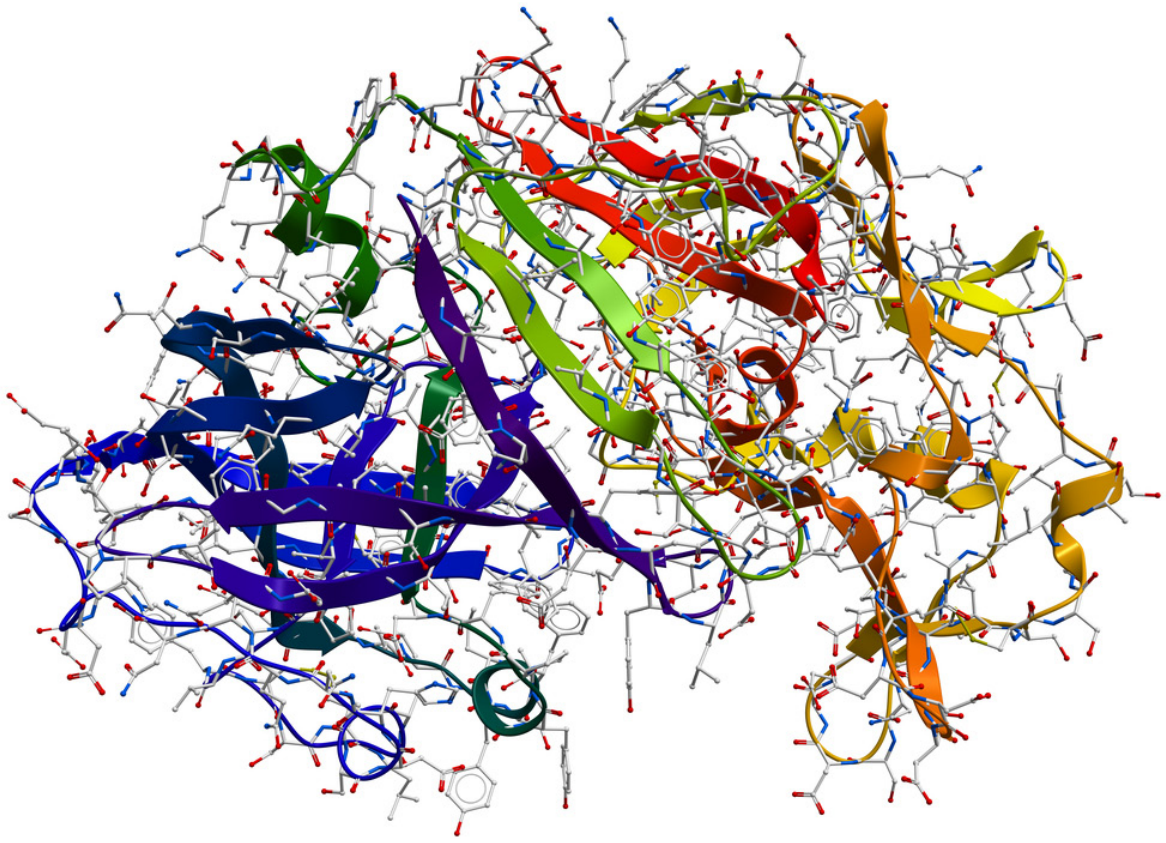
Host Institution: University of Cambridge, United Kingdom

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

ERC Call: Starting Grant 2007 & Proof of Concept 2011

ERC Funding: €563,848 for five years

Researcher's webpage:
http://www.bio.cam.ac.uk/~fhlab/index.html

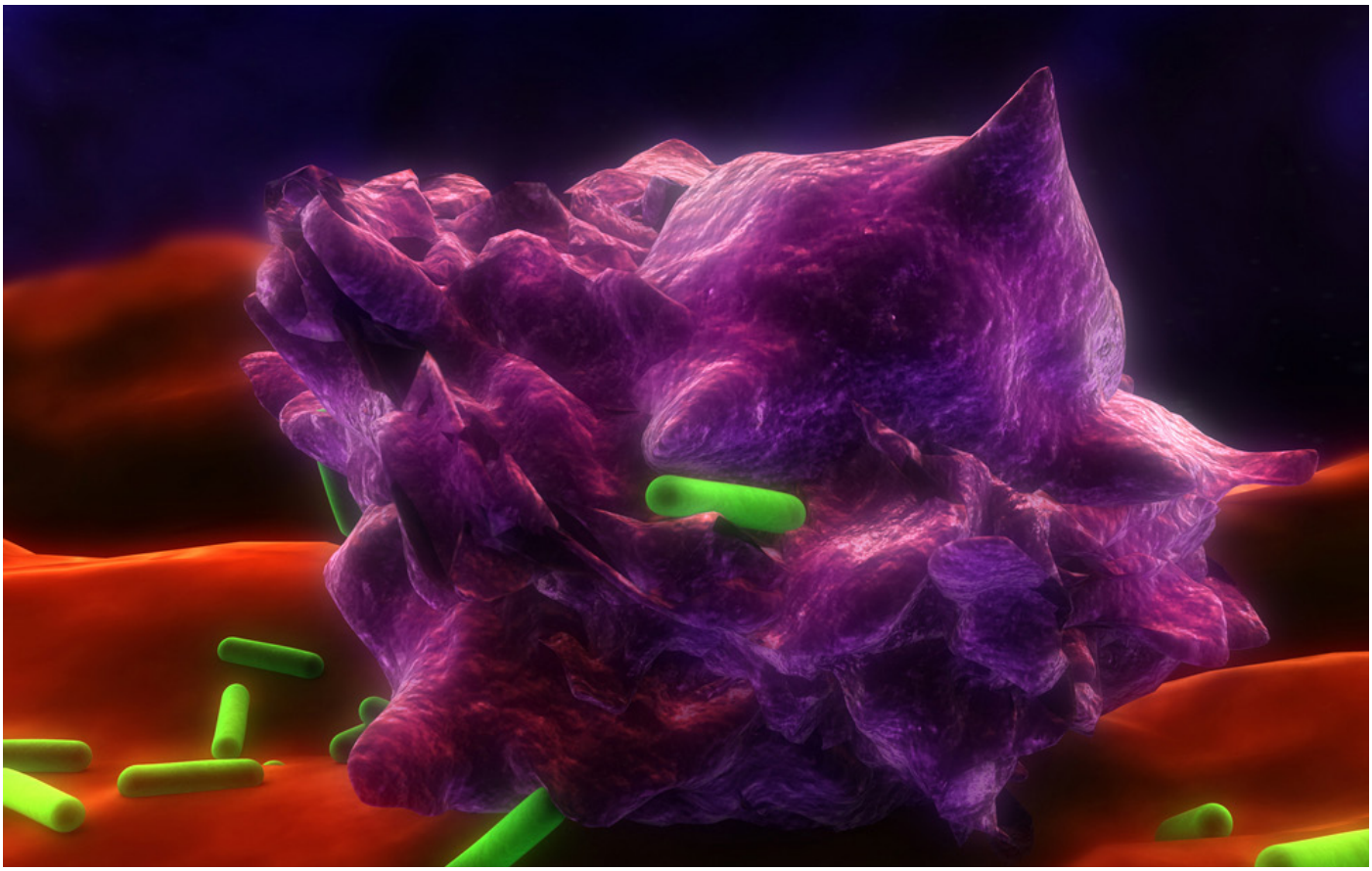


A new drug delivery system

With more than 20 years experience in biomedicine (molecular biology, protein chemistry and cell biology studies on vitamins, drugs, enzymes and haemoglobin metabolism), Søren Kragh Moestrup's laboratory has identified the haemoglobin scavenger receptor, CD163, as a molecule with a profound role in the macrophage-type immune cells. With his ERC grant, the researcher's team aims at designing novel combinatory drugs consisting of a receptor-targeting component (i.e. ligand or antibody) able to recognise the CD163 receptor of a disease-treating component (i.e. a drug molecule intended to treat inflammations, infections or malignancies). The team recently published evidence indicating that this ingenious approach would make possible the delivery of otherwise toxic or unstable drugs, such as steroids or antimicrobials to the diseased cells. This combinatory drug will be investigated for instance in monocytes/macrophages as well as in selected animal models including transgenic animals. Another side of the project consists in working on combinatory drugs to target trypanosomes, which cause the more commonly called "sleeping sickness". This "Trojan horse" principle for targeting the relevant sites of disease may have major implications for human health as of the serious obstacles still exists in many current medical treatments where serious side-effects reduce the use of otherwise efficient drugs.

Principal Investigator: Prof. Søren Kragh Moestrup
Host Institution: Aarhus Universiteit, Denmark
ERC Project: Targeting receptors of jointly assembled ligand-drug constructs (TROJA)
ERC Call: Advanced Grant 2008
ERC Funding: €2.4 million for five years

Researcher's webpage:
http://www.au.dk/en/about/uni/rektorat/newsletter/2008/35



Nanotechnology to help rebuild bodies and detect disease

Nanotechnology has the potential to transform many areas of science and engineering. Professor Molly Stevens of Imperial College is carrying out research into the areas where nanomaterials and biological systems converge. One of the fields in which she is making a big impact is tissue engineering. By mimicking the nanostructure of tissues in the body, it is possible that human organs and body parts could be made or grown in the laboratory. In particular, Prof Stevens' research has focused on growing replacement bones by using smart polymer systems.

First, the aim was to design biologically responsive peptides, which are component parts of proteins, to control the assembly and disassembly of nanostructures. By improving bio-sensing technologies for the real-time monitoring of enzymes and other bio-chemicals, this research could impact on many diseases ranging from cancer to early HIV detection.

Secondly, she sought to understand the natural biological nanostructures found in the support structures of biological tissues. By developing synthetic versions of these nanostructures, the research is making significant inroads into improved cell growth for tissue regeneration.

These new approaches could lead to clinical applications by, for example, helping large bone defects to heal. Greater understanding of cell differentiation and the interactions between cells and their surrounding support matrix is also of fundamental importance in understanding tissue development itself.

Principal Investigator: Dr Molly Stevens

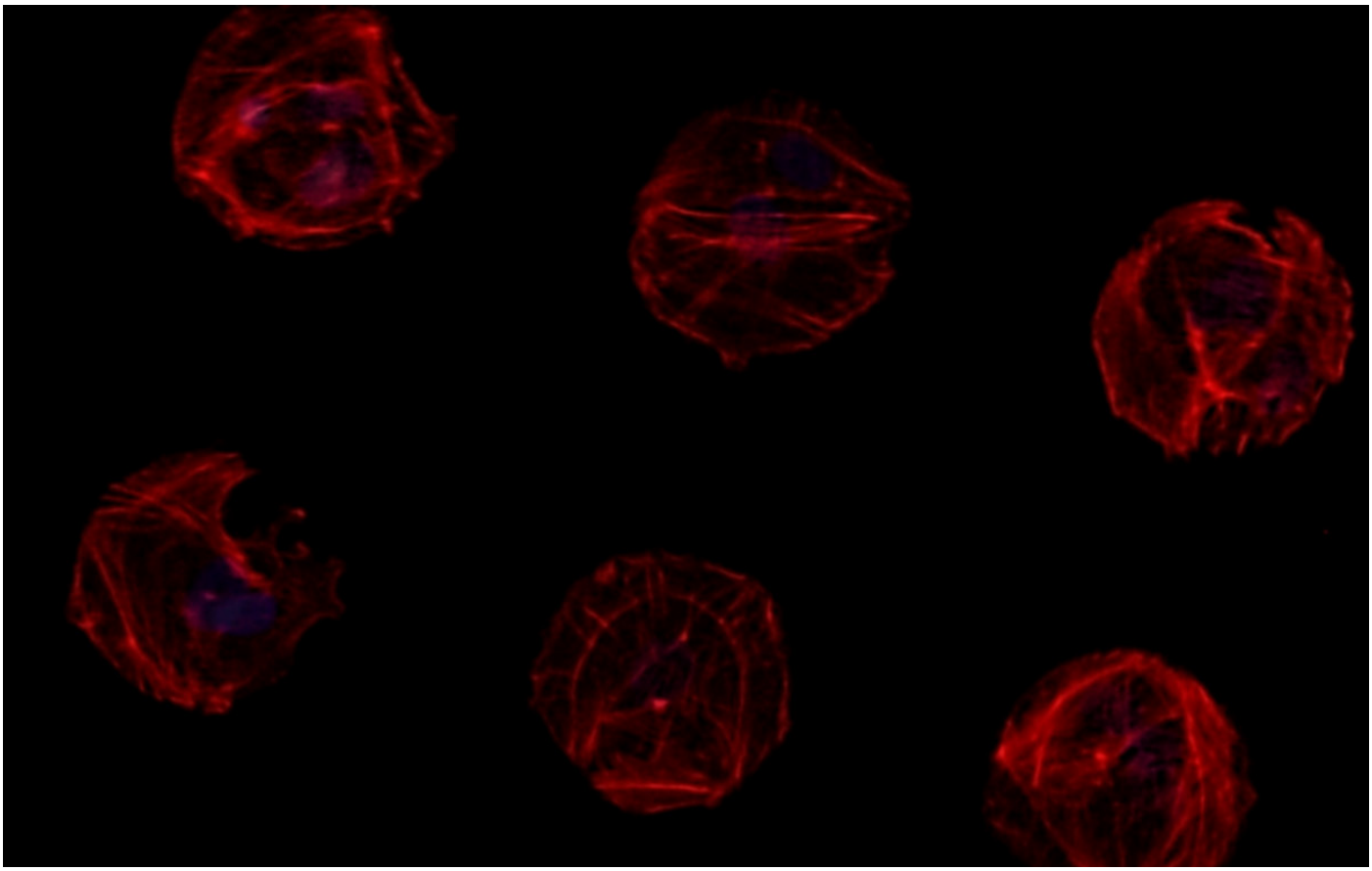
Host Institution: Imperial College London, United Kingdom

ERC Project: Bio-inspired materials for sensing and regenerative medicine (NATURALE)

ERC Call: Starting Grant 2007

ERC Funding: €1.64 million for five years

Researcher's webpage:
http://www.stevensgroup.org/research.php



Creating green chemicals and medicines with soil bacteria

Nitrogen is essential for life, in particular to synthesize DNA, RNA and proteins, the basic building blocks of plants, animals and all forms of life. ERC grantee Professor Éva Kondorosi is looking at the symbiotic relationship between legume plants and the soil bacteria known as Rhizobia, which have the ability to fix nitrogen from the air. She studies how the plant controls the number and physiology of its Rhizobia bacterial partner and whether and how this control improves the efficiency of nitrogen fixation. Nitrogen fixing symbiosis is especially efficient in protein-rich food and feed legumes like pea and alfalfa, whose root nodules host the bacteria and provide a treasure trove of antimicrobial activities resulting from the production of hundreds of plant peptides in the bacterium-infected nodule cells. The biological activity of these symbiotic plant peptides can open novel avenues of biotech applications, for instance the development of a new generation of antibiotics for medical and veterinary purposes against microbes including multiresistant pathogenic bacteria and fungi. The project also addresses challenges such as the need for higher agricultural production, enhanced food safety by applications of peptides as green chemicals for plant protection or agents against food poisoning microbes. Understanding nitrogen fixation could help in raising plant biomass production and deal with issues like food shortages and climate change.

Principal Investigator: Prof. Éva Kondorosi

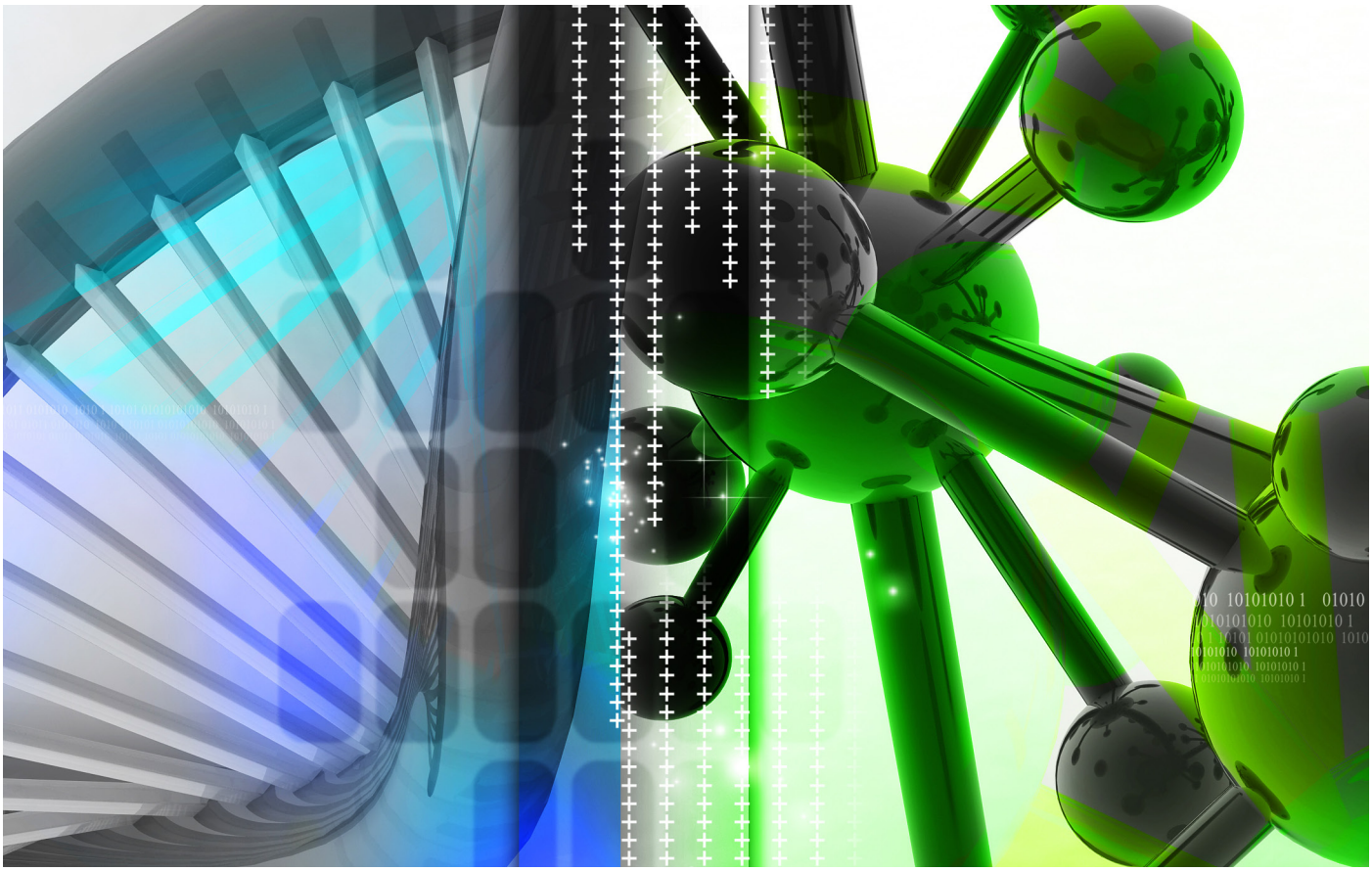
Host institution: Biological research Centre, Hungarian Academy of Sciences, Szeged, Hungary

ERC Project: Dual exploitation of natural plant strategies in agriculture and public health: enhancing nitrogen-fixation and surmounting microbial infections (SYM-BIOTICS)

ERC Call: Advanced Grant 2010

ERC funding: €2.32 million for five years

Researcher's webpage:
http://group.szbk.u-szeged.hu/kondorosie/people.html
http://www.isv.cnrs-gif.fr/isv/veranglais/research/eka/eka.html



Detecting and monitoring cancer via exhaled breath

The research team is developing a low cost, non-invasive diagnostic method for lung, breast, colon and other types of cancer based on breath testing. The person exhales for a few minutes into the device, which analyses the sample with an array of nano sensors. Such breath tests could indicate not only the stage and subtype of the cancer but could also contribute to monitoring the response to treatment. This approach could not only reduce health budgets through low-cost and earlier proposed tests but it would also in return lead to more cost-effective cancer treatments.

Principal Investigator: Dr Haick Hossam

Host institution: TECHNION - Israel Institute of Technology

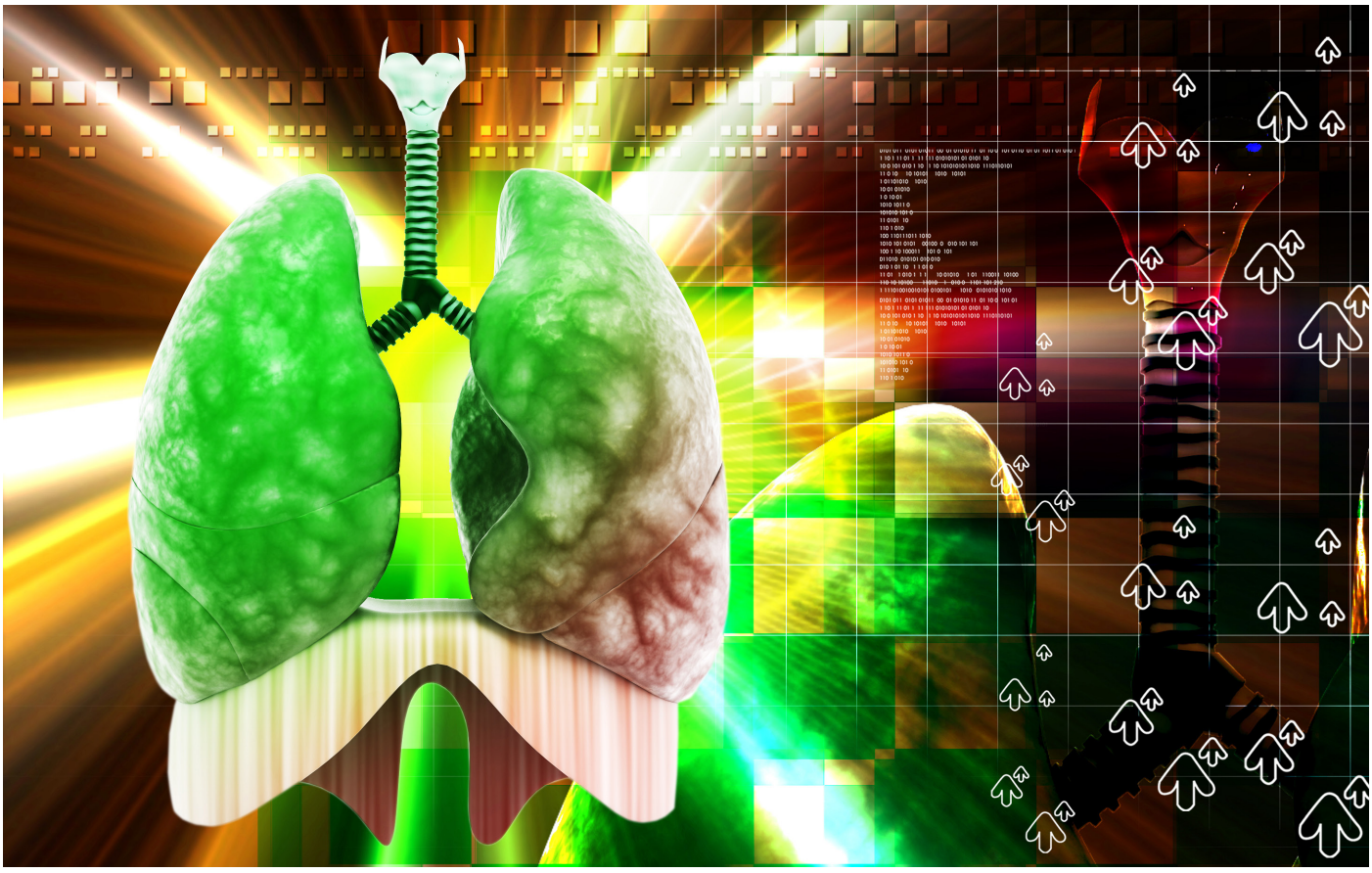
ERC Project: Diagnosis, Screening and Monitoring of Cancer Diseases via Exhaled Breath Using an Array of Nanosensors (DIAG-CANCER)

ERC Call: Starting Grant 2010

ERC funding: €1.2 million for five years

Researcher's webpage:
http://lnbd.technion.ac.il

Video:
http://www.youtube.com/watch?v=b47phYuNVf4



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Prof Helga Nowotny
ERC President and Chair of its Scientific Council

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