

European Research Council

A European Champions League for Research

ERC Starting Grants: First Swiss Success Stories

The European Research Council (ERC) is the first pan-European funding agency for frontier research. It is implemented through the European Union's Seventh Framework Programme for Research and Technological Development (FP7), in which Switzerland is fully involved as an associated country. It supports individual investigators in all disciplines and fosters excellent basic research at the frontiers of knowledge.

The ERC Starting Independent Researcher Grant supports starting researchers embarking on an independent career and establishing or consolidating their own research team. A call for Starting Independent Researcher Grants is issued every summer. The ERC Advanced Investigator Grant supports established top researchers at all career stages. A call for Advanced Investigator Grants is issued every autumn. Both types of grants are awarded through open competition to projects headed by starting or established researchers, irrespective of their origins, who are work-

ing or moving to work in Europe – the sole criterion for selection is scientific excellence.

In the first ERC Starting Grant call in 2007 around 300 grants were awarded to promising top scientists in Europe, out of 9,000 proposals. 15 of these grantees are performing their research in Switzerland, including one researcher at CERN, Geneva. Switzerland was thus one of the most successful host countries for top researchers: it ranked 2nd in terms of number of grantees per inhabitants, and 3rd in terms of number of grantees relative to the researcher population.

The Swiss National Science Foundation, the largest research funding organisation in Switzerland, and Euresearch, the Swiss information network for European Research, would like to congratulate the grantees on this great success.

Who are the grantees working in Switzerland? What is their research about? Let them introduce themselves and guide you to the frontiers of knowledge!

Growth Control by the TOR Signalling Network



Robbie Loewith:
 "Our ultimate goal is to understand how cell, organ and organism growth is regulated."

Why do cancer cells grow uncontrollably while normal, untransformed cells remain quiescent?

Short Project Summary

We now know that the Target Of Rapamycin (TOR) kinases lie at the heart of these fascinating questions. TORs reside in two distinct multi-protein complexes: TOR Complex 1 (TORC1), and TORC2. These two complexes are conserved among eukaryotes and function in signalling pathways that regulate different aspects of cell growth. By exploiting the facile genetics of the model eukaryote *Saccharomyces cerevisiae*, my lab aims to flesh out details of the TOR signalling network with the ultimate goal of understanding how cell, organ and organism growth is regulated. Additionally, given the conservation of the TOR complexes and their clinical importance, especially in oncology, we will also employ an innovative high throughput screen to identify novel drug-like compounds that inhibit yeast and mammalian TORC1 and TORC2.

Coherence of Spins in Semiconductor Nanostructures



Dominik Zumbühl:
 "Quantum mechanics is the overarching theory of our world. A century after its discovery, the time is ripe to try to harness quantum physics for performing computations."

How can we use individual electron spins in nanostructures for quantum computation?

Short Project Summary

Macroscopic control of quantum states is a major theme in much of modern physics because quantum coherence enables study of fundamental physics and has promising applications for quantum information processing. The potential significance of quantum computing is now recognized well beyond the physics community. For electron spins in GaAs quantum dots, it has become clear that decoherence caused by interactions with the host nuclear spins is a major challenge. We will investigate and aim to reduce nuclear spin induced decoherence. Further, the exciting combination of interacting electron and nuclear spin physics gives ample incentive to strive for sub-Millikelvin temperatures in nanostructures. We propose to build a novel refrigerator aiming to reach unprecedented low temperatures in semiconductor nanostructures. This interdisciplinary project combines Microkelvin with nanophysics and could be the beginning of a new era of coherent spin physics with unprecedented quantum control.

Information on the Principal Investigator (PI)

Name
 Prof. Dr. Robbie Loewith

Date of Birth
 20 July 1972

Nationality
 Canadian

Host Institution
 University of Geneva,
 Department
 of Molecular Biology,
www.molbio.unige.ch

Information on the ERC Project

Title of Project
 Growth control by
 the TOR signalling
 network

Acronym
 TOR signalling

Budget
 965,500 €

Duration of Project
 5 years

Information on the Principal Investigator (PI)

Name
 Prof. Dr. Dominik Zumbühl

Date of Birth
 15 January 1974

Nationality
 Swiss

Host Institution
 University of Basel,
 Department of Physics,
<http://physik.unibas.ch>

Information on the ERC Project

Title of Project
 Coherence of Spins
 in Semiconductor
 Nanostructures

Acronym
 COSPENA

Budget
 1,377,000 €

Duration of Project
 5 years

Plasticity of the Empathic Brain

The Genetic Basis of Animal Diversity

Tania Singer:

"In today's world, acquiring the capacity to effectively enhance empathy and prosocial behaviour is of the utmost importance."



Walter Salzburger:

"150 years after Charles Darwin it is high time that we understood the processes that lead to the emergence of new species."



What impact does empathy training have on the behaviour and the cortex of individuals?

Short Project Summary

Despite neuroscientists' advances in plasticity and empathy research, little is known about cortical and behavioural plasticity in emotional understanding and empathy. In this project we will investigate the malleability of empathy via training. Studies 1-3 will look at differences in the brains of individuals scoring high versus low on empathy (psychopaths, alexithymics, therapists). In study 4, participants will learn to self-regulate brain activity through immediate feedback from emotion-related brain areas while practising certain mental techniques. In Study 5, healthy individuals will receive extensive training in empathy-enhancing techniques. We will measure training-related changes in brain structure and functioning, in hormone levels, and in prosocial and economic behaviour. This project should have implications for the development of effective training programmes for schools, economic and political organizations and for the treatment of patients with marked social deficits.

What are the external factors that promote the evolution of new species?

Short Project Summary

The identification of the processes that lead to the emergence of new species remains a fundamental question to biology. Despite recent advances in evolutionary and developmental biology, the molecular mechanisms underlying diversification, adaptation and evolutionary innovation remain largely unknown. The exceptionally diverse species of cichlid fishes in the East African Great Lakes are excellent model systems for studying the genetic basis of biodiversity. East Africa's endemic cichlid species differ greatly in ecologically relevant, hence naturally selected, characteristics such as mouth morphology, but also in sexually selected traits such as coloration. In the framework of my ERC Starting Grant I will study the genetic basis of certain characteristics that appear to be responsible for the evolutionary success of the cichlid fishes, with particular emphasis on features that evolved in parallel in independent cichlid radiations.

Information on the Principal Investigator (PI)

Name
Prof. Dr. Tania Singer

Date of Birth
8 December 1969

Nationality
German and French

Host Institution
University of Zurich,
Centre for the Study
of Social and Neural Systems,
www.socialbehavior.uzh.ch

Information on the ERC Project

Title of Project
Plasticity of the empathic brain:
Structural and functional MRI
studies on the effect of empathy
training on the human brain and
prosocial behaviour

Acronym
EMPATHICBRAIN

Budget
1,500,000 €

Duration of Project
5 years

Information on the Principal Investigator (PI)

Name
Prof. Dr. Walter Salzburger

Date of Birth
1 January 1975

Nationality
Austrian

Host Institution
University of Basel,
Zoological Institute,
www.evolution.unibas.ch

Information on the ERC Project

Title of Project
The interaction and the genetic
basis of naturally versus sexually
selected traits in the adaptive
radiations of cichlid fishes

Acronym
INTERGENADAPT

Budget
750,000 €

Duration of Project
5 years

The Role of Lymphatic Vessels in Dendritic Cell Homing and Maturation



Melody Swartz:
 "Elucidating the initial steps in adaptive immunity is ultimately important for developing immunotherapeutic strategies."

How do lymphatic vessels actively regulate the adaptive immune response ?

Short Project Summary

Dendritic cell (DC) homing from the periphery to lymph nodes is a critical first event in the immune response, yet the mechanisms of DC migration towards, and entry into, lymphatics are still poorly understood; this severely limits new therapeutic strategies for immunomodulation. We propose a battery of physiological, cell-biological, molecular, and computational studies to determine both the mechanisms of DC homing to lymphatic vessels and how DCs modulate lymphatic function. We approach this from the perspectives of both the DC and the lymphatic vessel. Regarding the DC, we will examine how draining flows toward the lymphatic alter their migration tactics. Regarding the lymphatic vessel, we will elucidate how biochemical and biophysical inflammatory signals regulate their function to facilitate DC homing and entry. This deeper knowledge of mechanisms of DC-lymphatic cross-talk in a relevant biophysical context will enable our long-term goal of rational design for therapeutic immunomodulation.

Adipocyte Differentiation and Metabolic Functions in Obesity and Type 2 Diabetes



Christian Wolfrum :
 "Obesity and metabolic disorders are real scourges of the 21st century and are increasingly becoming the focus of public attention."

What are the molecular mechanisms of adipogenesis linked to the development of the metabolic syndrome ?

Short Project Summary

Obesity-associated disorders such as type 2 diabetes and cardiovascular disorders, referred to as the "metabolic syndrome", are prevalent traits of industrialized societies. The project aims to facilitate understanding of the molecular mechanisms underlying altered adipocyte differentiation and maturation in these metabolic diseases. To achieve this goal, we will establish novel methods to isolate pure primary preadipocytes. This will include a new animal model that will enable us to monitor preadipocytes in vivo and track their cellular fate in the context of a complete organism. These systems will allow us to study preadipocyte biology in an in vivo setting. Furthermore, they will help us answer key questions regarding the development of preadipocytes and examine signals that induce or inhibit their differentiation. Detailed knowledge of these mechanisms will facilitate the development of novel therapeutic approaches for the treatment of obesity and associated metabolic disorders.

Information on the Principal Investigator (PI)

Name
 Prof. Dr. Melody Swartz

Date of Birth
 26 April 1969

Nationality
 American

Host Institution
 Ecole Polytechnique
 Fédérale de Lausanne (EPFL),
 Institute of Bioengineering,
<http://ibi.epfl.ch>

Information on the ERC Project

Title of Project
 The role of lymphatic vessels in dendritic cell homing and maturation

Acronym
 DC-LYMPH

Budget
 1,731,200 €

Duration of Project
 5 years

Information on the Principal Investigator (PI)

Name
 Prof. Dr. Christian Wolfrum

Date of Birth
 17 July 1972

Nationality
 German

Host Institution
 ETH Zurich,
 Institute of Bioengineering,
www.imsb.ethz.ch

Information on the ERC Project

Title of Project
 Adipocyte differentiation and metabolic functions in obesity and type 2 diabetes

Acronym
 AdipoDif

Budget
 1,700,000 €

Duration of Project
 5 years

Epigenetic Determinants of the Genome that Govern Cellular Plasticity



Dirk Schübeler:
 "Stem cells have the fascinating ability to differentiate into any cell type. We will use functional genomics approaches to understand how this process is controlled."

What is the contribution of epigenetic gene regulation to cellular identity?

Short Project Summary

How does the cell organize the genome to activate the right gene when needed and to keep it silent at other times? In the ERC project we investigate how the epigenome changes when pluripotent stem cells differentiate into cells with defined functions, for example neurons. We will focus on DNA methylation and its interplay with several histone modifications as a way to achieve stable gene silencing. By applying new high-throughout methods we will create global profiles to gain insights into targeting principles and generate statistical, predictive models of regulation. Mechanistic models will then be derived and tested by genetically interfering with regulatory pathways and by dissecting DNA sequence components involved in specifying targets. These experiments aim to unravel the crosstalk between epigenetic regulation and cell plasticity and to incorporate epigenetic regulation into current transcriptional regulatory models.

Quality Control of Gene Expression: Mechanisms for Recognition and Elimination of Nonsense mRNA



Oliver Mühlemann:
 "A key to understanding life is to comprehend how cells transform their genetic information into function or structure, and how mistakes in this process are recognized and prevented."

How can cells recognize faulty mRNAs and prevent their translation into dangerous, truncated proteins?

Short Project Summary

Analogous to quality control checks along the assembly line in industrial manufacturing processes, cells possess multiple quality control systems that ensure accurate expression of the genetic information. One of these surveillance mechanisms, called "nonsense-mediated mRNA decay" (NMD), recognizes and degrades mRNAs in which the information for the encoded protein is truncated. By eliminating these defective mRNAs, NMD substantially reduces the synthesis of potentially deleterious proteins in cells. Given that 30% of all known disease-causing mutations in humans lead to such defective mRNAs, NMD serves as an important modulator of the clinical manifestations of genetic diseases. However, the mechanism of NMD is still unknown. One main goal of our research is to understand at the molecular level how premature termination codons are recognized and distinguished from correct termination codons, and how this recognition of nonsense mRNAs subsequently triggers their rapid degradation.

Information on the Principal Investigator (PI)

Name
 Dr. Dirk Schübeler

Date of Birth
 8 May 1969

Nationality
 German

Host Institution
 Friedrich Miescher Institute for Biomedical Research, Basel, www.fmi.ch

Information on the ERC Project

Title of Project
 Epigenetic determinants of the genome that govern cellular plasticity

Acronym
 EpiGePlas

Budget
 1,085,000 €

Duration of Project
 5 years

Information on the Principal Investigator (PI)

Name
 Dr. Oliver Mühlemann

Date of Birth
 18 June 1967

Nationality
 Swiss

Host Institution
 University of Berne, Institute of Cell Biology, www.izb.unibe.ch

Information on the ERC Project

Title of Project
 Quality control of gene expression: mechanisms for recognition and elimination of nonsense mRNA

Acronym
 mRNA quality

Budget
 1,300,000 €

Duration of Project
 5 years

Probing the Relevance of Carbene Binding Motifs in Enzyme Reactivity

Martin Albrecht:

"Is there anything more fascinating than improving our understanding of the pivotal processes of the machinery of life?"



Did we overlook relevant binding modes and reactivity patterns in metalloenzyme chemistry?

Short Project Summary

In metalloenzymes, amino acids are generally considered to bind to the metal centre via their heteroatoms, mostly nitrogen or sulfur. Under certain conditions however, a carbon-type bonding may be favoured. This possibility has been completely overlooked up to now. This is remarkable, since such a bonding mode affects the activity of the metal centre dramatically and may provide a rationale for the mode of action of metalloenzymes that are still not fully understood. Obviously, any evidence for carbon coordination in metalloenzymes will therefore induce a paradigm shift in classical peptide chemistry. Moreover, this unprecedented bonding mode will provide access to unique and hitherto unknown reactivity patterns for artificial enzyme mimics. A multifaceted approach will be pursued for identifying such bonding in enzymes, including site-directed mutagenesis, screening of classes of native enzymes and chemical synthesis of active site models.

Plant Endomembrane Trafficking in Physiology and Development

Niko Geldner:

"Plants cover the surface of this planet and provide for our everyday needs. We need to understand how they manage to adapt and thrive in diverse environments."



How are the ordered, subcellular structures of the root barrier put into place in plants?

Short Project Summary

In the ERC project I will analyse the Arabidopsis root endodermis as an example of a plant polar epithelium. Epithelia are a fundamental feature of multi-cellular organisms, representing the highly selective barriers and interfaces between the organism and its outside environment. The root endodermis is a tissue common to all higher plants and is of central importance for plant nutrition. Its function has been known for almost a century, yet we do not understand how its molecular structures are set up and maintained. While the endodermis has not previously been viewed as an epithelium, it does display all its defining features and therefore provides us with a unique opportunity to study a parallel and independent path of nature towards multi-cellularity. Moreover, understanding the structure and function of the endodermis will contribute to our knowledge of how plant roots interact with their soil environment and how they are able to adapt to various biotic and abiotic stresses.

Information on the Principal Investigator (PI)

Name

Prof. Dr. Martin Albrecht

Date of Birth

12 December 1971

Nationality

Swiss

Host Institution

University of Fribourg,
Department of Chemistry,
www.chem.unifr.ch

Information on the ERC Project

Title of Project

Probing the relevance of carbene binding motifs in enzyme reactivity

Acronym

CARBENZYMES

Budget

1,250,000 €

Duration of Project

5 years

Information on the Principal Investigator (PI)

Name

Prof. Dr. Niko Geldner

Date of Birth

29 May 1972

Nationality

German

Host Institution

University of Lausanne,
Department of Plant Molecular
Biology,
www.unil.ch/dbmv

Information on the ERC Project

Title of Project

Plant endomembrane trafficking in physiology and development

Acronym

Plant-Memb-Traf

Budget

1,200,000 €

Duration of Project

5 years

4D Spatio-Temporal Modelling of Real-World Events from Video Streams



Marc Pollefeys:
 "To understand complex visual events, it is important to be able to combine multiple videos into a single representation."

How can we recreate virtual representations of events from videos?

Short Project Summary

Today video cameras can be found everywhere, from mobile phones to surveillance systems. Often the same event is recorded from many different viewpoints. The goal of my ERC project is to develop new methods to integrate all these separate views into an integrated spatio-temporal model. This model will include the shape and motion of all objects in the scene as well as their appearance. It can be used to relive the event from an arbitrary viewpoint or to analyse the event. The video data could originate from cellphones or camcorders which happened to record an extemporaneous event or be captured by a smart camera network set up to track specific events. It is expected that this work will have applications in many different areas, ranging from surveillance, computer games and entertainment to human motion analysis and medicine.

Olfactory Perception in Drosophila



Richard Benton:
 "From mosquitoes to man, smell is a highly evocative but deeply mysterious sense."

How do genes and circuits encode smell in the brain?

Short Project Summary

The overall goal of our research is to understand how sensory information in the environment is detected and processed in the brain to evoke an appropriate behavioural response. Our project focuses on the olfactory system of the fruit fly, *Drosophila melanogaster*, a model genetic organism that displays a sophisticated repertoire of odour-driven behaviours under the control of neural circuits with similar anatomical and functional properties to those of mammals but with significantly reduced complexity. We will take a multidisciplinary approach to this problem, combining bioinformatics, genetics, molecular cell biology, neuronal physiology and behavioural analysis. We aim to gain insights into a fundamental problem of neuroscience – how genes and circuits control behaviour – and the evolutionary mechanisms operating in animal nervous systems. Our work also has potential direct application in the development of novel strategies to control the chemosensory-driven behaviours of pest insects.

Information on the Principal Investigator (PI)

Name
 Prof. Dr. Marc Pollefeys

Date of Birth
 1 May 1971

Nationality
 Belgian

Host Institution
 ETH Zurich,
 Institute of Computational
 Science,
www.icos.ethz.ch

Information on the ERC Project

Title of Project
 4D spatio-temporal modelling
 of real-world events from video
 streams

Acronym
 4DVideo

Budget
 1,750,000 €

Duration of Project
 5 years

Information on the Principal Investigator (PI)

Name
 Prof. Dr. Richard Benton

Date of Birth
 27 September 1977

Nationality
 British

Host Institution
 University of Lausanne,
 Center for Integrative
 Genomics,
www.unil.ch/cig

Information on the ERC Project

Title of Project
 Olfactory perception
 in *Drosophila*

Acronym
 OlfactoryiGluRs

Budget
 1,500,000 €

Duration of Project
 5 years

Cosmology at the CERN Large Hadron Collider

Géraldine Servant :

"The LHC will take us to a new energy frontier that will allow us to learn about new fundamental laws of physics and change our views about the early universe."



What are the deep connections between the fundamental laws of elementary particle physics and the properties of our universe today?

Short Project Summary

The Large Hadron Collider (LHC), a 7 + 7 TeV proton-proton collider nearing completion at the European Laboratory for Particle Physics (CERN) in Geneva, will take experiments into a new energy domain beyond the standard model of strong and electroweak interactions. As the LHC will unveil the mysteries of electroweak symmetry breaking, this will also have far-reaching implications for cosmology. The aim of this project is to establish what we can learn from discoveries at the LHC about the early universe. This concerns in particular the fundamental question of the nature of the dark matter. Another key topic is the mechanism responsible for the matter-antimatter asymmetry of the universe, which could have major implications for gravity wave physics. One goal of this project will be to explore thoroughly how the planned gravity wave detector and space interferometer LISA could complement the information provided by the LHC.

Towards Protein Folding in the Cell with Single Molecule Spectroscopy

Ben Schuler :

"Protein misfolding diseases such as Morbus Alzheimer pose an escalating problem for our aging societies. We need to understand how the cellular machinery controls the responsible processes."



What are the dynamic properties of protein molecules, and how do they find their folded structure in a cell?

Short Project Summary

Proteins are the most versatile group of biological macromolecules and form the basis of essentially all functional processes in living organisms. Following their synthesis as linear chains of amino acids, they undergo one of the most remarkable self-organization processes of life, spontaneously rearranging to produce the well-defined three-dimensional structure necessary to carry out their function. Whereas this folding process is autonomous at low protein concentrations, cells had to evolve a sophisticated molecular machinery to avoid misfolding and aggregation of folding proteins in the crowded environment of the cell. The goal of this project is to understand how the mechanisms of protein folding are changed by the central components of this machinery, the so-called molecular chaperones. In a multi-disciplinary project we use single molecule fluorescence spectroscopy to address this question.

Information on the Principal Investigator (PI)

Name

Dr. Géraldine Servant

Date of Birth

14 May 1974

Nationality

French

Host Institution

CERN, European Organization
for Nuclear Research,
Department of Physics,
<http://cern.ch/ph-dep-th>

Information on the ERC Project

Title of Project

Cosmology at the CERN
Large Hadron Collider

Acronym

Cosmo@LHC

Budget

800,000 €

Duration of Project

5 years

Information on the Principal Investigator (PI)

Name

Prof. Dr. Ben Schuler

Date of Birth

13 April 1971

Nationality

Austrian

Host Institution

University of Zurich,
Department of Biochemistry,
www.bioc.uzh.ch

Information on the ERC Project

Title of Project

Towards protein folding
in the cell with single molecule
spectroscopy

Acronym

SingleMolFolding

Budget

1,350,000 €

Duration of Project

5 years