The National Centres of Competence in Research NCCR

Cutting Edge Research Made in Switzerland

FNSNF
Swiss National Science Foundation

Content

The National Centres of Competence in Research: Secrets of a Swiss Success Story

The National Centres of Competence in Research (NCCRs) are an innovative funding instrument for promoting Swiss cutting-edge research. Working together in networks, researchers focus on more than two dozen topics ranging from medical technology, research into emotions and chemical biology to framework conditions for international trade.

When the federal council decided to promote a new, targeted funding instrument for leading-edge research at the end of the 1990s, the aim was clear: research must remain a trump card for Switzerland in the competition between scientific communities for new discoveries and brilliant minds. Research is being increasingly acknowledged as the real driving force of a country's future development, where value creation relies to a growing extent on knowledge and innovation.

Switzerland is well on the way to becoming a knowledge-based society and the National Centres of Competence in Research have contributed in no small way to this. "The NCCRs have achieved a great deal", explains René Schwarzenbach, President of Division IV of the Swiss National Science Foundation, "thanks to their outstanding work, they have made leading-edge Swiss research more visible at national and international level." This view is also shared by foreign experts assessing the NCCRs from a scientific perspective.

In specific terms, the current 27 NCCRs are intended to strengthen the Swiss research community in areas in which there is already a great deal of knowledge and outstanding research achievements. To do so, a network of partner institutions in which researchers collaborate closely on an interdisciplinary basis, is established around a centre of competence at a university or other higher-education research institution. Synergies are created within this network while the interfaces between the various disciplines frequently give rise to new insights and innovation. In a sense, the NCCRs generate a certain critical mass of expertise and state-of-the-art knowledge which enables Switzerland to keep pace with major research nations and to directly reinforce its scientific competitiveness.

Attractive long term perspectives

In the meantime, the long-term centres of competence are leaving a lasting mark on the Swiss research landscape. The first series of NCCRs will come to an end in 2013, while those of the second round are in full swing, and a third round is currently being established for launch in 2010. For this third series, 54 proposals were submitted for the eight NCCRs, indicating the high level of interest in the NCCRs. Yet the scientific selection is stringent and is carried out in several stages with recommendations from panels composed of international experts.

There are many reasons why researchers join together in consortia and compete to be awarded a NCCR. For example, the instrument promises a comparatively wide range of funding on a timescale that is unprecedented in Switzerland. A 12-year perspective is invaluable to the research sector because it allows new research fields to be developed and research approaches to be adopted on a trial and error basis.

It is not only the researchers, but also the universities that benefit from being involved in a NCCR. Being the host institution of a NCCR brings the promise of prestige and recognition. Moreover, the universities use the NCCRs to press ahead with structural change in their institutions. NCCRs help them to reflect on their own strengths. "On the one hand, NCCRs give the host institutions the opportunity to define strategic centres of competence, on the other, they place them under a financial obligation", explains René Schwarzenbach of the Swiss National Science Foundation, "which is what makes the continuing interest in the NCCR funding instrument all the more remarkable."

Background to a success story

The National Centres of Competence in Research have therefore proven their worth for the individual research teams as well as for the Swiss academic landscape. Above all, however, the NCCRs are a scientific success. Their reputation has attracted talented scientists from all over the world, reinforcing Switzerland's status as a centre of research. A progress report by the Swiss National Science Foundation shows that between 2001 and 2008, approximately 10,000 scientific publications were generated by the 20 NCCRs from the first and second round. (Further details are contained in the centre part of this brochure.)

Thanks to the specific approach to their work, in the form of intensive inter-institutional and cross-disciplinary collaboration, the NCCRs enable added value to be achieved in various areas that otherwise would require individual measures:

– They leave a lasting mark that far outstrips the period for which they run. By focusing their content, the NCCRs have permanently changed structures in the research landscape. This was how, for example, the Centre for Democracy in Aarau was set up, and the Oeschger Centre for Climate Research was formed at the University of Bern;

– They operate as a network in which a large body of scientific partners are active. The work in these networks has proved to be fertile ground in which original and innovative research approaches can flourish;

– They have proven to be a successful means of knowledge and technology transfer. The way they are structured helps ensure that the results of basic research are channelled as directly as possible into society. Between the years 2001 and 2008, the NCCRs entered into 580 partnerships with companies and founded or supported 46 start-up enterprises. The expertise of the NCCRs has aroused the interest of corporate global players.

– They are a hotbed of talent. The NCCRs have created 63 assistant professorships, in addition 972 junior researchers have completed their doctorates in the NCCR doctorate programme. Specific advancement of newcomers has allowed young researchers to fast-track their academic careers and has helped other NCCR doctoral students to succeed in business and administration.

It is undeniable that the NCCRs are a success, and, what is more, they represent a particularly exciting chapter in the history of Swiss research funding. This brochure is intended to provide an overview of the content and scope of the 27 National Centres of Competence in Research. Using facts and figures we will show what the NCCRs do, and with selected examples we will provide a closer look at the work of the researchers. In other words, we shall reveal the secrets of the making of a Swiss success story.

Fig. 1.1

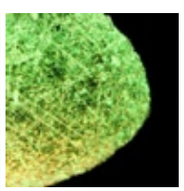


Fig. 1.2

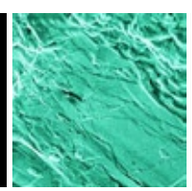


Fig. 1.3

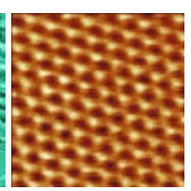


Fig. 1.4

Fig. 1.1–4 The nanosciences continue in their race to the infinitely small. For this they rely on new instruments such as tunnel microscopes. The maximum magnification obtained with these instruments reveals the atoms in the graphite tip of a pencil, magnified once, 300 times, 90,000 times, 27 million times.

Fig. 2.1 The NCCR “FINRISK” makes the results of its research available to the financial economy. At the annual meeting of the Swiss Finance Institute, researcher Olivier Scaillet presents a study on how the element of chance influences the performance of investment funds.

1. NCCR “Nanoscale Science”

The NCCR “Nanoscale Science – Impact on Life Sciences, Sustainability, Information and Communication Technologies” focuses on an area of research with great significance for the future. Nanosciences deal with the fundamental building blocks of matter and their properties in the smallest spatial dimensions and deliver basic knowledge from the disciplines of biology, chemistry, physics and engineering. Yet life sciences and new approaches in information technology are also based on nanoscale building blocks, which is why new approaches, scientific tools, manufacturing methods and understanding of nanosciences are being developed jointly. The NCCR “Nanoscale Science” provides an interface between research institutions and industry, and established the Swiss Nanoscience Institute (SNI) in Basel.

www.nccr-nano.org

2. NCCR “FINRISK”

The NCCR “FINRISK – Financial Valuation and Risk Management” is devoted to understanding risks associated with financial decision-making and the influence of such risks on asset and company valuation. The programme focuses on the study of financial and non-financial risk factors affecting wealth creation and the optimal operation of financial institutions. Despite its prominence as a financial centre, Switzerland has been poorly represented in the international finance research community. NCCR “FINRISK” has changed this situation, assembling first class researchers and contributing a steady flow of top international journal publications. A central aspect of the programme is the training of highly qualified specialists for the Swiss financial sector. In addition, the NCCR contributed to the establishment of the Swiss Finance Institute.

www.nccr-finrisk.uzh.ch

Fig. 3.1

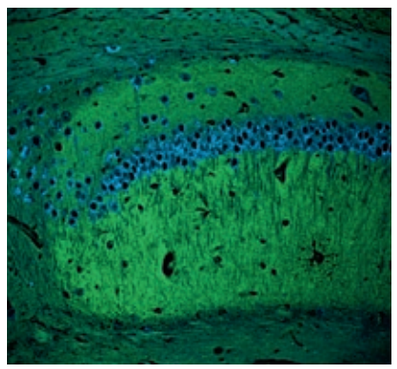


Fig. 3.2

3. NCCR “Neuro”

The NCCR “Neuro – Neural Plasticity and Repair” is working on restoring the functions of the nervous system following injury or sickness. It therefore investigates the cellular and molecular mechanisms of regeneration, plasticity and functional repair of damaged nervous systems. The research focuses on Alzheimer’s disease, multiple sclerosis, strokes and spinal cord injuries. The NCCR “Neuro” promotes synergies between experimental and clinical research in collaboration with biologists, physicians and engineers. They develop new therapies, generate leading-edge technologies and provide tools and services. The University of Zurich and ETH Zurich have extended considerably the research field of the NCCR “Neuro”. Further expansion is planned for the future.

www.nccr-neuro.uzh.ch

The NCCR “Neuro” seeks specifically to develop new therapies to fight against diseases of the nervous system. Tissue samples of mice (Fig. 3.1) are analysed to study how the protein Flotillin (in green) is associated with Alzheimer’s disease (amyloid peptides, in blue).

Combined with targeted training, therapy using the antibody blocking protein Nogo, allows rats with spinal cord lesions to recover their mobility (Fig. 3.2). Early clinical studies are already being conducted on human subjects.

Fig. 4.1

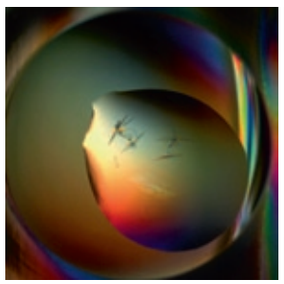


Fig. 4.2

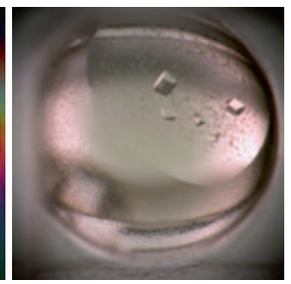


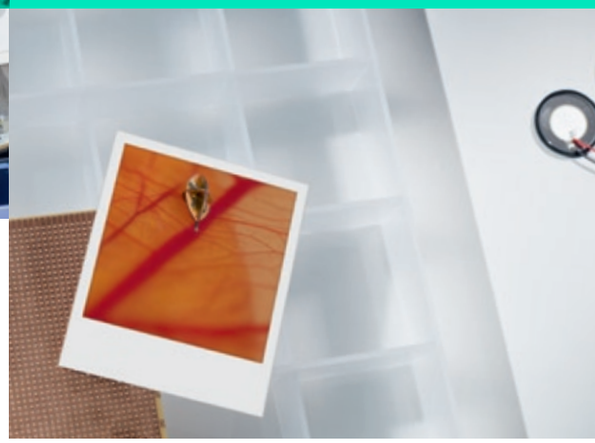
Fig. 4.1/4.2 The NCCR “Structural Biology” studies, most notably, the structure of membrane proteins. Proteins are much too small to be observed by optic microscopy. Only processes such as electron microscopy, nuclear magnetic resonance spectroscopy, or the analysis of the structure through X-rays make it possible to obtain an image of crystallized proteins.

4. NCCR “Structural Biology”

The NCCR “Structural Biology – Molecular Life Sciences: Three Dimensional Structure, Folding and Interactions” investigates the structure of macromolecules, in particular membrane proteins and supra-molecular complexes, and links these findings with functional information. Knowledge of the three-dimensional structure of proteins, and their folding and interaction with other molecules, is crucial both to understanding basic life processes and developing innovative medicines. Access to innovative technologies is important for this type of research, which is why the NCCR “Structural Biology” has invested heavily in this area and has also set up three technology platforms. The NCCR initiated the foundation of a centre of competence in structural biology, which is jointly managed by the University of Zurich and ETH Zurich.

www.structuralbiology.uzh.ch

Special care thanks to ultrasound robots



Swiss researchers are world leaders in the field of non-invasive surgery. The recipe for success: doctors and engineers work hand-in-hand in the NCCR “CO-ME”, combining the best of their expertise to create new methods.

The microscopic robot is injected into the eye using an ultra-fine needle. Controlled by a magnetic field, it moves through the vitreous humour and attaches itself to the retina, where, over an extended period, it dispenses medication that prevents the patient from going blind.

In a few years this could be the standard treatment for an eye disease known as wet macular degeneration. In initial tests on pigs, the researchers were able to inject miniature robots into an animal’s eye and to control them. A team of doctors, chemists, engineers and robotics scientists are now working to enable medicinal robots to one day be used in the human eye.

This collaboration of doctors and engineers forms the basis for the success of the National Centre of Competence in Research (NCCR) “CO-ME – Computer-Aided and Image-Guided Medical Interventions”. By combining different areas of knowledge and using the latest computer technology, internationally ground-breaking results are achieved that are safer and less invasive for patients. “It is wonderful when two such different worlds come together, so that each can learn another approach”, says Carsten Framme, ophthalmologist at University Hospital Bern. He advises scientists at the Federal Institute of Technology, which has been developing miniature robots for six years, as to how these can be used to best effect in ophthalmology. “This means that we look at the problem both from a technical perspective and a medical one”, says Professor Bradley Nelson, founder of the Institute of Robotics and Intelligent Systems at the Federal Institute of Technology in Zurich. In addition to leading the Multi-Scale Robotics Lab and to being a “CO-ME” Project Leader, he has also observed eye operations in order to gain a better understanding of the doctors’ work: “That was extremely important”.

Close collaboration between research and practice

Whereas the robotics project is still in the early stages of research, other NCCR projects have already progressed further. For example, in 2008 Ernst Martin’s team at the Children’s Hospital in Zurich carried out the world’s first brain surgery without opening the cranium. Using focused ultrasound the researchers switched off nerve cells that were causing severe pain to the patient. In a subsequent stage, research is now being carried out to determine whether ultrasound could be effective against brain tumours. Together with the Cantonal Hospital of Aarau, Ernst Martin’s team is conducting trials in which they will attempt to destroy small brain tumours

using ultrasound – a further example of the intensive collaboration between research and practice, as specifically encouraged in the NCCR “CO-ME”.

The ultrasound researchers also want to solve a further puzzle in the battle against brain tumours: how can medication be transported into the brain in sufficient quantities? The brain is protected against foreign substances by a physiological barrier, which stops a significant quantity of medication from reaching the place where it is to take effect. In animal experiments Ernst Martin’s team have already succeeded in opening this blood-brain barrier for a few hours using focused ultrasound. “If we could manage to do that in humans as well, it would be a milestone in the treatment of brain tumours”, says Martin. But it doesn’t stop there: “We aim to set up a major platform so that specialists from all over the world can access our knowledge.”

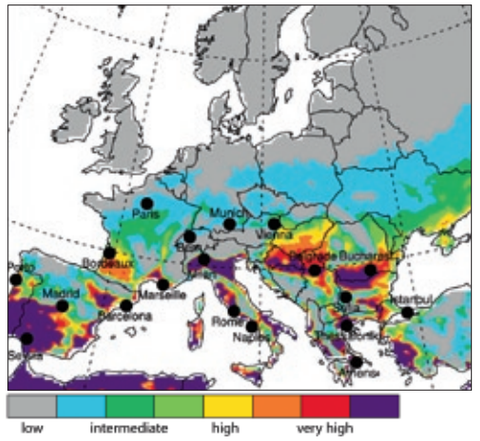
Fig. 5.1 The instruments developed by the NCCR “CO-ME” are used worldwide in the development and training of doctors. With the “HystSim” simulator, a surgeon performs a virtual uterine operation.

5. NCCR “CO-ME”

The NCCR “CO-ME – Computer Aided and Image Guided Medical Interventions” develops leading-edge technology for the operating theatre, focusing on surgical interventions on the head. The key issues include protection of tissue by using minimally invasive surgery and reducing the size of surgical instruments. The researchers work closely with surgeons and medical practitioners to ensure that technological developments are tested in practice and brought to the market as quickly as possible. The strengths of the NCCR “CO-ME” are simulation, navigation and the development of instruments including robots. The NCCR generated three medical technology centres at ETH Zurich and at the Universities of Berne and Basel, which intend to continue their collaboration after the conclusion of the NCCR.

www.co-me.ch

Fig. 6.1 In Southern Europe, the health risks due to global climate change have increased more than was previously thought. Metropolises such as Athens, Marseille and Milan (Fig.) are particularly threatened.



6. NCCR “Climate”

The NCCR “Climate – Climate Variability, Predictability and Climate Risks” investigates processes in the climate system, its variability and predictability, as well as the complex relationships between climate, economy and social factors. Scientists from a wide range of disciplines work together towards this end. The main focuses of the projects are the impact of climate change on the water cycle, climate change and extreme events, and the assessment of climate risks. Risk considerations focus on sectors of industry which are particularly affected: from agriculture to the insurance and financial sectors. The NCCR “Climate” has generated two permanent research centres: the Oeschger Centre for Climate Change Research at the University of Bern and the Centre for Climate Systems Modeling at the ETH Zurich.

www.nccr-climate.unibe.ch

Fig. 7.1

The NCCR “North-South” includes focusing on issues related to promoting health in developing countries. The builder of a bridge over a polluted river in Côte d’Ivoire (Fig. 7.1) requests a small fee from users who are now able to avoid the health risks of crossing through the river.

The extent of environmental damage around the world is varied: in the Pamir region in Tajikistan (Fig. 7.2), teresken bushes are cut and used as firewood. This practice contributes more to soil degradation than overgrazing.

Fig. 7.2

7. NCCR “North-South”

The NCCR “North-South – Research Partnerships for Mitigating Syndromes of Global Change” seeks answers to the challenges of global change and sustainable development. The programme network includes 350 researchers, active in over 40 countries. Of central importance is the partnership between participants in the industrialised “North” and in developing and transition countries (“South”). The NCCR “North-South” promotes a transdisciplinary approach to research on sustainable development. Fields of research include livelihoods, armed conflicts, health and environmental sanitation, natural resources, and governance. The University of Bern, the host institution, has designated North-South research as one of its main focuses. The NCCR has already led to the creation of the interdisciplinary Centre for Sustainable Development and Environment at the University of Bern as well as the International Graduate School North-South which offers a doctoral programme covering subjects on global change, innovation and sustainable development.

www.north-south.unibe.ch

Fig. 8.1

Fig. 8.2

8. NCCR “MICS”

The NCCR “MICS - Mobile Information and Communication Systems” uses the latest developments in mobile communication: in particular the ever increasing ability of devices to interconnect directly with one another to form decentralized, self-organizing networks. Thus environmental information, for example, is measured, processed and provided over the internet using wireless sensor networks. Environmental monitoring is just one of the applications of these newly developed technologies and platforms. Other projects involve the localization of mobile robots and security protocols for wireless networks. As the home institution of the NCCR “MICS”, the EPF Lausanne has substantially expanded its School of Computer and Communication Sciences with 20 new professorships. In addition, the ETH Zurich has refocused its research activities in the area of the NCCR “MICS”.

www.mics.org

9. NCCR “Molecular Oncology”

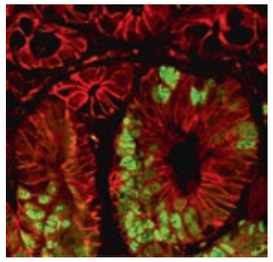
The NCCR “Molecular Oncology – From Basic Research to Therapeutic Approaches” strengthens cancer research in Switzerland. Working with partners from different university hospitals and the pharmaceutical industry, the researchers seek new cancer therapies, discover mechanisms of tumour formation and endeavour to translate these findings into therapeutic approaches. The NCCR “Molecular Oncology” thus creates bridges between basic and clinical cancer research. The research projects target different aspects of the fundamental biology of tumours and the response of healthy cells to cancer. Thanks to this NCCR, cancer research in Lausanne is being strengthened and reorganised. A cancer research centre, where teams from EPF Lausanne and the University of Lausanne will work closely together, is being set up at the University Hospital Center (CHUV) Lausanne.

www.nccr-oncology.ch

The NCCR “Molecular Oncology” studies among other issues, the mechanisms behind the formation of tumours. The transcription factor Prox 1, which is responsible for the development of this tumour in the intestine of a mouse (Fig. 9.1), is visible in green.

In human skin (Fig. 9.2), original stem cells are the source of all hair follicles cells (Fig. 9.2 left). If the original stem cells mutate, their growth can become uncontrollable and lead to the formation of cancer (Fig. 9.2 right).

Fig. 9.1



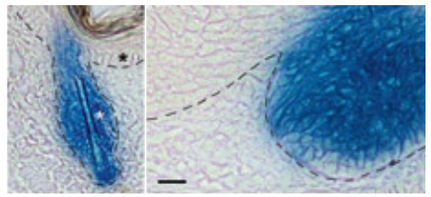


Fig. 9.2

International laurels for a genetics lab

The research of Professor Pedro Herrera, member of the NCCR "Genetics", opens up new horizons in the treatment of diabetes. It also reveals the ability of specific cells to re-programme themselves and change function: a discovery published in the journal Nature.

The University Hospitals Geneva Medical Centre is a maze of long corridors. At the end of one of these corridors, on the fifth floor, we find Simona Chera, 30 years old and head biology assistant in Professor Pedro Herrera's team. Her computer screen displays a picture of World of Warcraft, a well-known online adventure game. "When I'm not working, I spend most of my time playing on the computer." This young Romanian woman believes you must sacrifice everything to the cause in order to be an outstanding scientist. Simona joined Pedro Herrera's team in June 2008. Before that she completed a thesis as part of the NCCR "Genetics – Frontiers in Genetics: Genes, Chromosomes and Development" at the laboratory of Brigitte Galliot, a renowned specialist in the study of hydra and the capacity of this aquatic creature to regenerate itself. The knowledge of cell regeneration acquired by the young biologist over four years is precisely what interested Pedro Herrera who has been working for several years on the regenerative potential of the pancreas.

Prof. Herrera asked Simona Chera to join his team, illustrating the exceptional mobility offered to young scientists by the NCCRs, thanks to the many contacts they establish within the network. The team developed a transgenetic mouse to simulate type 1 diabetes, triggered by an auto-immune reaction to the pancreatic beta cells, the ones which produce insulin. "Using this mouse we can target and destroy beta cells with over 99% accuracy by injecting diphtheria toxin," explains Pedro Herrera. "As opposed to unabated auto-immune attack, here we're dealing with isolated destruction which allows us to see whether the pancreas can generate new beta cells."
And that's exactly what happened. After a few months, new beta cells formed in the rodents' pancreases. Regeneration definitely occurred.

Significant insight into diabetes

Does this discovery give rise to hope of new therapies? "Yes, because if we were to find a way of checking or moderating the auto-immune attack, patients might be able to recover some of their beta cells spontaneously," adds the head of the laboratory.
Simona Chera is the latest member of the laboratory team. "Part of my work is to trace which genes trigger regeneration of the beta cells". The team actually discovered that most of the new beta cells derive from the spontaneous reprogramming of another type of pancreatic cell, the alpha cells. They produce glucagon which has the opposite effect to that of insulin. An obvious case of transdifferentiation, or less specialised cell transformation that does not include an intermediary form of stem cell.
Simona Chera is now trying to find out why young mice are better able to generate new cells than old mice: fascinating work which does not stop the young Romanian woman from enjoying the outcome of the new sequel to another online game, Starcraft.

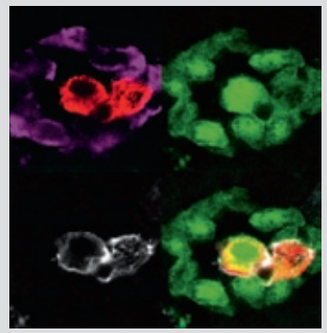


Fig. 10.1 The NCCR "Genetics" develops animal models in vivo to analyze specific aspects of gene regulation. This makes it possible to determine the genetic causes of human diseases. The section of a mouse brain shows various sectors, depending on the composition of brain cells, that are colored differently using viruses.

10. NCCR "Genetics"

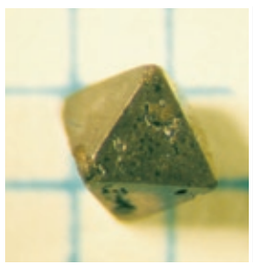
The NCCR "Genetics – Frontiers in Genetics – Genes, Chromosomes and Development" studies the function and regulation of certain genes during their development, as well as their role in maintaining health or favouring the emergence of pathologies. The NCCR "Genetics" promotes exchanges between the different research groups, most of them in the Lake Geneva Region, investigating gene expression, chromosome structure and organism development. This collaboration has led to the creation of five biotechnological platforms. This shared infrastructure gives the scientific community and private sector access to the latest analytical technology and unique genetic molecular tools. An interfaculty institute in "Genetics/Genomics" is planned at the University of Geneva. The NCCR "Genetics" postgraduate programme attracts talented individuals from all over the world.

www.frontiers-in-genetics.org

The NCCR “MaNEP” not only develops materials with exceptional properties, for example crystalline structures produced under pressure (Fig. 11.1) or artificial multilayers (Fig. 11.2).

At PhysiScope (Fig. 11.3), young visitors can also discover the mysteries of physics through interactive experiments and games.

Fig. 11.1



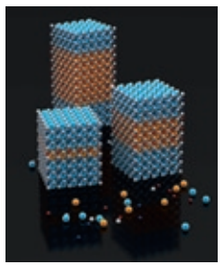


Fig. 11.2

Fig. 11.3

11. NCCR “MaNEP”

The NCCR “MaNEP – Materials with Novel Electronic Properties” studies materials with outstanding properties. These materials are featured in some magnetic, ferroelectric and super conductors. All have a large potential for applications, particularly in energy production and distribution, information technology, sensors and nanotechnology. As electronic interactions play an important role in many of these materials, it is difficult to describe their properties theoretically. The work of the NCCR “MaNEP” researchers aims at achieving a better understanding of these new materials and at preparing for future applications. Academic and industry partners cooperate closely towards this end, within the NCCR’s Swiss-wide network.

www.manep.ch

Fig. 12.1

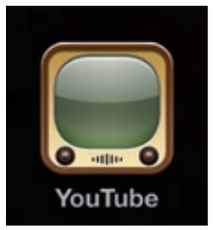
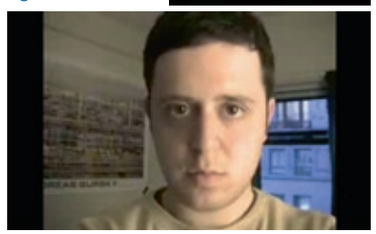


Fig. 12.2



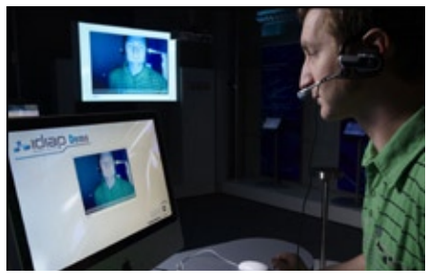
The NCCR “Iconic Criticism” examines, most notably, what determines and changes our perception of images. The iPhone application “You Tube” (Fig. 12.1) shows how our perception is marked by how we see the world on and off the screen. The NCCR is also interested in how social networks on the internet (Web 2.0) affect the identity of individuals. In his work “Everyday”, photographer Noah Kalina publishes to the Web the series of self-portraits he has taken every day since 2000 (Fig. 12.2).

12. NCCR “Iconic Criticism”

The work of the NCCR “Iconic Criticism – Power and Importance of Images” is situated against the backdrop of the digital revolution that has created a new image-based society. Images are used more today than ever before as a means of universal communication and vehicle for imparting knowledge. The knowledge society has also become an image-based one. However comprehension of the particularities, functions, power and impact of images has failed to stay abreast of this development. The NCCR “Iconic Criticism” (also called “eikones”) gives images the attention they deserve. Its key questions are: How do images create meaning – in science, daily life and art? What influences images and how, in turn, do images influence us? And where does the specific power of images lie?

www.eikones.ch

Fig. 13.1



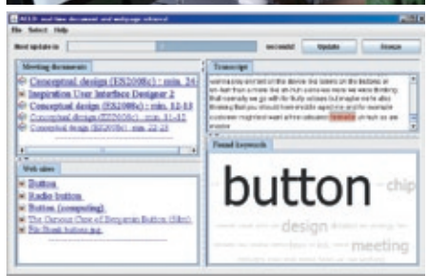


Fig. 13.2

NCCR “IM2” focuses on ways to simplify the use of everyday computing. Face recognition allows a login without a username or password (Fig. 13.1). As for the virtual assistant “Automatic Content Linking Device” (Fig. 13.2), it monitors conversations in a ‘Smart Meeting Room’ and automatically makes available relevant information and documentation such as minutes, websites or excerpts that might be useful to the discussion.

13. NCCR “IM2”

The NCCR “IM2 – Interactive Multimodal Information Management” researches interaction between humans and computers. At the forefront is the development of interfaces, therefore researchers study how spoken, written and gestural language may be combined in multimedia systems. These so-called multimodal interactions cover a broad range of applications: from voice recognition and computer visualisation, to dealing with multimedia information. The new interfaces are to be used wherever current technologies such as keyboard, mouse and screen no longer suffice for the complex interaction between humans and machine. Thanks to the NCCR, the IDIAP research institute in Martigny has been considerably extended and has intensified its cooperation with EPF Lausanne.

www.im2.ch

Fig. 14.1

The NCCR “Mediality” studies forms of communication predating our current mass media. The first cartographic representation of Switzerland dating from 1480 (Fig. 14.1) was intended to establish this then young political entity among the concert of European powers.

The silent film “Nosferatu” from 1922 (Fig. 14.2) is interesting from the point of view of media history. This letter with its hieroglyphics gives a historical background to events.

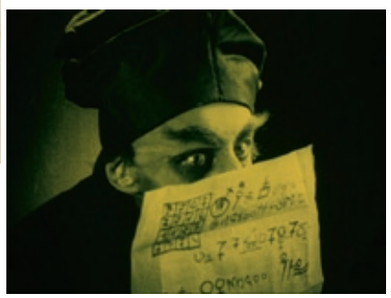


Fig. 14.2

14. NCCR “Mediality”

NCCR “Mediality – Historical Perspectives” focuses on the historicity of media and mediality. It investigates forms of communication before the era of mass-media and technologically oriented media discourses. Through the analysis of texts, images, maps, sculptures, architecture, textiles, sounds and films, particular situations are examined, in which change in communication practices, new dynamics in media forms, and reflection on the conditions of communication become palpable. The main question is what can act as a medium, and what are the specific conditions that make mediacy possible. Participating fields of the NCCR are: German literature and linguistics, history, history of art, film studies, musicology, Scandinavian studies, romance literature and linguistics, as well as law.

www.mediality.ch

Research in networks – the NCCR recipe for success

– International recognition

– Boosting structures

– Focusing on applications

– Promoting young talent

Networking of the National Centres of Competence in Research (NCCR)

International Recognition

Articles in Scientific Journals **13'110**
Other Scientific Publications **5'278**
International Research Cooperations **2'140**
Participation of Projects in International Programmes **407**

Development of Research Structures (2001-2008)

New Chairs **65**
Existing Chairs Refocused to a Research Area of an NCCR **47**
Assistant Professorships **63**
Participating Professors (overall) **600**

Knowledge Transfer

Patents **295**
Projects Funded by The Innovation Promotion Agency CTI **87**
Cooperation with Industry **661**
Prototypes **45**
Start-up-companies / Spin-offs **56**

Promoting Young Talent

Completed Doctorates **1013**
Completed Postdoctorates **1146**

Employers of Completed Doctorates/ Postdoctorates

Research **71%**
Public Service **5%**
Industry **21%**
Others **3%**

Students' Origin

	Doctorates	Postdoctorates	Overall
Switzerland	**443**	**283**	**726**
Europe (without Switzerland)	**414**	**639**	**1053**
America (N/S)	**38**	**67**	**105**
Africa	**29**	**14**	**43**
Asia	**84**	**132**	**216**
Australia / Oceania	**5**	**11**	**16**
Overall	**1013**	**1146**	**2159**

NCCR Funding Sources (Accumulated 2001 – 2010)

	Amount (bn CHF)		Notes
SNSF Funding	**581,92**	**36.6%**	Including data from all NCCRs 2001 and 2010
Home Institution's Funding	**226,66**	**14.3%**	Including data from 20 NCCRs 2001 – 2010, without 3rd NCCR series
Funding from Network or University Partners	**607,45**	**38.2%**	Including data from 20 NCCRs 2001 – 2010, without 3rd NCCR series
3rd-Party-Funding	**174,00**	**10.9%**	2001 – 2008
Overall	**1'590,03**	**100.0%**	

Home institution
Network

Culture & Coexistence Cultural, Social, Economic Questions
New Materials & Technology Physical, Technological and Natural Science Questions (except Biology)
Life & Health Issues Related to Biology and Medicine and the Basics of Life
Environment Issues Related to Ecology and Ecosystems

Universities of Applied Sciences

BUAS	Bern University of Applied Sciences
FHNW	University of Applied Sciences Northwestern Switzerland
HES-SO	University of Applied Sciences Western Switzerland
SUPSI	University of Applied Sciences and Arts of Southern Switzerland

Various Swiss Research Institutes

ART/ACW	Agroscope Agricultural Research Stations
CABI	Commonwealth Agricultural Bureau International; Bioscience Institute, Délemont
CSEM	Centre Suisse d'Electronique et Microtechnique, Neuchâtel
SDC	Swiss Agency for Development and Cooperation
EAWAG	Swiss Federal Institute of Aquatic Science and Technology
EMPA	Swiss Federal Laboratories for Materials Testing and Research
FMI	Friedrich-Miescher-Institute for Biomedical Research, Basel
IBM	IBM Research, Rüschlikon
IDHEAP	Swiss Graduate School of Public Administration, Lausanne
IHEID	Graduate Institute of International and Development Studies, Geneva
IOSI	Istituto Oncologico Svizzera Italiana, Bellinzona
LI	Ludwig Institute for Cancer Research, Lausanne
MeteoSwiss	MeteoSwiss, The Federal Office of Meteorology and Climatology
Novartis	Novartis Research Centre, Basel
PSI	Paul Scherrer Institute
Schaulager	Schaulager (Laurenz Foundation), Münchenstein
SIB	Swiss Institute of Bioinformatics
Swiss TPH	Swiss Tropical and Public Health Institute
swisspeace	Peace Research Institute, Bern
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research
c2D	Centre for Research on Direct Democracy, Aarau

Various International networks

-1-	Numerous Research Partnerships with Universities and other Institutions on Four Continents
-2-	Numerous Participating Research Groups from European and US universities as well as from International Organisations
WZB	Social Science Research Center Berlin

FNSNF
Swiss National Science Foundation

Fertile ground for young firms

The EPFL spin-off company which deals in semi-conductive materials for diodes and lasers, draws significant benefits from the technologies, knowledge and equipment of the NCCR “Quantum Photonics”. An essential, indispensable pool for the company’s development, NCCR QP is also a boon to the university researchers.

Sometimes a lot of ground has to be covered before a brilliant idea becomes a technical reality. To do so, the optimum conditions must be found. The founders of Novagan, a fledging company in the photonics sector, considered that they had struck it lucky in 2009 with the EPF Lausanne, the host institution of the NCCR “Quantum Photonics”. Assisted by scientists at the EPFL, the fledgling company develops innovative components for light-emitting diodes (LEDs) and lasers sought by electronics giants. Novagan aims to tap into a whole new niche.

One of the sectors targeted by Novagan is perfecting pico-projectors, which are increasingly being integrated into mobile phones. Using laser diodes, current devices can project pictures onto all kinds of surfaces. However they are hindered by flickering. “We aim to use laser beams with a broad emission spectrum, generated by unique semi-conductor materials. Nonetheless, the light must cover a wide range of wavelengths to blue and ultra-violet”, explains Eric Feltin, Director of Novagan. Manufacturing materials of this kind is no easy task: “You’ve got to find the right mix of different atoms, then stack perfect layers of crystals of nano-metric proportions”.

Time and means

In taking up the challenge, Novagan benefits from the transfer of technologies developed as part of the NCCR “Quantum Photonics”. Without it, the task would have been impossible. Eric Feltin explains: “Several factors are needed to get started: time, for one, to assess the market, and as a researcher at EPFL, I could do it; followed by cutting-edge equipment, which would have been unthinkable on my own, but was available in the Lausanne laboratories; not to mention a network of researchers, such as the NCCR that is capable of developing a product; and finally, financial backing”, (Feltin was awarded an EPFL Innogrant as well as government support).

For all that this is worth to the start-up, the interaction between NCCR and Novagan scientists is by no means one-sided. “Working together on ideas that result in practical applications is motivating,” adds Nicolas Grandjean, Professor at the EPFL Laboratory of Advanced Semiconducors

for Photonics and Electronics – LASPE, and himself involved in the founding of Novagan. “Collaboration is fixed by contract, and, if the fledgling company takes off, it will sign other commercial contracts with EPFL, which in turn will fund more exploratory basic research”.

Assured of the growth of his company, Eric Feltin estimates that the semi-conductor market for pico-projectors will run to 500 million dollars in 2010. He hopes to get his slice of the silicon cake. And, six years after the creation of Novagan, having realised a turnover of several million Swiss francs: this is a success story that is set to propel the spin-off company from behind the shadows into blue laser limelight.

Fig. 15.1 Basic research conducted within the framework of the NCCR “Quantum Photonics” leads to the development of new products. The technique of molecular beam epitaxy (MBE) makes it possible to grow the single crystal layers of semiconductor compounds. This technique is used most notably for the manufacture of optoelectronic components such as laser diodes or quantum cascade lasers.

15. NCCR “Quantum Photonics”

The NCCR “Quantum Photonics” conducts basic research and seeks potential applications for quantum physics. The research ranges from the physical description of light and its interaction with matter, to the use of these concepts in information and communication technology. One objective is the development of new laser sources. These are superior to current lasers in terms of wavelength, spectral properties und pulse duration: one example being Quantum Cascade Lasers, which are also being used in NASA’s Mars Exploration Program. The NCCR “Quantum Photonics” has generated various spin-off companies and resulted in a strengthening of quantum photonics. When the NCCR “Quantum Photonics” concludes in 2013, the established “Swiss Photonics” platform will serve as the first port of call for science, industry, and the public sector for photonics in Switzerland

www.nccr-qp.epfl.ch

The NCCR “Trade Regulation” focuses on, among other issues, the functioning of the World Trade Organization (WTO) and particularly, on how trade disputes are settled: for example in the Trade Negotiations Committee (Fig. 16.1).

Researchers are also studying the links between food security and climate change in developing countries, for example in the Caucasus, where the population does not benefit equally from international food aid (Fig. 16.2).

Fig. 16.1

Fig. 16.2

16. NCCR „Trade Regulation“

International treaties involving the World Trade Organization (WTO) are becoming increasingly wider in scope, often stretching beyond mere commercial matters into areas such as climate and development policy, migration issues, human rights and the promotion of innovation. Researchers at the National Centre of Competence in Research (NCCR) “Trade Regulation – International Trade: From Fragmentation to Coherence“ are identifying and analysing these and other aspects of international trade relationships, in close collaboration with national and international governmental and non-governmental organisations. This enables the development of innovative approaches to the problem of reconciling different regulations at an international level.

www.nccr-trade.ch

Fig. 17.1

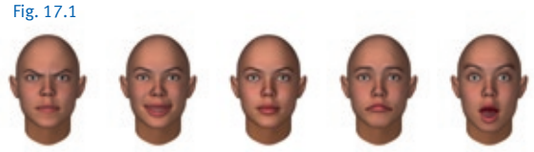


Fig. 17.2

Emotions are important to everyday life in society. The NCCR “Affective Sciences” is engaged in examining among other issues, how people react to different facial expressions on an avatar face (**Fig. 17.1**). **To this end, sci**entists use an electroencephalography (EEG) helmet. Equipped with 256 electrodes, it can measure the electrical activity of the brains of the people tested (Fig. 17.2).

17. NCCR “Affective Sciences”

The NCCR “Affective Sciences – Emotions in Individual Behaviour and Social Processes” is one of the world’s first interdisciplinary research networks to examine emotions in a comprehensive manner. The influence of emotional factors is becoming increasingly important in explaining human behaviour: not only in research, but also in politics and economics. Psychologists, neuroscientists, philosophers, economists, lawyers and anthropologists work together on research on the psychological, biological and social mechanisms that generate and control emotions. They explore the emergence of emotions and feelings, their regulation and their social functions. Their findings may help to improve physical and mental health, foster well-being in the family and the workplace, and develop skills in the handling of emotions.

www.affective-sciences.org

Fig. 18.2 The NCCR “Quantum Science and Technology” examines the microscopic states of matter that meet the laws of quantum mechanics. On the surface of a semiconductor wafer, an electron has two possibilities (0 and 1) to move from A to B. According to quantum mechanics, this leads to a superposition of states, a particle can be in two places at once. A better understanding of this particular property could in the future allow for a much more efficient processing of data (i.e. quantum computer).

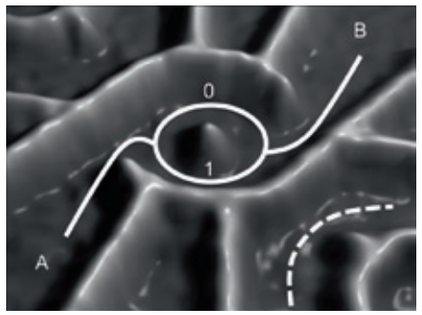


Fig. 18.2

18. NCCR “QSIT”

The NCCR “QSIT – Quantum Science & Technology” is active in a field which unites the key discoveries of the 20th century: quantum physics and information theory. In the future, research in this field will strongly influence science and technology. Potential applications are primarily focused in the area of computer science and sensors. The NCCR “QSIT” takes a multi-disciplinary approach, combining concepts from physics, chemistry, engineering and computer sciences. Researchers from many Swiss universities and basic researchers from industry work together in the NCCR network. Their two common goals are to develop applications in the area of quantum computer science and to investigate new paradigms in physical basic research such as the order and states of material.

www.nccr-qsit.ethz.ch

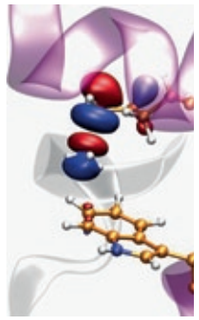


Fig. 19.1

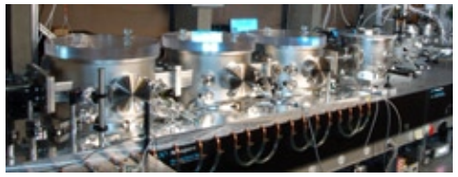


Fig. 19.2

19. NCCR “MUST”

The NCCR “MUST – Molecular Ultrafast Sciences and Technology” opens up new perspectives for the study of molecular systems and time-resolved structural investigations in physics, chemistry and biology. The NCCR “MUST” focuses on the multi-disciplinary development of experimental and theoretical tools. Therefore researchers will investigate chemical reactions and energy-transfer processes at the atomic and molecular level, as well as electron and proton transfer processes with ultra-short temporal and spatial resolution. A deeper understanding of matter at microscopic level is crucial for dealing with important social challenges such as the quest for alternative energy sources, the synthesis of complex, functional medicines, or the development of new electronic devices.

www.nccr-must.ch

NCCR “Plant Survival”

Odour explorers in a cornfield

When attacked by pests, maize plants use a scent to call for help from their enemies' enemies. Ted Turlings, with his team from the National Centre of Competence in Research (NCCR) "Plant Survival – Plant Survival in Natural and Agricultural Ecosystems" is trying to find out how best to use this fascinating defence mechanism for biological pest control.

Ted Turlings loves maize. Not just because it is used to make polenta or popcorn, but because for him, as a chemical ecologist, these plants represent a superb object of research. It is easy to cultivate, yet corn, though unspectacular, has an astonishing secret: it is by no means as helpless as you would expect a plant to be. As a young researcher from the Netherlands, who earned his spurs in the USA, Turlings discovered that maize plants secrete a scent when their leaves are attacked by caterpillars. This scent attracts parasitic wasps which lay their eggs in the caterpillars and kill them. The maize therefore protects itself with its scented 'cry for help'.

After this discovery, Turlings had his pick of universities all over the world. He opted for Switzerland, because "it was the best offer", as he puts it. He spent the first three years conducting research at ETH Zurich, then he moved to Neuchâtel, where he currently manages the NCCR "Plant Survival". In the NCCR Turlings and his team discovered that the maize also emits scent signals into the ground. If its roots are nibbled at by the maize root borer larva – a notorious pest – the maize uses the scented signal method to attract tiny worms which destroy the larva.

High-risk study reaped success

The researchers discovered that numerous maize varieties from the USA, as a result of many years of cultivation, had lost their ability to generate the life-saving scent signal. Using genetic engineering they managed to restore this ability to the maize. The publication of these findings made headlines worldwide: from Argentina to Japan and China. "Without close cooperation with partners both inside and outside the NCCR, this success would not have been possible", explains Turlings. Geneticists at the Max Planck Institute for Chemical Ecology in Jena, for instance, were responsible for fine-tuning the genetic engineering and, thanks to agricultural scientists from the University of Missouri and the CABI Bioscience Research Institute in Delsberg, field trials were possible in the USA and Hungary.
The NCCR, as a funding instrument, played a crucial role: because the management of each NCCR has the freedom to use a small part of the long term financial resources for studies in which the chances of success is uncertain. "It was in such a pilot project that we discovered the maize root signals", says Turlings. The astonishing discovery has now prompted interest from the agricultural giant Syngenta. The Basel company wishes to use the NCCR researchers' biological pest control method to improve resistance in genetically modified maize varieties. Turlings is extremely pleased about the interest. Even though his motivation has always been to conduct high-calibre basic research, seeing his results put into practice brings enormous satisfaction.

Fig. 20.1 Researchers in the NCCR "Plant Survival" examine the relationships between plants and insects. Maize emits an odorous substance that attracts the wasp *Campoletis sonorensis*. This wasp lays eggs in the caterpillar *Spodoptera littoralis* thereby eliminating this corn parasite.

20. NCCR "Plant Survival"

The NCCR "Plant Survival – Plant Survival in Natural and Agricultural Ecosystems" investigates the basic physiological and ecological aspects of plant survival. The research ranges from the molecular level, through ecosystems, to the landscape level. Besides exploring fundamental physiological processes, such as responses to light, researchers also study plant-insect interaction, for example, the importance of chemical defence compounds produced by plants to attract natural enemies of pests. Another focus is on invasive plants; the NCCR "Plant Survival" aims to explain why these alien species are proliferating at the expense of native species. The NCCR has triggered a reorganisation of biological research at the University of Neuchâtel. It has also contributed to the establishment of a nationwide research network in the field of plant science.

www.unine.ch/plantsurvival

Fig. 21.1

In collaboration with other organs and systems, the kidneys ensure the dynamic balance of body fluids (homeostasis). They are therefore essential for the regulation of blood pressure (**Fig. 21.1) and the maintenance** of many other organ functions.

This microscopic slice of a mouse's healthy kidney where specific proteins are stained with fluorescent antibodies, provides important information (Fig. 21.2).

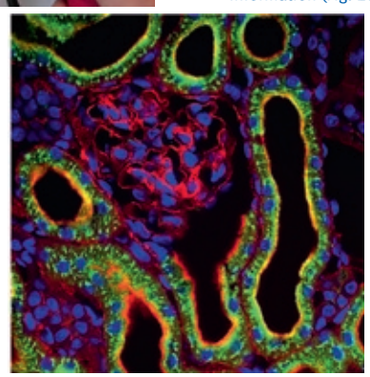


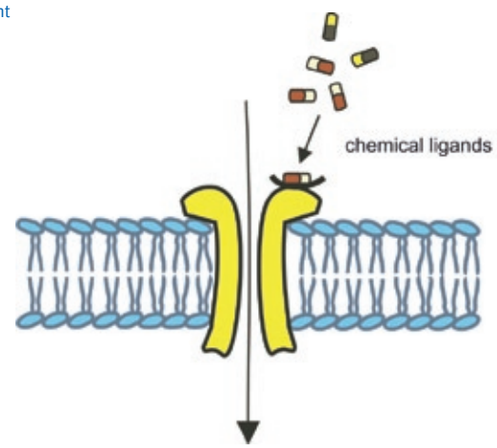
Fig. 21.2

21. NCCR "Kidney.CH"

The NCCR "Kidney.CH – Kidney Control of Homeostasis" is the world's first research network to explore the physiological processes in healthy and diseased kidneys across a broad thematic spectrum. The aim is to seek insights for new preventive, diagnostic and therapeutic approaches to treating kidney patients. The motivation being that kidney diseases have increased dramatically in recent years. Patients with chronic kidney diseases risk exposure to further secondary diseases such as high blood pressure or osteoporosis. Reduced kidney function has drastic consequences for the body as the kidneys are responsible for maintaining the balance between the most varied of substances in the body (homeostasis). Homeostasis is of central importance to body functions and thus a healthy life.

www.nccr-kidney.ch

Fig. 22.1 Transport proteins play a critical role in the physiological processes of the human body. One of the objectives of the NCCR "TransCure" is the correction of pathological dysfunctions of these proteins with specific chemical ligands.



22. NCCR "TransCure"

The NCCR "TransCure – From Transport Physiology to Identification of Therapeutic Targets" seeks to integrate the disciplines of physiology, structural biology and chemistry and to develop new therapeutic strategies for treating the most important diseases. Transport proteins and ion channels play a key role in all physiological processes in the human body. Malfunctions in these proteins may contribute to the occurrence of diseases like diabetes, high blood pressure, osteoporosis and neuro-degeneration, and play a role in heart disease and cancers. The NCCR "TransCure" researchers aim to achieve a more profound understanding of the structures and mechanisms of these proteins. By broadening their knowledge of how transport proteins and channels work, they hope to develop new medicines.

www.transcure.org

Fig. 23.1

Much progress is still required before robots play a role in everyday life. The NCCR "Robotics" is interested in whether, in the future, robots will be able to learn like humans (Fig. 23.1).

If so, they could be used in rescue operations. The minirobots slide under the prone body of a victim in a fire and move him out of the danger zone (Fig. 23.2).

Fig. 23.2

23. NCCR "Robotics"

The NCCR "Robotics – Intelligent Robots for Improving the Quality of Life" encompasses a promising field of engineering which aims at developing new, human-oriented robotic technology. In the near future, intelligent robots will play an important role in improving quality of life. For example, "care robots" will help elderly people to stay in their familiar surroundings longer; "neuroprosthetic" and "exoprosthetic" robots will increase the mobility and autonomy of disabled persons; "educational robots" will support the training of a new generation of scientists and engineers; and "environmental robots" will keep our world cleaner and safer. In order to progress towards this vision, the NCCR "Robotics" is working towards developing fundamental insights in terms of technology, materials and control mechanisms.

www.nccr-robotics.ch

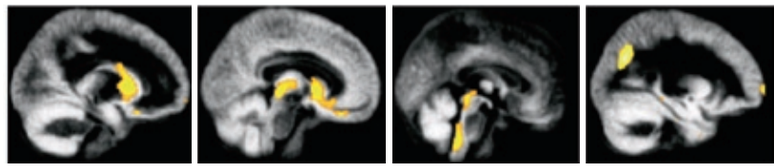


Fig. 24.1 The images show the brain structures of people who are still healthy. These individuals however, are from families in which other members suffer from Huntington's disease. The yellow areas show signs of brain atrophy in the locations usually most affected by the disease. In the presence of certain indicators (biomarkers), imaging allows early detection.

24. NCCR "SYNAPSY"

The NCCR "SYNAPSY – Synaptic Bases of Mental Diseases" aims to discover the neurobiological mechanisms of mental and cognitive disorders, since one of the major challenges in psychiatry is to achieve a better understanding of how these illnesses originate. It is hoped that this research will lead to the development of improved diagnostic tools and therapeutic approaches. The NCCR "SYNAPSY" focuses on the interface between preclinical research and clinical development, combining neuroscience with psychiatry. This research focus will help train a new generation of psychiatrists, who will possess both high clinical expertise and a sound knowledge of the basic neurobiological aspects of mental functions and dysfunctions.

www.nccr-synapsy.ch

The quality of democracies put to the scientific test

How democratic is a country? This type of question is answered by a measuring instrument developed in the National Centre of Competence in Research “Challenges to Democracy in the 21st Century” (NCCR “Democracy”). The basic idea is that a democracy only functions if the principles of equality, freedom and democratic control exist in a balanced relationship to one another. An interview with the project manager, political scientist Marc Bühlmann:

Mr Bühlmann, your democracy barometer works with an ingenious set of functions, components and indicators. What do you measure with it?
The variations in democratic quality within and between established democracies: we compare constitutions, but also constitutional reality. In Italy, for example, the constitution scarcely changed at all under Silvio Berlusconi between 2000 and 2005, yet the constitutional reality did. For instance, confidence in the judiciary decreased since Berlusconi, reinforced by the media, led a campaign against the judges and made the courts look ridiculous. This loss of confidence by the population can be measured with the help of various indicators. Another area of research is public articulation, where one of the things we measure is the independence of the media from the government. The extent to which the political elite is controlled by the public, and therefore also via the media, is a key quality characteristic of a democracy. If the media loses its independence, it can cause serious problems. This was, and still is, the case in Italy under Berlusconi.

Why was your project conducted as part of the NCCR “Democracy”? What are the strengths of a National Centre of Competence in Research in this type of research?
The challenge of the NCCR “Democracy” is not only to conduct research, but to give the public access to the knowledge as well. This is precisely what we are doing with our project. The democracy barometer is a good way of showing what constitutes a democracy, how a democracy changes and where it might be jeopardised. As researchers, we were required both to work scientifically and to take care of public relations. We tried to make our work easy to understand while still observing scientifically correct procedures. That was a great challenge. What is unique about the NCCR for the researchers, is the long-term financing: it is necessary to take this long-term view in order to develop a working instrument like the democracy barometer.

Your results suggest that good democracies achieve more than poor ones; in dealing with economic crises, for example.
Yes, there is some indication of this. We attempted to illustrate this using the dot-com crisis of 2000 as an example. There are countries in which democratic quality clearly declined as a result of this crisis. Yet it didn’t happen everywhere! Certain democracies actually emerged even stronger from the crisis: for example Denmark, which endeavours to incorporate as many interests as possible, on an equal basis, into its political decision-making processes. Democracy works in these countries thanks to the population’s increased willingness to see through even stringent reforms. In Denmark, reform of the labour market laws was a success provoked by the dot-com

crisis. Similar reforms were attempted in Portugal, yet failed; additional factors certainly played a role there. The idea of the democracy barometer, with its fine measurement criteria, is to explain precisely these things and on this basis, to suggest improvements in the workings of democracy.

In 2005, the quality of Swiss democracy ranked as only average in comparison with the 30 countries studied. Why was that?

Although Switzerland has many possibilities for participation, the population takes scant – and above all – highly unequal advantage of these. Those who participate in political life tend to be wealthy, well educated, and – first and foremost – male. There are also structural minorities that remain entirely excluded. This is not the case in other countries. One quarter of the population capable of voting in Switzerland is not actually entitled to do so: migrants. It is difficult to justify why people who live here and – in particular – also pay taxes, cannot be involved in decisions about what happens to their money.

Fig. 25.1 A “show of hands” at the Landsgemeinde (gathering of the electorates) in the Canton of Glarus: the oldest form of direct democracy and one of the many opportunities for political participation in Switzerland. The results of the NCCR “Democracy”, however, show that these opportunities are used in a very inequitable manner overall.

25. NCCR “Democracy”

The NCCR “Democracy – Challenges to Democracy in the 21st Century” explores how democracy develops in the current conditions created by globalisation and mediatisation. On the one hand, decision structures at nation-state level are being increasingly called into question in the face of growing European integration and globalisation, on the other, the media exercise a growing influence on politics and public debates that are important aspects of democracies. The NCCR “Democracy” achieves a combination of political, journalism and communication sciences that is unique in Europe. It aims to develop proposals for improving political decision-making processes, political education and the quality of media reporting. The NCCR launched the Centre for Democracy in Aarau.

www.nccr-democracy.uzh.ch

Fig. 26.1

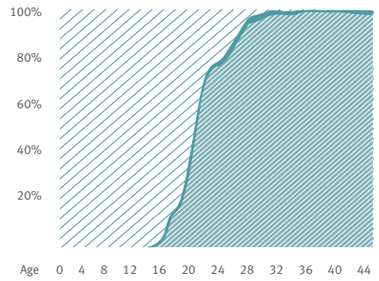
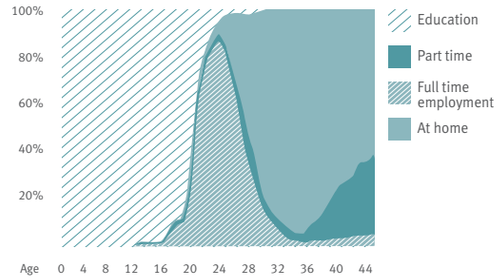


Fig. 26.2



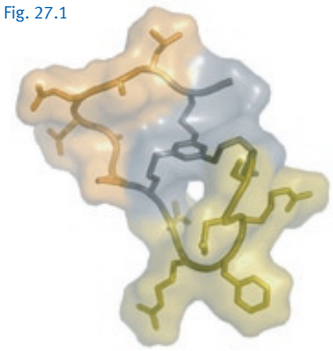
26. NCCR “LIVES”

The NCCR “LIVES – Overcoming Vulnerability: Life Course Perspectives” analyzes the burdensome effects of post-industrial economies and societies on the development of vulnerability in terms of social exclusion or precariousness. It conducts comparative, longitudinal analysis to examine the impact of socio-structural and personal resources on overcoming vulnerability. Hosted by the Universities of Lausanne and Geneva, the NCCR brings together national and international researchers to examine life courses as developmental processes, as outcomes of institutional regulation and policies, or as biographical meanings. The Life trajectories of about 25’000 people will be studied across health, family, work, and institutional domains in order to develop innovative social policy measures.

www.lives-nccr.ch

NCCR “LIVES” – Overcoming Vulnerability: Life Course Perspectives examines the factors that promote long-term development of health, social or psychological vulnerability. In Switzerland, the integration of men and women in the labour market is very different. While men (Fig. 26.1) make the transition from training to work full-time without interruption, the professional biography of women (Fig. 26.2) meanders greatly.

Fig. 27.1



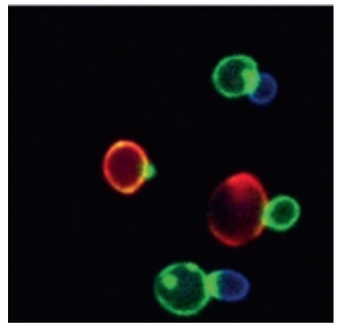


Fig. 27.2

The NCCR “Chemical Biology” develops methods to better visualize and influence the biological processes at work in molecules. Here, for example the structure of a new class of peptides that has been developed to monitor the activity of protein molecules (Fig. 27.1).

Another example is the growth of the cell wall of budding yeast. The image (Fig. 27.2) was obtained through chemical marking of proteins with fluorescent probes and then analyzed with a fluorescence microscope.

27. NCCR “Chemical Biology”

The NCCR “Chemical Biology – Visualising and Controlling Biological Processes using Chemistry” employs chemistry tools to obtain a better understanding of life at the molecular level. Until now, few technologies could characterise in detail the countless biochemical activities that constitute a living cell. In the NCCR “Chemical Biology”, chemists, biochemists, physicists and cell biologists develop innovative techniques based on small molecules and proteins to obtain new information about cellular processes and control them in-situ. The new tools will be applicable to various biological phenomena like visualising the activity of selected proteins during cell division and investigating how membranes control the activity of the proteins within them. The NCCR is also engaged in establishing a platform for chemical screening aimed at developing a new generation of molecules with biological effects.

www.nccr-chembio.ch

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