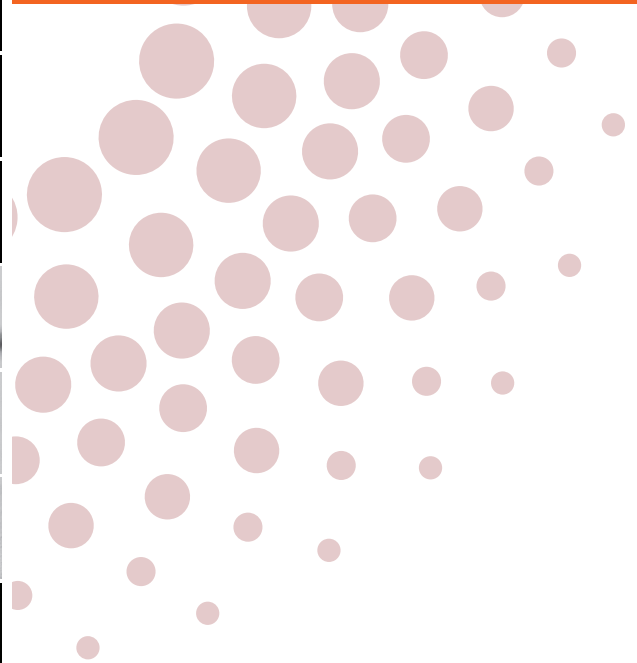


Spotlight

on ERC projects in
Central and Eastern Europe

June 2013



European Research Council
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<http://erc.europa.eu>

The background of the page is a black and white photograph of a highly ornate wooden door. The door features intricate carvings, including a large central panel with a decorative border and a central floral motif. The carvings are detailed and appear to be made of a dark wood. The door is set within a frame that also has decorative elements. The overall style is classical or Baroque.

Central and Eastern Europe: a hub for scientific excellence

Famous names like Nicolaus Copernic, Sigmund Freud or Szent-Györgyi Nagyrápolyi Albert have populated the history of sciences in Central and Eastern Europe for years.

The European Research Council (ERC) today continues to believe that excellence in science may be found anywhere. However, the number of grants awarded to researchers in Central and Eastern Europe remains relatively low.

The ERC has recently engaged in a campaign to encourage a broader participation in its funding calls, with a view to increase the number of successful applicants from this region. It also called for national research systems to invest in science and to champion excellence in science.

With its grants, the ERC supports the very best scientists of any nationality and any age who wish to pursue their frontier research in Europe. It nurtures the most brilliant ideas on the basis of scientific excellence.

In this brochure, the ERC presents several examples of excellent research conducted in Central and Eastern Europe. The projects featured address various challenges: from discovering novel types of antibiotics, developing innovative biochips that detect diseases or new techniques for weather predictability, to decoding the attitudes of citizens towards public goods.

Sweet solutions for detecting disease

Dr Ján Tkáč and his team are developing weapons to fight viruses, harmful bacteria and cell-related diseases with new detection technologies. Based at the Institute of Chemistry in the Slovak Academy of Sciences, Dr Tkáč's research combines glycomics – the study of sugars in organisms – with biochip sensors based on nanoparticles and nanotubes.

Glycans are sugar molecules that carry the information human cells need to stay healthy and fight infections. They are a vital early-warning system for triggering an organism's natural defensive systems at the first sign of attack. In the ELENA project, Ján Tkáč's team is developing innovative biochips that can detect changes in 'glycosylation', of glycans attached to a protein or other organic molecules, and which can indicate diseases such as cancer. A typical biochip starts with a gold-plated glass substrate. Nanoparticles are then deposited on to the gold surface, followed by a layer of lectin (a glycan recognising protein). Finally, a layer of glycoprotein is deposited over the lectin after incubation with a sample. Interactions between the lectin and glycoprotein layers can then be detected by changes in the electrical resistivity of the biochip assembly. The research team has hopes to make the measurements and diagnoses of diseases faster and more sensitive but also more accurate.



By courtesy of J. Tkáč

ERC grantee: Dr Ján Tkáč

Host institution: Institute of Chemistry, Slovak Academy of Sciences, Slovakia

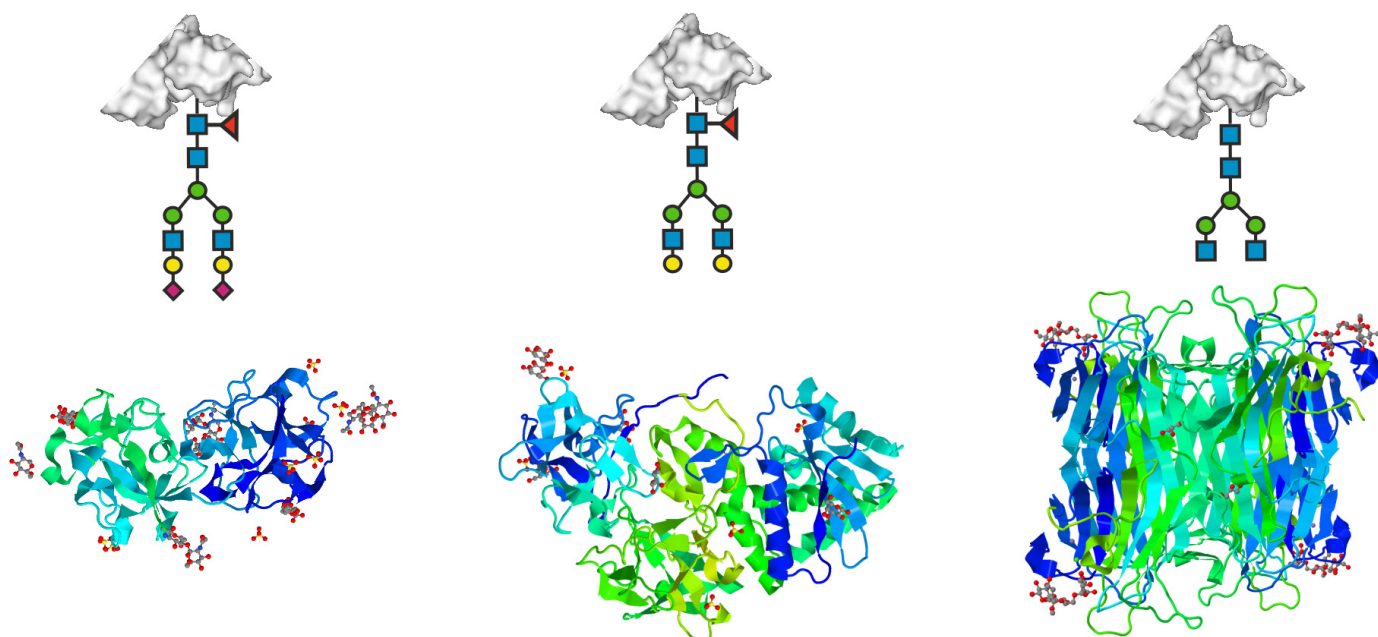
Project: Electrochemical Lectin and glycan biochips integrated with Nanostructures (ELENA)

ERC call: Starting grant 2012

ERC funding: €1.16 million for five years

Links:

[Ján Tkáč's webpage](#)



Changes in the composition of a glycan attached to the protein backbone (in white-grey) detected by three different lectins (glycan recognising proteins shown in color).

Public goods through private eyes

At crossroads between politics, economics, psychology and sociology, Dr Natalia Letki and her team examine the attitudes that citizens in post-communist countries hold towards public goods and common pool resources such as healthcare, education, security or clean air. They also explore a range of factors determining the willingness of citizens to contribute to producing such goods directly or through taxes. In order to analyse the social mechanisms behind maintaining and encouraging cooperation between citizens, as well as between the State and citizens, the team carries out a cross-national survey on the determinants of the public's attitudes and behaviour towards public goods. These data will be combined with a wider range of indicators, related to institutional design, social changes, political and economic reform, as well as historical legacies in post-communist Central and Eastern Europe. The research indicates that people from post-communist countries are less aware of the link that exists between their contributions towards public goods and the returns they get from the State. Also, in comparison to Western countries, there is a very strong legacy of hostility towards the State. Dr Letki expects to draw policy recommendations to find different ways to further engage people in production and maintenance of public goods and common pool resources.



© Jan Grabek

ERC grantee: Dr Natalia Letki

Host institution: University of Warsaw, Poland

Project: Public Goods through Private Eyes (PGPE)

ERC call: Starting grant 2009

ERC funding: €1.7 million for five years

Links:

[Project website](#) - [Interview of Natalia Letki in the ERC ideas newsletter](#)



© Natalia Letki

Explaining the unexpected: how communism fell in Eastern Europe

Fascinated by the history of late communism, Prof. Ivaylo Znepolski focuses his research on individual and collective motivations to explain how democratic change became possible in Eastern Europe from 1956 to 1989.

By analysing the motives and behaviour of individuals and groups, Prof. Znepolski wants to identify the key factors behind the social and political changes that took place in Eastern Europe till the fall of the Berlin Wall. The research shows that individual and community ways kept changing in literature, arts, or in the work carried out by associations, while regimes persistently held on to the same guiding principles. Prof. Ivaylo Znepolski's team believes that the concept of "incidents", which describes events that cannot be predicted and that were often sanctioned by the authorities, is a promising element to explain how communist regimes really functioned during this period of time. Through his research, he wishes to offer young generations a renewed appreciation of the history of Eastern Europe.

By courtesy of I. Znepolski



ERC grantee: Prof. Ivaylo Znepolski

Host institution: Sofia University Sveti Kliment Ohridski, Bulgaria

Project: Regime and Society in Eastern Europe (1956 - 1989). From Extended Reproduction to Social and Political Change (RESOCEA)

ERC call: Advanced grant 2010

ERC funding: €1 million for five years

Links:

[Project website](#) - [Interview of Ivaylo Znepolski in the ERC ideas newsletter](#)



A better chance of predicting weather

Meteorologists have been tracking the course of hurricanes or tropical storms for years, with a view to improving weather analyses and forecasts. Much of the time, the atmosphere is in a nearly balanced state, i.e. it is continuously working against non-homogeneously distributed forces to return to a balanced state. In the tropics, this balance can hardly be maintained, due to significant dynamics which occur vertically, as described by the so-called "inertio-gravity" (IG) motions. In her ERC project, Prof. Zagar studies the role of IG circulation in the global atmospheric balance and the global energy distribution. She has hopes to better quantify the role of IG motions in the atmospheric predictability. In this way, she expects to improve the way atmospheric temperature and wind data is analysed. To conduct this project, she will develop a specific software package. Her project could lead to a better understanding of the fundamental atmospheric processes for weather and climate prediction, and the results could help to improve the planning of economic activities such as in the energy sector.



By courtesy of N. Zagar

ERC grantee: Prof. Nedjeljka Zagar

Host institution: University of Ljubljana, Slovenia

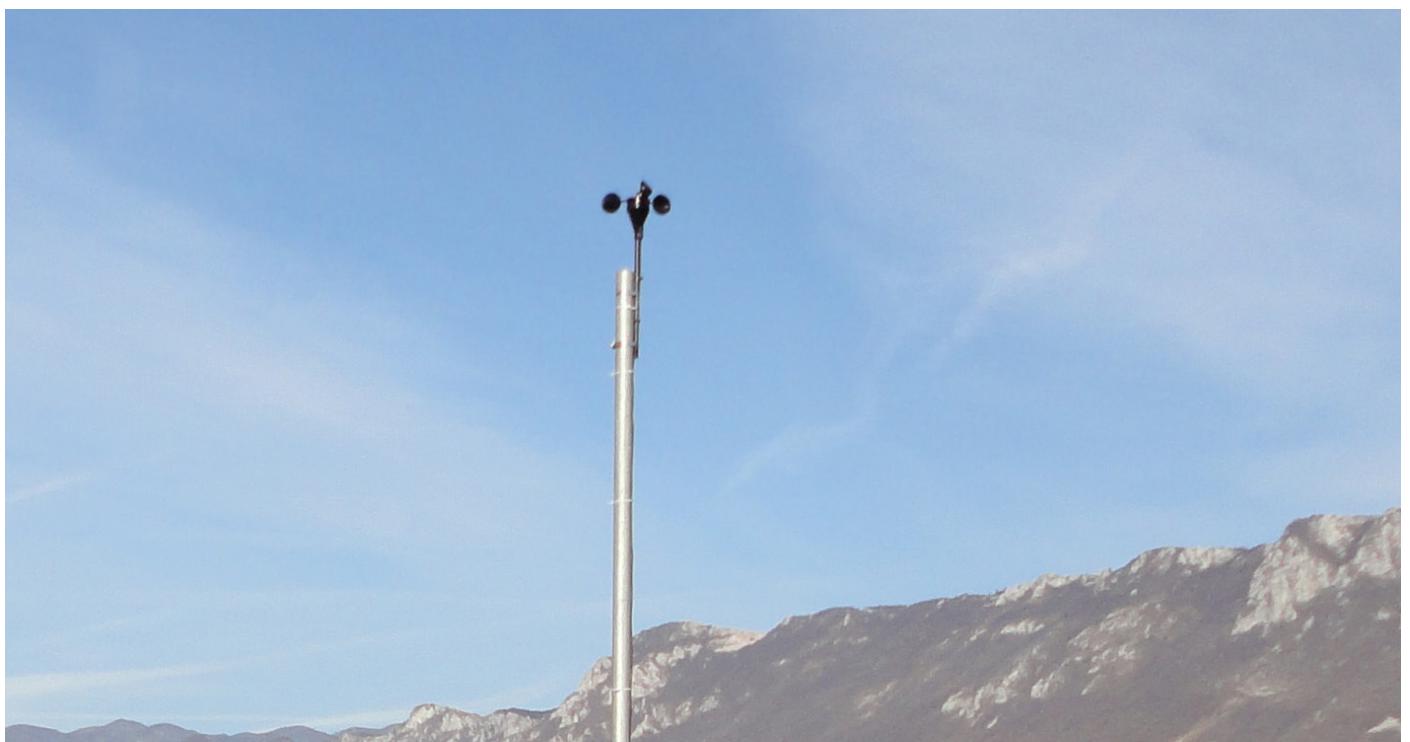
Project: Modal Analysis of Atmospheric Balance, Predictability and Climate (MODES)

ERC call: Starting grant 2011

ERC funding: €500,000 for four years

Links:

[ERC story](#)



Meteorological device to take wind measurements (anemometer)

By courtesy of N. Zagar

Analysing the mechanisms of DNA repair

The recipe for every living organism is stored in its DNA. This chemical compound can suffer damages. DNA damage occurs spontaneously or is induced by factors such as ultraviolet light, radiation or heat. When the genetic material of a cell is disturbed, there are mutations that can lead to the formation of tumours. To ensure genetic stability, the chemical damage of DNA must be corrected and one of the main pathways to achieve this repair is nucleotide excision repair (NER). The damage is first located, its presence is verified and two cuts occur on both sides of the lesion. The resulting DNA fragment is removed, the gap is filled by a DNA specific enzyme and sealed by a ligase (an enzyme that joins DNA fragments). The unique feature of NER is its ability to correct a wide spectrum of DNA modifications of different sizes and chemical structures. The aim of Prof. Marcin Nowotny's project is to better understand the mechanisms involved in NER. His research has great relevance for genomics, and indirectly, for human diseases like cancer. Cancer cells are very often unable to repair DNA. Exploring these processes is very important for developing new drugs or therapies to treat such diseases.

By courtesy of M. Nowotny



ERC grantee: Prof. Marcin Nowotny

Host institution: International Institute of Molecular and Cell Biology, Warsaw, Poland

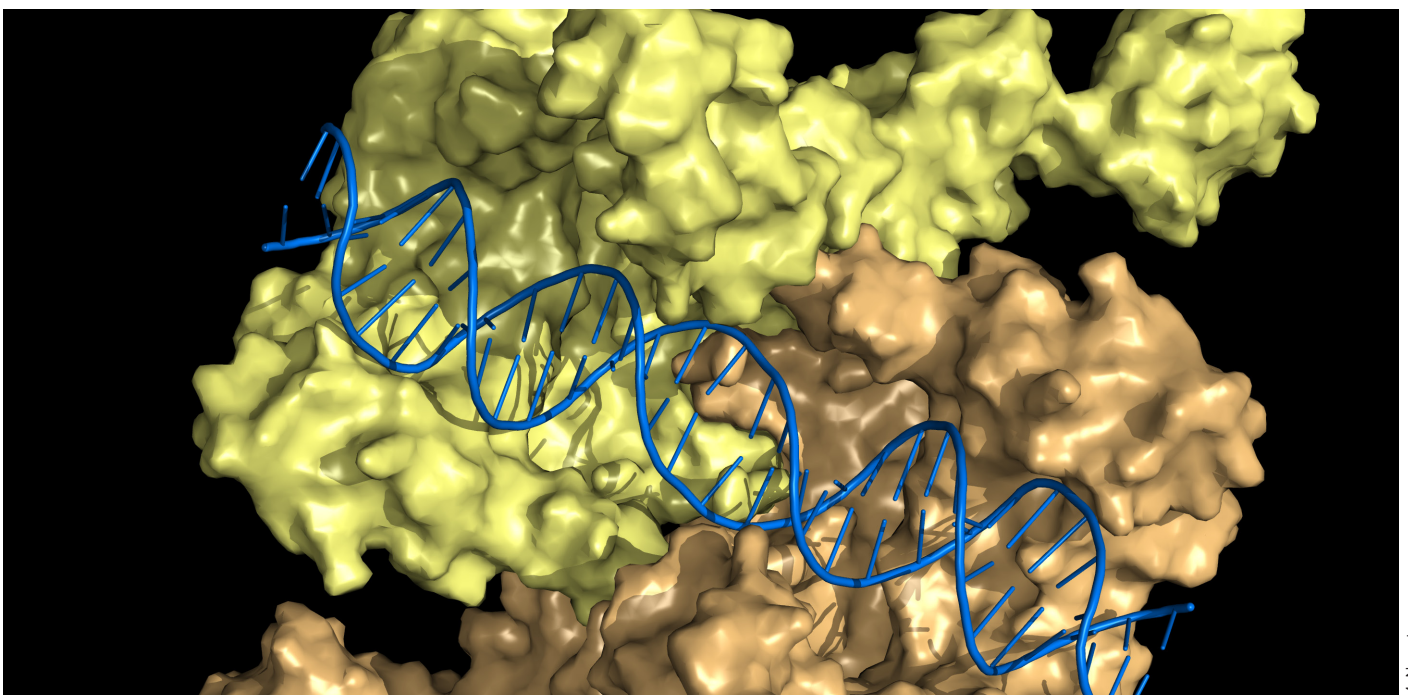
Project: Structural studies of Nucleotide Excision Repair complexes (NERCOMP)

ERC call: Starting grant 2011

ERC funding: €1.5 million for five years

Links:

[Marcin Nowotny's webpage](#) - [Article on Marcin Nowotny's project](#) - [ERC video featuring Prof. Marcin Nowotny](#)



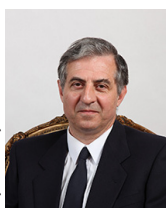
A molecule of UvrA protein (yellow and orange) interacting with a fragment of damaged DNA (blue) as determined by X-ray crystallography. UvrA is a bacterial sensor of DNA damage. This molecular structure has been determined by the group of Prof. Marcin Nowotny and illustrates how the mechanism of DNA repair can be visualized and understood at the level of single molecules.

By courtesy of M. Nowotny

The secrets of prime numbers

A prime is a number greater than 1 that has no positive divisors other than 1 and itself (such as 2, 3, 5, 7, 11, 13, 17, 19, 23 etc). Primes are a fundamental concept in mathematics. They seem to be random, although they are in fact determinate. For centuries, mathematicians have spotted patterns, made conjectures, and then (tentatively) proved them. For instance, the question of whether there is an infinite number of twin prime pairs (primes that differ from each other by 2, e.g 41 and 43) is probably the oldest unsolved problem in mathematics (twin prime conjecture). In the last decade, two important breakthroughs have revolutionised the theory of primes: the discovery of the existence of arbitrarily long arithmetic progressions of primes and the discovery of unusually small gaps between consecutive primes. Prof. Pintz's project analyses patterns in primes by combining these two recent theories. One of the main problems he is trying to solve is whether there are infinitely many bounded gaps between primes (bounded gap conjecture).

By courtesy of J. Pintz



ERC grantee: Prof. János Pintz

Host institution: Alfred Renyi Institute of Mathematics, Hungarian Academy of Sciences, Hungary

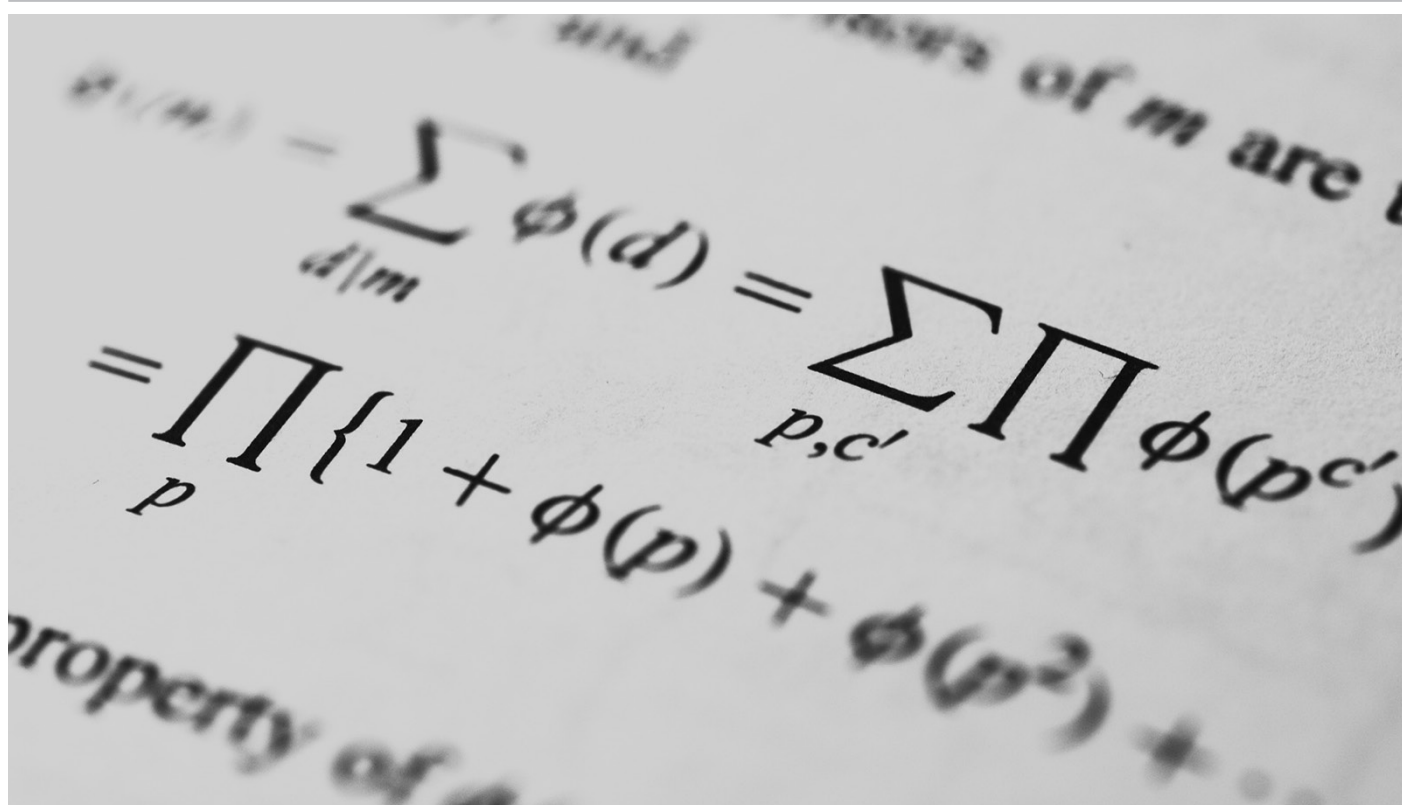
Project: Gaps between primes and almost primes. Patterns in primes and almost primes. Approximations to the twin prime and Goldbach conjectures (PRIMEGAPS)

ERC call: Advanced grant 2008

ERC funding: €1.4 million for five years

Links:

[János Pintz's webpage](#) - [János Pintz's project on Cordis](#)



Towards new antibiotics

Food safety, increasing demand for agricultural products, as well as the alarming rise of antibiotic resistant bacteria are some of the main challenges of this century. The research carried out by Prof. Eva Kondorosi from the Biological Research Centre of the Hungarian Academy of Sciences is likely to bring new perspectives to control bacteria in the food industry and medicine. Her research uses the Rhizobium-legume symbiosis as model system which results in the formation of a symbiotic organ, the root nodules, where bacteria invade the plant cells and gain the capacity for nitrogen fixation and support plant growth by supplying the host with reduced nitrogen (ammonia). Her group demonstrated that bacteria in Medicago (alfalfa and related legumes) nodules undergo a remarkable terminal differentiation process that is mediated by hundreds of symbiotic plant peptides produced exclusively in the nodule cells. The biological function of these peptides needs to be discovered but many of them have antimicrobial activities. Her research team investigates the peptide activities in symbiosis and *ex planta* on different microbes and model organisms. Natural plant peptides with potent antimicrobial activities are promising candidates for novel types of antibiotics. They could be used also as green chemicals for plant protection and in food industry, for example for the decontamination of meat samples (e.g. eliminating *Listeria* and *Salmonella* contamination).



By courtesy of E. Kondorosi

ERC grantee: Prof. Eva Kondorosi

Host institution: Biological Research Centre of the Hungarian Academy of Sciences, Hungary

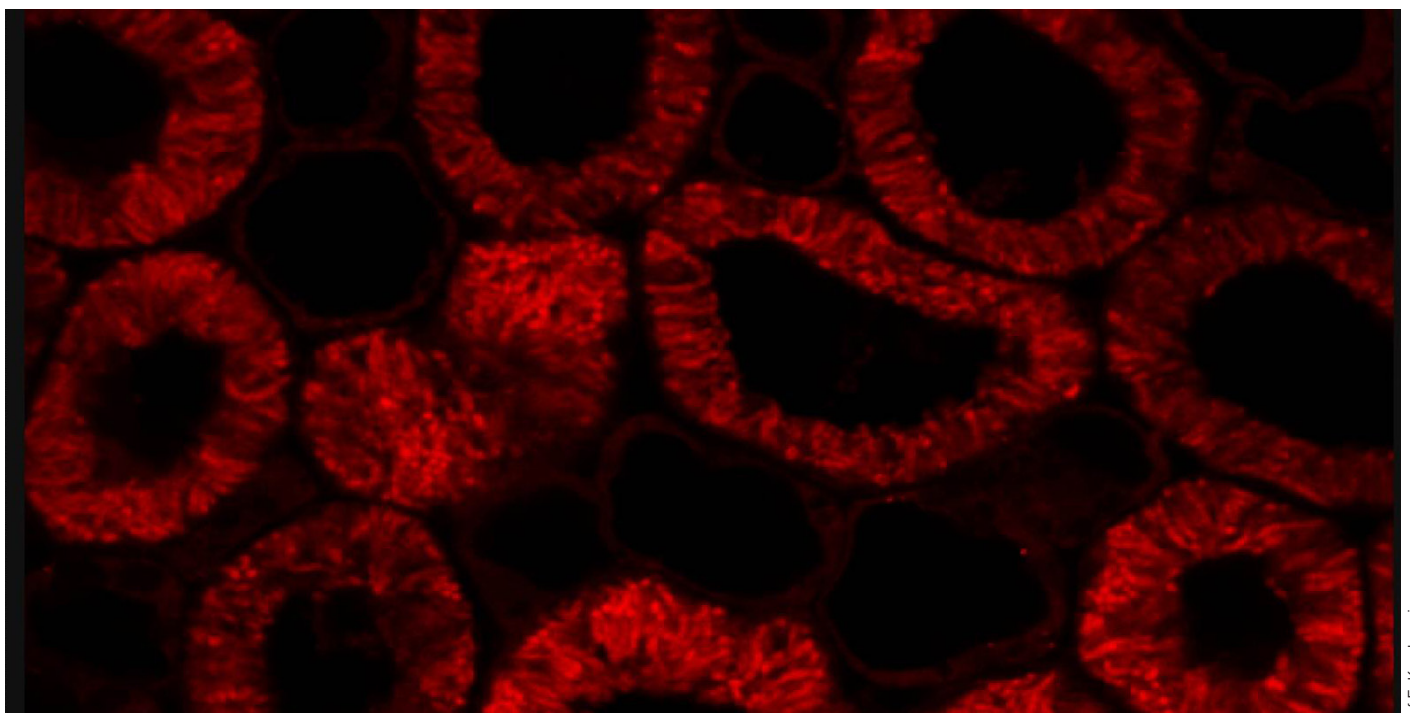
Project: Dual exploitation of natural plant strategies in agriculture and public health: enhancing nitrogen-fixation and surmounting microbial infections (SYM-BIOTICS)

ERC call: Advanced grant 2010

ERC funding: €2.3 million for five years

Links:

[CV - Research centre](#)



Differentiated symbiotic cells in Medicago root nodule contain several ten thousands of nitrogen fixing bacteria. Red color marks an NCR peptide that colocalizes with the bacteria.

By courtesy of E. Kondorosi

The new generation of microscopic robots

Toxic spills can be devastating to humans, animals and to the ecosystem. Prof. Štěpánek's project has successfully created the first prototypes of chemical robots that could serve for "Intelligent Cleaning". These "chobots" are about tens of micrometers so they can get to the tiniest places. They could be used for different purposes, for instance to seek out a source of contamination and neutralise it in toxic waters, to identify chemicals or cancerous cells in the human body. Robots may even be able to deliver the exact amount of drug directly to the right place without harming any other cells, as is the case in the current cancer treatments. With a truly visionary angle, Prof. Štěpánek's project covers many scientific fields, ranging from chemical engineering, material engineering, biophysics, microbiology to applied mathematics for computer simulation.

© Ladislav Hovorka, 2011



ERC grantee: Prof. František Štěpánek

Host institution: Institute of Chemical Technology, Prague, Czech Republic

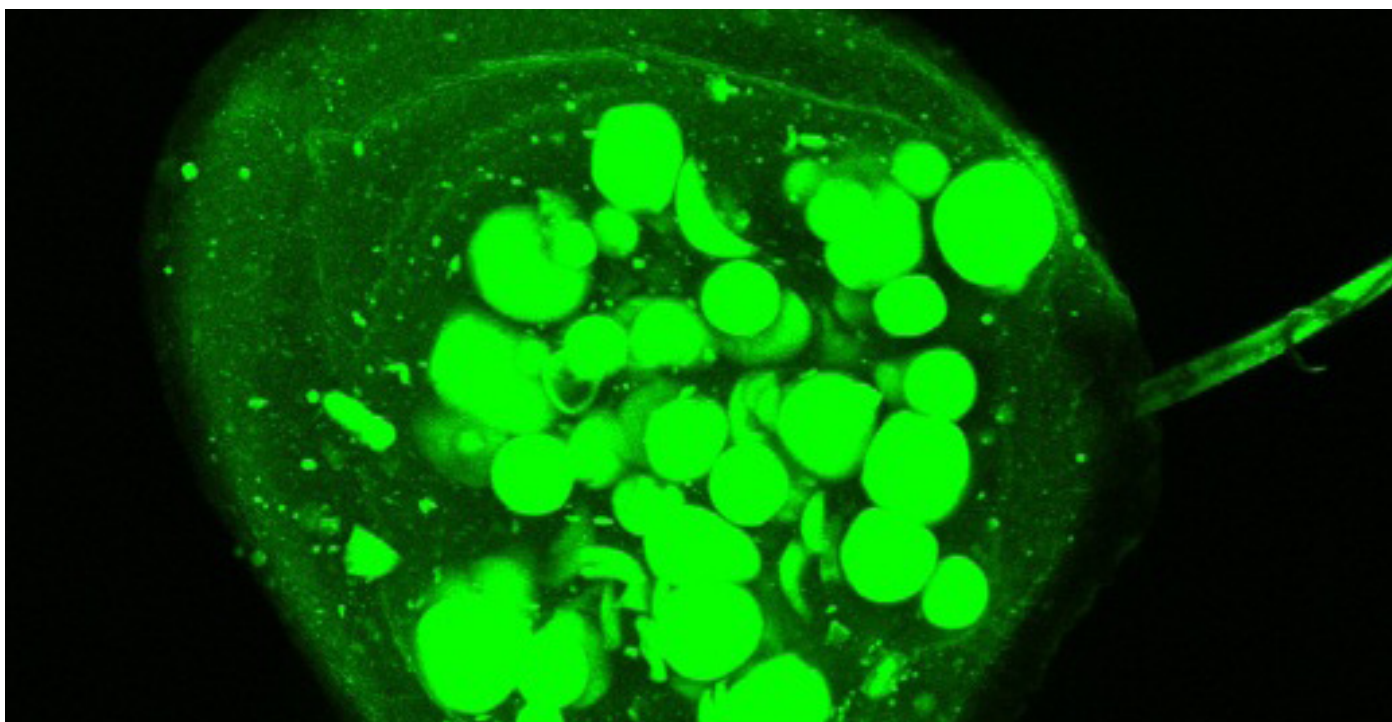
Project: Chemical Processing by Swarm Robotics (CHOBOTIX)

ERC call: Starting grant 2007

ERC funding: €1.6 million for five years

Links:

[ERC story and video on the project](#)



This picture shows confocal microscopy images of the bodies of the chemical robots with internal reservoirs for chemical reagents, which are fluorescently labelled for better visibility. These are based on silicon dioxide and embedded in a calcium alginate hydrogel.

By courtesy of F. Štěpánek

Long-lasting vaccines

Vaccination has already resulted in the complete control of many devastating infectious diseases. However, there are a large number of pathogens, such as HIV and influenza viruses, for which even immunity induced by natural infection does not fully protect against re-infection and disease. Therefore, there is a strong need for vaccines which offer superior protection compared to the one following natural infection. Dr Stipan Jonjic and his research team are using highly attenuated cytomegalovirus as a vaccine vector. They are engineering it to express cellular ligand for an important immune receptor, NKG2D, and certain parts (antigens) of pathogens that are recognized by CD8 T lymphocytes. CD8 T cells are major killers in the immune system, capable of memorising pathogens so that every subsequent reinfection with the same or similar pathogen is quickly resolved. The role of CD8 T lymphocytes is therefore crucial in many infections. The team expects that their results will improve the development of new vaccines.



By courtesy of S. Jonjic

ERC grantee: Prof. Stipan Jonjic

Host institution: Faculty of Medicine, University of Rijeka, Croatia

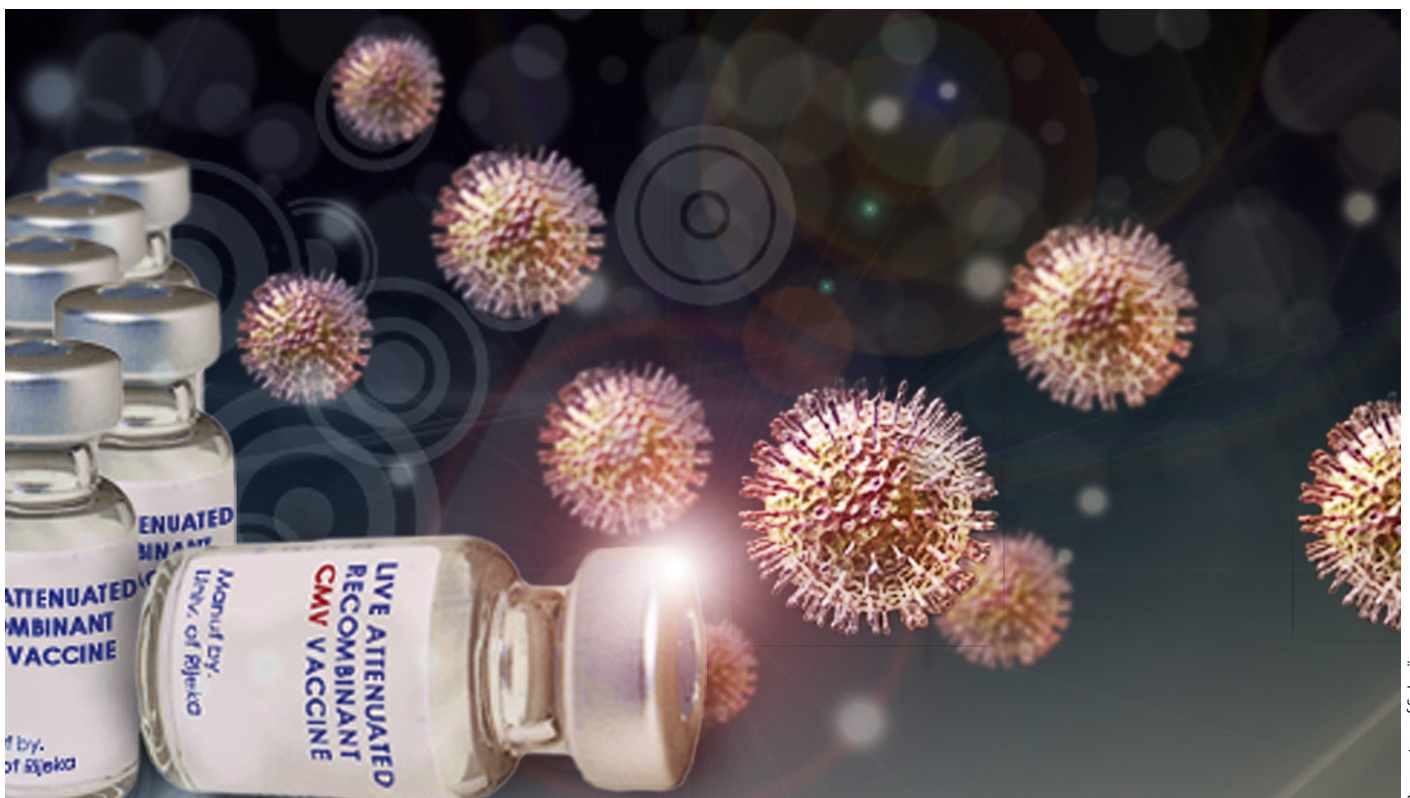
Project: Strengthening adaptive immunity via innate immunity: enhancing the CD8 T cell response by using the NKG2D ligand expressed in a herpesvirus vector (StAdvInn)

ERC call: Advanced grant 2012

ERC funding: €1.7 million for five years

Links:

[Stipan Jonjic's webpage](#)



By courtesy of S. Jonjic

“One of my aspirations is that young scientists from Central and Eastern Europe further explore the possibilities for funding offered by the ERC. Some measures need to be taken so that the pool of high calibre researchers present in this region is encouraged to successfully apply for ERC grants. That is essential to build a truly European culture of competition in science.”

Prof. Helga Nowotny
ERC President and Chair of its Scientific Council



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