Opportunities and Risks of Nanomaterials

Implementation Plan of the National Research Programme NRP 64

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FNSNF
Swiss National Science Foundation

Contents

What are National Research Programmes (NRP)?

Research carried out in the context of National Research Programmes consists of targeted research that contributes to providing solutions to present-day problems of national importance. Under the provisions of Article 6, paragraph 2, of the Law on Research of 7 October 1983 (as of 25 February 2008), the Federal Council selects the topics and foci to be researched in NRPs and mandates the Swiss National Science Foundation (SNSF, Division IV), giving it full responsibility to implement the Programmes.

Article 4 of the Federal Ordinance on the Law on Research of 10 June 1985 (as of 1st January 2009) describes the purposes and contents of NRPs as follows:

«[1] National Research Programmes are a means to direct and support coordinated research projects that have a common goal. Where needed, National Research Programmes should strengthen scientific research capacities.

[2] Topics of research are appropriate for National Research Programmes if, in general,

- *a. scientific research on the problem is of national importance;*
- *b. Swiss research can make a significant contribution to the resolution of the problem;*
- *c. solutions require research contributions from multiple disciplines;*
- *d. they cannot be exclusively assigned to either basic research, research performed by the administration in answer to legal requirements and political mandates, or industrial research;*
- *e. within five years, research on the problem can produce results that may be useful for practical applications.*

[3] The selection procedure also takes into account whether programmes:

- *a. can provide a scientific basis for decision-making by the government and the administration;*
- *b. can be elaborated as part of international collaborations and also be of great interest to Switzerland.»*

Summary

The National Research Programme “Opportunities and Risks of Nanomaterials” (NRP 64) is tailored to identify and foster areas where there is a need for further research to gain a better understanding of the major opportunities and possible risks of nanomaterial-based products. Research performed in the context of this programme should provide scientific bases to formulate recommendations and appropriate measures for the manufacture, utilisation and disposal of nanomaterials, thereby allowing society to benefit from scientific advances in nanomaterial-based applications whilst protecting consumers and the environment.

This programme includes nanometer-scaled objects and nanocomposites which may revert to their particulate nature at any stage of their life-cycle (through migration, erosion, etc). The focus is on engineered nanomaterials, i.e. defined as synthetically produced materials, with structural components such as fibres and particles that have at least one dimension at the nanoscale level, typically ≤ 100 nm. Preference is given to nanomaterials with a high probability of human or environmental exposure, since exposure to hazardous nanomaterials has a significant bearing on any resulting risk or impact on human health and the environment.

The programme focuses on five areas of application: (1) medicine, (2) environment, (3) food and consumer products, (4) energy and construction and (5) innovative nanomaterials. Once completed, the following goals should be fulfilled:

- Provide data to develop tools and methods to monitor the behaviour of nanomaterials and their potential impact at all stages of their life cycle on humans and the environment, including flora and fauna within different media (air, soil, water).
- Provide scientific bases to develop tools to maximise benefits and minimise possible human health risks and environmental risks arising from synthetic nanomaterials throughout their life-cycle.
- Provide data to support the development and implementation of safe and effective applications of nanomaterial-based technologies.

The programme will promote the gathering of information needed by the government, manufacturers and distributors to define working practices and regulations

Funding for NRP 64 is CHF 12 million with a research duration of 5 years.

1. Introduction

1.1 Background and definition of nanomaterials

Nanomaterials represent an important part of nanotechnology which clearly belong to the key technologies of the XXIst century. Nanomaterials that are economically promising for the future include those that have applications in information technology, electronics, building materials, household appliances, textiles, cosmetics, food, environmental technologies, energy technologies, and medicine.

Both risks and opportunities of nanomaterials are of vital significance for Switzerland not only from a scientific perspective, but also from an economical and social

perspective. According to experts, the application of nanomaterial-based technologies not only holds promises of a positive economical development but also shows promises of major improvements in the areas of health and in the protection of the environment. Despite fast-paced advances in the development of nanomaterials and a growing number of commercially available nanomaterial-based products, very little is known about the exposure of humans and the environment to nanomaterials. On an international level, this subject matter has already instigated a number of research initiatives.

Switzerland is already in a leading position in research on nanoscience and nanomaterials. Innovative and interdisciplinary research fostered by NRP 64 should help Switzerland maintain this position, while generating benefits for its economy, industry and employment market and allowing it to take the lead in risk assessment and issues involving regulatory control.

This programme includes nanometer-scaled objects and nanocomposites which may revert to their particulate nature at any stage of their life-cycle (through migration, erosion, etc). The focus is on engineered nanomaterials, i.e. defined as synthetically produced compounds, with structural components such as fibres and particles that have at least one dimension at the nanoscale level, typically ≤ 100 nm. Preference is given to nanomaterials with a high probability of human or environmental exposure.

Physically confining materials at the nanoscale alters the behaviour of electrons within them, which in turn can change the way they conduct electricity and heat, and interact with electromagnetic radiation. Moreover, materials engineered at the nanoscale can enter into places that are inaccessible to larger materials, and can therefore be used in new ways. These behaviours also have potential consequences on the abilities of synthetic nanomaterials to cause harm in novel ways.

All projects should consider that nanomaterials may interact with biological systems in a way which is different from that of larger particulate material (100 nm and more) and individual molecules. This knowledge can help with the handling of nanomaterials in general and in a wide range of applications. It can also help to create safety measures. Modern and innovative techniques as well as novel models to study these biological effects are needed.

Consequently, projects should be multidisciplinary, propose a tight collaboration between material sciences and safety-oriented research and be application-oriented. Inter- and trans-disciplinary projects are encouraged. The application-oriented nature of the programme should also encourage technical colleges (“Fachhochschulen”) and federal research institutions (“eidgenössischen Forschungsanstalten”) to submit their own projects, either alone or in collaboration with other technical colleges, federal research institutions or universities.

For joint projects, an application package containing individual pre-proposals may be submitted. However, it is important that the individual pre-proposals in the application package are written up such that they can be reviewed and evaluated individually.

On November 28, 2007, the Federal Council mandated the Swiss National Science Foundation (SNSF) to conduct NRP 64 "opportunities and risks of nanomaterials". The National Research Council of the SNSF elected a steering committee for the strategic management of the programme. This implementation plan was approved by the Head of the Federal Department of Home Affairs on September 24, 2009.

1.2 Research field at national and international levels

A significant number of internationally recognised Swiss institutions and organisations are conducting research on nanomaterials:

- NCCR Materials with novel electronic properties (MaNEP), leading house in the University of Geneva
- NCCR Nanoscale Science, leading house in the University of Basel
- NRP 62 Smart materials
- nano-tera.ch – the Swiss initiative in engineering and information technology for health and security of the human being and the environment
- Competence centre for materials science and technology (CCMX) of the ETH-domain
- Micro and Nano Science Platform (MNSP), ETH Zürich
- Materials Research Centre (MRC), ETH Zürich
- Material Science and engineering, EPF Lausanne
- Institute of Micro engineering, EPF Lausanne
- Nanoscale material science, Swiss Federal Laboratories for Material Testing and Research (EMPA)
- Nanotech@surfaces, Eidg. Materialprüfungs- und Forschungsanstalt (EMPA)
- Fribourg Center for Nanomaterials (FriMat), University of Fribourg
- Adolphe Merkle Institute (AMI), University of Fribourg
- Swiss Nanoscience Institute (SNI), University of Basel
- Action Plan Synthetic Nanomaterials (FOPH, FOEN and SECO)
- ERA-Net Nanomedicine, leading house in the University of Basel

In particular, the National Centre of Competence in Research (NCCR) Nanoscale Sciences is focused on the fundamental and quantitative aspects of "nano" as a natural science discipline. The Action Plan Synthetic Nanomaterials, was set up by the Federal Office of Public Health (FOPH), Federal Office for the Environment (FOEN) and the State Secretariat for Economic Affairs (SECO). One of the aims of the Action Plan is to define a regulatory framework for the handling of nanoparticles during production, usage and disposal. The ERA-Net Nanomedicine is a network initiated by CLINAM (Clinical NanoMedicine, www.clinam.org), to establish a European research centre for clinical nanomedicine in Basel.

On an international scale, research on innovative new nanomaterials and their applications as well as action plans to establish recommendations and regulations for nanomaterials are increasing across Europe and beyond, for example: the SPP 1313 "Biological responses to nanoscale particles" of the DFG[1], the ERA-Net Nanotechnology projects[2], the National Nanotechnology Initiative in the USA[3], the IMPART –

[1] http://www.uni-due.de/~hb0082/website/homepage/univer/startseite_83/de/de_startseite_univer_1.php
[2] http://cordis.europa.eu/nanotechnology/src/pressroom_projects_nmp7.htm
[3] http://www.nano.gov/

Nanotox initiative of the European Commission's Sixth Framework Programme[4], the OECD Working Party on Manufactured Nanomaterials (WPMN)[5] and its research database for international collaboration[6], the SCENIHR Scientific Committee on Emerging and Newly Identified Health Risks[7], the National initiatives on ethical, legal and social implications (ELSI) of nanomaterials and the EC NanoImpactNet Programme[8].

There are many new European projects commencing in 2009 but details are not yet available. The EU is also trying to cluster such projects to coordinate activities and allow sharing of resources and expertise between projects, however their structures have not yet been established.

NRP 64 would clearly benefit from international links, and so its integration into an international network on a project- as well as on a programme-level is therefore encouraged.

NRP 64 is designed to complement the above-mentioned programmes, in particular the Action Plan "Synthetic Nanomaterials", the NCCR Nanoscale Science, and the NRP 62 Smart Materials.

2. Goals of the research programme

NRP 64 should be conducive to the identification of opportunities arising from the use of nanomaterials for human health, the environment and natural resources while at the same time help to identify possible risks presented by nanomaterials for human health and the environment. Once completed, the following goals should be attained:

- Provide data to develop tools and methods to monitor the behaviour of nanomaterials and their potential impact at all stages of their life cycle on humans, the environment and flora and fauna within different media (air, soil, water).
- Provide data needed to develop tools to maximise benefits and minimise human health risks and environmental risks arising from synthetic nanomaterials throughout their life-cycle.
- Provide data to support the development and implementation of safe and effective applications of nanomaterial-based technologies.
- Provide information needed for the government, manufacturers and distributors to define working practices and regulations.

Another goal of this programme is to enhance and strengthen Swiss expertise and competence in the development of innovative nanomaterials as well as in risk assessment. Successful projects within NRP 64 are encouraged to seek continued support through other funding schemes, including those proposed by the SNSF (www.snf.ch).

[4] http://www.impart-nanotox.org/
[5] http://www.oecd.org/department/0,3355,en_2649_37015404_1_1_1_1_1,00.html
[6] http://www.oecd.org/document/26/0,3343,en_2649_37015404_42464730_1_1_1_1,00.html
[7] http://ec.europa/health/ph_risk/committees/04_scenihr/scenir_opinions_en.htm#nano
[8] http://www.nanoimpactnet.eu/object_class/nano_men_home.html

3. Main research topics

Projects submitted within the context of this programme should investigate opportunities and their concomitant risks presented by nanomaterials at different stages of their life-cycle. They should be either integrative (risk/benefit investigation), should propose risk related research for commercially relevant applications or should take a life-cycle approach to risk identification and assessment. Risk related research can include exposure and/or hazard (toxicity) research for both humans and the environment. Projects where there is a clear collaboration between nanomaterial developers and risk research, for example via linking to existing material development projects, will be favoured.

Priority will also be given to projects investigating and designing ways to minimise exposure; to projects focussing on the development of new nanomaterials or manipulation of existing nanomaterials, if they integrate a risk assessment; to projects investigating the interaction of nanomaterials with biological systems; to projects proposing physico-chemical characterisation of nanomaterials; to projects dealing with nanomaterials in food, food packaging and health supplements; to projects investigating nanomaterials with novel or significantly altered (improved or worsened) properties when size is decreased, provided that the experimental design includes larger-sized controls of the nano-sized materials under scrutiny; to projects looking into the susceptibility of humans or different phyla to risk (with particular attention to susceptible groups); to projects exploring the life cycle of, exposure to, and hazards of nanomaterials and to projects investigating nanomaterials in cosmetics. In all cases, benchmarking research against the properties and behaviour of non-nanoscale materials is highly recommended.

Likewise, projects proposing multiple applications for nanomaterials, projects examining the use of nanomaterials for environmental applications or projects determining the impact of nanomaterials on humans and the environment or investigating the fate and behaviour of nanomaterials in the environment are encouraged.

Moreover, projects proposing integrative and multidisciplinary approaches that include material development and applications are also given priority, as well as targeted research projects that include both a basic and applied approach.

Projects dealing exclusively with the development of screening or measurement tools and classical material applications will not be considered. Similarly, projects focussing on incidental nanomaterials, in particular nanomaterials arising from combustion processes, for example diesel particles (but not excluding fuel additives) or projects without appropriate physico-chemical characterisation or projects concentrating on nanotechnologies will not be considered.

Applications can fall within one module or span across more than one module.

3.1 Module 1: Medical applications

New nanomaterials are leading to breakthroughs in new drugs and medical devices and are beginning to blur the distinction between the two. Synthetic nanoparticle-

based medical agents are enabling a new generation of multi-functional, targeted drugs. These combine features of conventional drugs and devices to diagnose and treat diseases in situ, providing localized treatments that use fewer active agents to greater effect. However, the unconventional nature of these synthetic nanomaterial-based medicines raises questions over possible health impacts that may not be identified using conventional evaluations. The transport, bioaccumulation, mechanisms of action, unconventional (or even absent) metabolism routes and excretion pathways of these new therapeutics raise new challenges to evaluating safety. Where the agents are biopersistent, new approaches may be needed to assess long-term impacts on human health and the environment following excretion.

This includes determining the potential for exposure to occur at all points within the life cycle of a nanomaterial; developing appropriate approaches to material characterization, exposure assessment and dose characterization; exploring material transformation, and its impact on exposure, transport and toxicity; investigating mechanisms of biological action; and establishing nanoscale material-relevant toxicity assays. In addition, as the development of new synthetic nanomaterials exceeds the ability to conduct quantitative risk assessments in parallel, innovative new approaches to risk assessment and management are needed that enable decisions to be made from limited data.

This module includes investigations regarding the uptake mechanism (at different levels including organs, tissues and cells) and the influence of the particles on cell functions independently of the application (such as drug delivery, imaging, etc). Other applications include the use of nanomaterials in implants. It is important to assess the reaction of the body to these implants and their stability. Wear and tear of the implant that may result in the release of particulate nanomaterials and their fate must also be assessed.

Projects focusing on the application of nanoparticles or nanotechnology for medical devices, implants or imaging will not be considered, if they are not related to investigations as mentioned above.

3.2 Module 2: Environment

Synthetic nanomaterials may enter the environment through the intentional release of nanomaterials for applications in environmental remediation or control. In addition, they can be released as a component of the effluent from manufacturing, through the use (and degradation) of products containing the materials and through the disposal of these. Although there is a body of knowledge on nanometer-scale particles in the environment, this falls short of enabling the release, transport, transformation, accumulation and eventual environmental impact of synthetic nanomaterials to be assessed with any degree of certainty.

Transformation of nanomaterials throughout their life cycle, including agglomeration, de-agglomeration and interaction with other substances in the environment presents particular challenges to understanding potential impacts.

New research is needed to enable the environmental impact of synthetic nanomaterials to be assessed and managed over their full life cycle – from generation to disposal and recycling.

3.3 Module 3: Food and consumer products

Providing a growing population with food that is plentiful, affordable, attractive, healthy and safe will depend on the development and implementation of new technologies. Synthetic nanomaterials have the potential to improve production efficiency, increase food security, prolong shelf life, enhance the nutritional value and improve the aesthetic appearance of foods. Yet there are significant scientific and perceptual barriers regarding safety that need to be overcome if synthetic nanomaterials are to find widespread sustainable use in food products. For instance, little is currently known regarding the impact of enhanced dose rates resulting from nanoscale food components, or the biological transport of materials attached to engineered nanoparticles. Where synthetic nanomaterials are incorporated into food processes or packaging, or are introduced as food additives, it is unclear whether current tests adequately evaluate potential health impacts. Additionally where conventional ingredients are synthesized at the nanoscale, there is little knowledge on how this might alter their risk profile, and on how to ensure safe use.

Simple synthetic nanomaterials are already being incorporated into a range of consumer products. These range from textiles and plastic products incorporating silver nanoparticles, to sports equipment constructed from carbon nanotube composites, and to cosmetics relying on nano-encapsulated ingredients. Little is currently known about the extent and nature of nanomaterials being used in consumer products, whether these materials present an enhanced risk to consumers, or how their safe use can be assured. Research challenges include assessing the characteristics of synthetic nanomaterials in consumer products, evaluating the potential for exposure and environmental release, and their potential impact on humans and the environment. The safe disposal and efficient recycling of consumer products containing synthetic nanomaterials present particular research challenges.

3.4 Module 4: Energy and construction

Energy and construction applications often include nanomaterials incorporated into a matrix. The applications are very diverse. These have the potential to sustain and greatly enhance the quality of human life and endorse sustainable and efficient use of natural resources and improve the protection of the environment. Such technologies may allow a more efficient conversion, storage and transport of energy. Similarly, for construction, this includes better use of natural resources and materials with enhanced properties of building materials. Nevertheless, new and novel nanomaterials being developed for energy and construction applications will need to undergo life cycle-based risk assessment if they are to perform well without causing harm to humans or the environment.

3.5 Module 5: Innovative nanomaterials

The previous modules relate to clearly established applications in well-defined areas whereas this module allows the consideration of completely new, previously undefined materials and applications. Innovative nanomaterials are those that lead to sudden advances in technological capability, which are not easily predicted from past progress. They have the potential to lead to new nanomaterials rather than simply add value to existing technologies.

An example of an innovative nanomaterial leading to new technologies is the use of complex fluids in protective clothing which harden on impact. Another example is gold nanoparticles with paramagnetic behaviour which can be used as a contrast agent for MRI.

Innovative nanomaterials present unique challenges for science-based risk assessment, as often there is little information on potential risks to humans or the environment available from analogous materials.

4. Practical significance and target audience

4.1 Practical significance

The practical significance of nanomaterials is conspicuously demonstrated with several commercially available and economically successful products and industrial companies. A high visibility of Switzerland on an international level is thus of great importance. In addition to scientific advances promoted by this programme, Switzerland's standing as a centre for innovation in high technology will be strengthened, interdisciplinary research will be enhanced and new competencies will be established.

The programme is not expected to generate directly marketable products. However, data gathered through intensive and integrated research exploring opportunities and risks inherent to nanomaterials-based products should lead to the development of sustainable products, allow for science driven insight, improve general knowledge on the matter and thereby promote informed public debates. Last but not least, it should provide the basis for the authorities and regulatory bodies for decision-making and the establishment of recommendations and regulations spanning the entire life cycle of nanomaterial-based products.

4.2 Target audience

As atoms and molecules are used to construct increasingly smaller structures, the properties of the resulting materials begin to diverge from those associated with macro-scale versions of similar materials. A significant increase in the ratio of surface atoms to core atoms within these materials leads to their behaviour being dominated by surface-chemistry. These characteristics create new opportunities of great economical, public and scientific interest, but also have potential consequences on the ability of synthetic nanomaterials to cause harm to humans and the environment in novel ways.

Once risk and opportunity parameters are more clearly understood, the prospective market potential of high-performance products based on nanomaterials is huge. Nanomaterials that are economically promising for the future include those that will have applications in information technology, electronics, building materials, household appliances, textiles, cosmetics, food, environmental technology and medicine.

The required knowledge exists in the Swiss research community and covers a wide range of disciplines and engages scientists from very different fields, such as natural sciences, chemistry, physics, medicine, biology, pharmacy, environmental sciences

and technologies, engineering sciences, material sciences and mathematics. These are present in different institutions of the ETH domain (ETHZ, EPFL, PSI, EMPA, EAWAG, WSL), the Universities of Basel, Bern, Fribourg, Geneva, Neuchâtel and Zurich, in several Universities of Applied Sciences as well as at the Swiss Centre for Electronics and Microtechnology (CSEM). This broad institutional coverage illustrates the high interdisciplinary nature of NRP 64 and will help establish the necessary close connection between basic and applied research within the programme. Consequently, it can also be expected that the programme will not only promote research in one of the key technology areas, but also foster education in interdisciplinary research and at the interface of basic research and industrial application.

5. Submission procedure

The implementation plan as well as the relevant instructions, regulations and forms for submission of proposals via the "mySNF" portal can be found on the website of the SNSF: www.snf.ch

A two-stage submission procedure will be used: pre-proposals are to be submitted first, followed by full proposals. Both the pre- and the full proposals must be written in English for screening and evaluation by a group of internationally recognised experts.

Pre- and full proposals must be submitted online via the "mySNF" portal. For submission via the "mySNF" portal, prior user-registration is needed and can be obtained from the homepage of the "mySNF" website: www.mysnf.ch. User accounts obtained in the past should still be valid and provide access to all the funding instruments of the SNSF. In order to submit within the deadline, a new user account has to be opened at least two weeks before the submission deadline. Submission of proposals by postal delivery is only accepted in exceptional cases and only after consultation with the SNSF.

Research projects must adhere to SNSF guidelines and must be limited to a period of no more than 36 months. Based on the evaluation of interim reports, the steering committee will decide whether individual projects can be extended for a maximum of 24 months.

Collaboration with research groups in other countries is highly valued if the planned cooperation brings significant added value or substantially enriches Swiss research in respect to content or methodology. For this purpose, the SNSF has completed agreements with various governmental funding agencies. In some cases, funding of the foreign research partner is possible. More information on these schemes can be found on the website www.snf.ch. The Secretariat is available to discuss with all parties involved which is the most suitable funding procedure for the foreign party in a specific research project.

SNSF funds awarded are exempted from VAT taxation (Federal law on VAT, [SR 641.20] art. 33, par. 6). Under the programmes supporting targeted research, the SNSF does not issue contracts but instead awards grants for the promotion of scientific research in Switzerland.

5.1 Pre-proposals

Interested researchers must first submit a pre-proposal. Deadline for submission is 14 January 2010. Pre-proposals should provide information on the following points:

A. To be submitted online, using the predefined form:

— Basic data and abstract

— National and international co-operations

— Estimation of financial support required for salaries and running costs (budget).

B. To be submitted as attachments and uploaded PDFs on the "mySNF" platform:

— Research hypotheses and objectives of the project

— State of research

— Methodology

— Timeframe and milestones

— Possible applications of results

— References

— A CV and list of the five most relevant publications, in the area of the application, for each applicant (maximum 2 pages each).

The project description described above must be submitted using the template document provided on the mySNF portal. The project description must be in English and the final PDF file should not exceed five pages.

Pre-proposals are subjected to international scientific peer review. Based on the reviewers' reports and its own evaluation, the steering committee will decide on which pre-proposals should be developed into full proposals (see the criteria listed below).

5.2 Full proposals

In the second stage of the submission procedure, the steering committee will invite the authors of the selected pre-proposals to submit detailed full proposals online via the "mySNF" portal (see above). Proposals must adhere to standard SNSF rules and guidelines.

All full proposals will be subjected to international peer review. Principal investigators will be invited to present their projects to the steering committee. Following the evaluation procedure, the steering committee will select the projects to be recommended for approval or rejection by the National Research Council (Division IV; Presidential Board).

5.3 Selection criteria

The Secretariat of Division IV will check that the proposals meet with formal criteria such as completeness of application, adequate formal presentation and submission within the deadlines. Applications that do not meet with these formal criteria will not be processed further.

Pre- and full proposals will be reviewed on the basis of the following criteria:

— **Scientific quality and originality**: pre- and full proposals should fulfil international state-of-the-art criteria with respect to scientific quality and originality as well as methodology.

— **Feasibility and compliance with the goals of NRP 64**: proposals should reflect the programme's scientific objectives, selection criteria and comply with its overall framework.

— **Application and implementation:** National Research Programmes should focus on relevant results/objectives leading to potential practical applications. Projects with practical relevance are therefore given higher priority.

— **Personnel and infrastructure**: Projects have to be carried out within a framework that provides adequate infrastructure and personnel.

6. Schedule and budget

The following schedule is foreseen for NRP 64:

Call for pre-proposals:	22 October 2009
Submission of pre-proposals:	14 January 2010
Invitation to submit full proposals:	mid April 2010
Final decision on full proposals:	end October 2010
Start of research:	1st December 2010

Funding for this NRP is CHF 12 million with a research duration of 5 years. Allocation of this funding between the different research modules and administrative activities is planned to be as follows:

Module 1: Medical applications	CHF 2'550'000.-, (21%)
Module 2: Environment	CHF 2'550'000.-, (21%)
Module 3: Food and consumer products	CHF 2'040'000.-, (17%)
Module 4: Energy and construction	CHF 2'040'000.-, (17%)
Module 5: Innovative nanomaterials	CHF 1'020'000.-, (9%)
Implementation and administration:	CHF 1'800'000.-, (15%)

7. Organisation

Steering Committee

Prof. Dr. Peter Gehr, Institute of Anatomy, Faculty of Medicine, University of Berne, CH, **(President)**

Prof. Dr. Vicki Stone, School of Life Sciences, Edinburgh Napier University, Edinburgh, UK

Prof. Dr. Ueli Aebi, M.E. Müller Institute for Structural Biology, Biozentrum, University of Basel, CH

Prof. Dr. Heinrich Hofmann, Powder Technology Laboratory, Institute of Material Science, EPFL, Lausanne, CH

Prof. Dr. Patrick Hunziker, Cardiology, Department of Internal Medicine, Cantonal Hospital Basel, CH

Prof. Dr. Andrew Maynard, Director, Risk Science Center, University of Michigan, Ann Arbor, MI, USA

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Prof. Dr. Peter Schurtenberger, Adolphe Merkle Institute, University of Fribourg, CH

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Dr. Marjory Hunt, Swiss National Science Foundation (SNSF), Berne

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Representatives of the Swiss Federal Administration
Dr. Christof Studer, Federal Office of Public Health FOPH (as of 1st. Nov. 2009), Berne

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