



Final Report

**COST Nanoscience and Nanotechnology Advisory Group
(NanoSTAG)**

**presented to the Committee of Senior Officials
at its meeting on February 6-7, 2003 in Strasbourg**

Preface

At its 139th meeting on March 16/17, 2000 in Brussels the Committee of Senior Officials (CSO) approved the terms of reference for the need for horizontal co-ordination and an interdisciplinary approach for the science of biomaterials COST Nanoscience and Nanotechnology Advisory Group (NanoSTAG) for a period of three years "to provide co-ordination of COST interests in interdisciplinary nanoscience".

Almost all COST member states strengthened significantly its support for national research activities in this emerging multidisciplinary field – resulting in even more COST Actions related to nanoscience and nanotechnology. The European Science Foundation (ESF), very active in this field since 2000 recently approved a Programme on Nanotribology and started a EUROCORES Programme on Self-Organised Nano-Structures. The European Community will provide increased funding of multinational research and networking through the multi-annual 6th Framework Programme of the European Commission e.g. in the Thematic Priority Area 3 “Nanotechnology and nanoscience, knowledge-based multifunctional materials and new production processes and devices”. The USA and Japan also intensified its research efforts - in the end all in order to create new products based on nanoscience and nanotechnology innovations.

This report reviews the NanoSTAG activities in the past three years, reflects the new situation, attributing nanoscience and nanotechnology research an even increased importance, and recommends to the CSO to take the appropriate measures to the benefit of the respective European research community and of COST.

The NanoSTAG asks the CSO to accept this report at its meeting on February 6-7, 2003 in Strasbourg.

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**Final Report of COST
Nanoscience and Nanotechnology Advisory Group (NanoSTAG)**

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1. Executive Summary and recommendation

The emerging field of nanoscience and nanotechnology research had been identified by the COST CSO in the mid 1990's. Due to its multi- and interdisciplinary character the greatest advances in this field are expected to occur at bridges between the classical disciplines represented within COST by the Technical Committees. Therefore the CSO set up in 1997 the Ad hoc Working Group on Nanoscience (AHGN), then in 2000 as follow up the Nanoscience and Nanotechnology Advisory Group (NanoSTAG), in order to stimulate and monitor activities in this field within COST as well as to look for synergy and complementarity to activities outside COST, especially in the Framework Programme of the European Commission. The mandate of NanoSTAG terminates in March 2003.

18 COST countries nominated experts to NanoSTAG. The NanoSTAG plenary meetings were also attended by up to 10 representatives from outside COST, mainly from the European Commission. National, European as well as outside European activities in the field of nanoscience and nanotechnology research were presented and discussed at those meetings. A new nanoscience information facility and service was created and centred upon a web site <http://www.nanoforum.org>. This initiative "**NanoForum**" is meanwhile transferred into a Thematic Network 2002-2007. It thus not only survives NanoSTAG but got much more responsibilities and impact in this field: one of the success stories of COST. The bridging between classical domains was encouraged by organising joint Working Group meetings with the participation of interested experts from COST Actions in the chemistry, materials, medicine & health and physics domain and again from outside COST. The preparation of these meetings was done by another subgroup of NanoSTAG "**NanoFuture**". In this way NanoSTAG met the need for stimulation and horizontal co-ordination of interdisciplinary nanoscience research within and outside COST. Commissioner Philippe Busquin acknowledged this initiative of NanoSTAG as it fitted "perfectly" within the **European Research Area** (ERA).

At a "brainstorming" meeting of NanoSTAG October 2002 different views on the need for **future strategies** for stimulation and horizontal co-ordination of interdisciplinary nanoscience and nanotechnology research were presented and discussed. In the form of a questionnaire the scenarios pro and contra a new COST ad hoc group were summarised and presented also to the Chairpersons of the relevant COST Technical Committees and Management Committees. A majority was in favour of a "new" ad hoc group: **Strategic Group on Nanoscience and Nanotechnology** (working title **NanoTech**). Actually, the key players of this "new" group are already active within COST, thus it is not a "new" group. But these experts need a clear mandate and a professional support.

Thus NanoSTAG recommends to create a **Strategic Group on Nanoscience and Nanotechnology** (working title **NanoTech**) for three years with the following composition and tasks:

Composition:

- experts from respective TC's and MC's (one each)
 - experts from FP6 and ESF
 - delegates from the CSO, including the SIG Chairperson
 - Scientific Officer from COST Scientific Secretariat (preferentially from the chemistry domain) with professional assistance to NanoTech
 - invited experts for specific topics
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- a subgroup of NanoTech may act as task force in order to prepare the NanoTech activities and disseminate its results
 - the profile of the experts should comprise:
 - expertise in the respective sub-field of nanoscience and / or nanotechnology
 - interest/expertise in research management strategies
 - commitment to act as Rapporteur between the respective committee and NanoTech.

Tasks:

- to promote COST interests in multidisciplinary nanoscience and nanotechnology research , more explicitly:
- to identify and to discuss emerging science-driven issues which could benefit from specific international co-operation, special attention is given to proposals from COST TC's and MC's
- to advice TC's, MC's and SIG and, where necessary, the CSO on such emerging issues
- to promote both scientific and organisational initiatives for interdisciplinary, multi domain activities within the COST scheme, taking into account its bottom up approach; e. g. to bridge between more basic research from physics, chemistry etc. and more applied research from materials, information technologies and medicine etc. in order e. g. to find future research directions and results and to gain experience
- to raise the interest of young researchers for nanoscience and nanotechnology by granting an award for outstanding diploma thesis'
- to identify possible links with other national & international organisations, networks and initiatives
- to cooperate with representatives from ESF, 6th Framework Programme on a regular basis in order to establish synergies and complementarities within the ERA, e.g. in the existing Commission' Interservice Group on Nanotechnology
- to set up a NanoTech web site with links to web sites of TC's and MC's of COST as well as to the Thematic Network NANOFORUM and its web site www.nanoforum.org

2. Introduction

2.1 COST Ad hoc Working Group on Nanoscience (AHGN)

In 1997 the Committee of Senior Officials (CSO) has taken the initiative, to explore how COST, the European Cooperation in the Field of Scientific and Technological Research, can act as a principal focus in Europe for **stimulation of new interdisciplinary collaborations in the emergent areas of nanosciences and nanotechnologies**, by bringing together an interdisciplinary, international ad hoc group of experts selected to cover the entire spectrum of nanosciences and nanotechnologies.

At its 130th meeting on 8-9 January 1998 at Brussels the CSO set up the Ad hoc Working Group on Nanoscience (AHGN) to consider the status and potential for further support to the nanosciences within the COST mechanism.

The **AHGN recommended** the following practical measures be implemented, as a matter of urgency:

- the design, development, implementation & subsequent support of an information and co-operation exchange - the “**COST NanoForum**”, including development of a directory of European nanosciences. The facility would create for the first time, a focused European gateway for access across the whole field, and provide a mechanism for further stimulation and realisation of co-operation opportunities in the emerging areas of nanosciences;
- the creation and support for a “**COST NanoFutures**” series of exploratory, interdisciplinary workshops - targeted towards stimulation of research in interdisciplinary aspects of the basic nanosciences. The workshops would respond to leading edge research questions of direct relevance to the core scientific and engineering disciplines of nanosciences.

The AHGN recognised that there is already nanoscience & technology related activity within the COST mechanism, and agrees that future developments must build on this experience. However, novel cross disciplinary stimulation will require more effective co-ordination across these domains.

The **AHGN therefore recommended**:

- the creation of a new nanoscience **co-ordination & advisory group (Nanogroup)**, accountable to the CSO and operationally distinct from the existing technical committee structures, but with a membership which adequately reflects the diversity of the field and of existing COST domains. The Nanogroup should also seek actively to reflect the interest and activities of other international fora and institutions, for example the EU Framework, ESF etc. Flexibility and efficiency of action should be more important than any mandatory representation across all member states of COST;

- the Nanogroup should itself have separate operational responsibility for development, management and implementation of the initiatives recommended in this report, including where appropriate, recommending of measures to stimulate areas of specific weakness.

2.2 The mandate for NanoSTAG

At its 139th meeting on March 16/17, 2000 in Brussels the CSO approved the terms of reference for the Nanoscience and Nanotechnology Advisory Group (NanoSTAG) "to provide co-ordination of COST interests in interdisciplinary nanoscience" (see annex I). The scientific and administrative support to NanoSTAG was provided by the COST Materials Secretariat of the Commission, Research Directorate-General.

The CSO thus followed in the essential points the recommendations of the AHGN.

A list of national delegates (and their representatives) to the NanoSTAG as well as representatives from the EU Commission is given in annex II.

2.3 Emerging topics in nanoscience and nanotechnology

Nanotechnology is not a new scientific discipline, it is a new way to put together classic academic disciplines such as physics, quantum mechanics, chemistry, biochemistry, complexity theory, electronics... in order to design materials, devices and functional systems with **extraordinary properties arising from the quantum nature and self-organisation phenomena characteristic of the nanoscale**.

The importance of nanotechnology has been clearly recognised within national programs and the EU Framework Programmes and important measures have been undertaken to promote its development. As an emerging field, however, of rapid and with implications impossibly to be foreseen, it needs continuous monitoring and the creation of efficient mechanisms to detect bottlenecks, propose solutions to the problems, identify emerging topics and opportunities or, on the contrary, detect open gaps and missing important activities. Such mechanisms should arise and actuate in the immediate proximity of the research activity and, therefore should be optimally situated within the COST (- ESF) frame.

Following paragraphs are some of the today observations, opportunities, bottlenecks and actions to be taken in consideration with respect to nanoscience and nanotechnology research.

The role of **chemistry** in Nanotechnology is of critical importance since chemistry acts as a link between other classical disciplines and is the fundamental tool for the "bottom-up" approach. For example, it is particularly obvious that self-assembly and molecular electronics greatly benefit from chemists experience and

know-how. The choice of promising molecules which can be used as electronic devices and the prediction of reactions taking place during self-assembly of molecules and nanostructures are two important assets which are in chemist's hands. However, to obtain reliable devices from self-assembled molecules and building blocks, chemists should understand the needs of electronics engineers. Conversely, to design and optimise devices according to the requirements of the microelectronic industry, scientists should know the possibilities offered by chemistry in order to play with the arrangement of molecules and to guide their self-assembly. Therefore, it becomes obvious that the route to success depends on the dialogue between chemists and electronic engineers. Coordination of the research and consolidation of the results from both sides are required.

But, chemistry also plays an essential part in the development of the "top-down" approach. Among many examples, it is worth while mention that improvement of the existing lithographic techniques to reach a resolution below 100 nm calls for the development of new resists, which is essentially dependent on polymer science progress. In this case also, a dialogue must be established between chemists and scientists working on lithographic techniques, materials irradiation, surface science, silicon technology and so on. Additional examples of the fundamental role of chemistry can be found in biotechnology, medicine, agriculture, etc.

Although coordination of efforts within the COST programme was necessary three years ago, it is now becoming even more critical because the field of nanotechnology has grown exponentially. This is now particularly obvious in chemistry which, at the beginning of "nanoscience" was not considered as a big player. Advancement of knowledge in nanoscience has recently revealed the key role of chemistry. The research efforts, booming in all fields, have gone far beyond the most optimistic estimations and now coordination of these efforts should be envisaged at a higher level.

The diversity of the approaches in nanotechnology and the broad range of disciplines involved are the promise of success with however a risk of over-diversification and duplication of efforts. A careful and methodical coordination at a high level should avoid this pitfall. The convergence of technologies and knowledge will open doors to success while a strong support of fundamental research at the intersections of fields remains a need not only for the scientific community but also for the society which is expecting rapid improvements in medicine, information technologies, transportation, safety, etc.

A bottleneck for the development of **nanoelectronics** in Europe in the next future will be the disparity of approaches between industry oriented research and academic research. The most powerful approach originates top-down, driven by the need of further scaling down the microelectronics circuitry. There is a lot of pressure, money, realism and engineering power behind this line. However, well established silicon microelectronics technologies and concepts, even in this highly innovative field, are inherently conservative and difficult to evolve towards novel nanotechnology concepts such as self-assembly and biomimetic processes. In other words, the top-down approach towards nanoelectronics is in the hands of engineers, not physicists, chemist or, in general, more fundamental researchers. A very remarkable effort to help orientating research has been carried out by the EU Commissions Information Science and Technology (IST) programme with the preparation of an excellent Nanoelectronics Roadmap. In contrast, the bottom-up approach, with much more

creative and risky proposals originating from the academic sector, lacks very often the necessary contact with reality in economic and production aspects. In Europe, it will be difficult to compete with the USA/Asian industrial developments with the top-down approach but, due to the high quality, size and creativity of the nanoelectronics academic community, there are many chances to be able to come up with relevant and competitive nanoelectronics developments. In particular, in the emerging new fields of spintronics and nanomagnetism, solid state quantum computing based on quantum dots, on superconducting devices, on electron or on nuclear spin, cellular automata, single photon sources for quantum cryptography, molecular electronics, polytronics, DNA computing, the future is absolutely open and the available man power very large in Europe. Support from the IST -FET initiative has been instrumental to develop those lines of research during past years, together with the other relevant EU Commissions Growth programmes and the COST Actions. The main gap between European and USA in the field of nanoelectronics is probably due to the European lack of rapid and effective interactions between the two approaches and respective research communities.

The interdisciplinary approach of biology, chemistry and material sciences is opening up a great variety of new opportunities for innovation in **nanobiotechnology**. Moreover, one of the most relevant areas of research will be at the interface between biology and solid state physics. One of the key challenges in molecular nanobiotechnology is the technological utilisation of self-assembly systems wherein molecules spontaneously associate into reproducible supramolecular aggregates ("Bottom-Up" Strategy). Self-assembly of molecules into mono-molecular arrays has grown into a scientific and engineering discipline that crosses the boundaries of several established fields. The attractiveness of such „Bottom-Up“ processes lies in their capability to build uniform, ultra small functional units and the possibility to exploit such structures at meso - and macroscopic scale for life and non-life science applications. In particular, biomolecules have a number of attributes making them highly suitable for use as building blocks in nanotechnology. The molecules of primary interest for mesoscale and macroscale biological assemblies are proteins, lipids, glycans and nucleic acids. Furthermore, the modification of biomolecules with specific functions is highly reproducible using either (classical) chemical methods, genetic engineering, or synthetic pathways. The immobilisation of biomolecules in an ordered fashion on solid substrates and their controlled confinement in definite areas of nanometer dimensions are key requirements for many applications including the development of bioanalytical sensors, biochips, molecular electronics, biocompatible surfaces, magnetic nano-carriers for controlled drug release and hyperthermia, for signal processing between cells and integrated circuits. It is anticipated that the incorporation of single or multifunctional domains in biomaterials opens a new horizon for the tuning of their structural and functional features. Nanobiotechnology provides a new tool kit in this research area based on the key capabilities of biomaterials. Moreover, it will lead to a paradigm shift in the way scientists do research since a broad range of knowledge has already been accumulated.

3. NanoSTAG activities

The NanoSTAG activities were discussed and decided in plenary meetings (see 3.1) and special meetings like joint Working Group meeting (see 3.2), presentation of national programs from non-COST countries (see 3.3), NanoForum (see 3.4) and NanoFuture (see 3.5) meetings - following the terms of reference.

A special activity was dedicated to the initiative of Commissioner Philippe Busquin **Towards a European Research Area**. The NanoSTAG stressed the importance of nanoscience and nanotechnology research in Europe and exemplified the COST NanoSTAG strategy (see the letter by the NanoSTAG Chairman in annex IV). In his reply Commissioner Philippe Busquin appreciated the initiative of NanoSTAG in the field of nanoscience and announced a workshop in October 2000 in Toulouse in order to define the main lines of a strategy for nanotechnology in Europe (see annex V). In its 6th Framework Programme the EU Commission selected nanotechnologies as one of the thematic priority areas (see annex VI).

During the period of the mandate of the NanoSTAG the number of COST Actions related to nanoscience and nanotechnology increased enormously. Table 1 lists all these Actions, some of which meanwhile terminated. The Actions come from information science & technology, materials, agriculture & biotechnology, medicine & health, chemistry and physics showing the multidisciplinary character of nanoscience and nanotechnology research. By far the most Actions come from the chemistry domain, not surprisingly, as most molecules have nanometer dimensions. NanoSTAG tried to cross-link those Actions in joint Working Group meetings (see 3.2).

Table 1: Nanoscience and nanotechnology related Actions within COST

		Domain	Duration	Sign.
265	Measurement techniques for active and passive fibres to support future telecommunication standardisation	Information S&T	12/98-12/02	14
268	Wavelength scale photonic components for telecommunications	Information S&T	8/98-8/02	22
288	Nanoscale and ultrafast photonics	Information S&T	Open for signature	
514	Ferroelectric thin films	Materials	5/93-5/99	16
518	Molecular materials and functional polymers for advanced devices	Materials	6/96-6/00	18
520	Impact of biofilm and biofouling on materials and processes	Materials	04/97-04/02	16
523	Nano-structured materials	Materials	02/98-02/04	17
525	Advanced electroceramics: Grain-boundary engineering	Materials	07/99-07/05	18
527	Plasma polymers and related materials	Materials	05/00-05/05	14

528	Chemical solution deposition of thin films	Materials	06/00-06/05	17
533	Biotribology, materials for improved wear resistance of total artificial joints	Materials	Open for signature	
840	Bioencapsulation innovations and technologies	Agriculture, Food Sciences & Biotechnology	12/98-12/03	21
853	Agricultural biomarkers for array technology	Agriculture, Food Sciences & Biotechnology	3/02-3/07	19
B11	Quantification of magnetic resonance image texture	Medicine & Health	3/98-3/02	13
B19	Molecular cytogenetics of solid tumors	Medicine & Health	9/00-9/05	17
D9	Advanced computational chemistry of increasingly complex systems	Chemistry	6/97-6/02	19
D11	Supramolecular chemistry	Chemistry	1/98-1/03	19
D14	Functional molecular materials	Chemistry	1/99-1/04	18
D15	Interfacial chemistry and catalysis	Chemistry	11/98-11/03	21
D17	Oligomers, polymers and copolymers via metal catalysis	Chemistry	11/99-11/04	19
D19	Chemical functionality specific to the nanometer scale	Chemistry	3/00-3-05	16
D22	Protein-lipid interaction	Chemistry	5/00-5/05	16
D24	Sustainable chemical processes: stereoselective transition metal-catalysed reactions	Chemistry	6/01-6/06	19
D25	Applied bio-catalysis: stereoselective and environmentally friendly reactions catalysed by enzymes	Chemistry	10/01-01/06	16
D27	Prebiotic chemistry and early evolution	Chemistry	2/02-2/07	17
P1	Soft condensed matter	Physics	7/97-7/01	22
P3	Simulation of physical phenomena in technical applications	Physics	9/97-9/01	18
P5	Mesoscopic electronics	Physics	10/98-10/02	16
P6	Magneto fluid dynamics	Physics	01/00-01/04	10
P7	X-ray and neutron optics	Physics	03/02-03/06	11
P8	Materials and systems for optical data storage and processing	Physics	03/02-03/06	16

3.1 Plenary meetings

There were six plenary meetings of the NanoSTAG. They are shortly reviewed in table 2. Special meetings like joint Working Group meetings, NanoForum and NanoFuture meetings are also mentioned in this table but are presented extensively in the next paragraphs.

Table 2: Meetings of NanoSTAG

Meeting	Date	Place	Focal points
1 st plenary	15.03.00	Brussels	Presentation of new mandate, Discussion of US Nanotechnology Report and White House Paper, presentation of the Irish Nanotechnology Initiative by Prof. Gabriel Crean, a respond to Commissioner Philippe Busquin to the announcement Towards the European Research Area was agreed upon (see annex IV)
2 nd plenary	22.05.00	Brussels	The coordination with FP5 and ESF activities was agreed upon, cluster of nano-related COST Actions were defined
NanoForum	14.07.00	Brussels	Further development of the information platform www.nanoforum.org for the NanoSTAG and discussion about a Thematic Network in Growth
3rd plenary	23.10.00	Brussels	Prof. Gabriel Crean was elected Vice-Chairman. Prof. Hans Hintermann gave a profound presentation of the Swiss National Science Foundation program in nanosciences
4th plenary	05.04.01	Brussels	Presentation of Actions from different domains: materials 518, 523, 525, chemistry D9, D11, D22 and physics P1; of FP5: technology roadmap for nanoelectronics (DG INFSO), and survey of networks in nanotechnology (DG RTD)
NanoFuture	14.06.01	Brussels	Preparation of joint Working Group meeting in Leuven
Joint Working Group meeting	29.10.01	Leuven	Joint Working Group meeting with presentation of Actions from different domains: materials 520, 523, 528, medicine & health B11, chemistry D14, D15, D17 and physics P5 as well as from invited experts – also on ethical legal and social aspects
5th plenary	30.10.01	Leuven	Presentation of national activities outside Europe, discussion on workshop on nanoelectronics
NanoFuture	10.12.01	Brussels	Preparation of workshop on nano-electronics in Porvoo
NanoForum	22.01.02	Brussels	Cooperation with planned Thematic Network NANOFORUM

6th plenary	25.10.02	Brussels	Brainstorming on future "monitoring" of nanoscience and nanotechnology activities within COST
Editorial board	13.01.03	Brussels	Analysis of questionnaire, conclusion and recommendation, editing of final report

3.2 Joint Working Group meetings

A Joint Working Group meeting was organised on October 29, 2001 at the Castle of Arenberg with strong organisational and hospitable support from the Catholic University of Leuven (KULeuven). The meeting was focused on four topics: Nanomaterials, simulation, nanometrology and legal, ethical and social aspects. The contributions came from COST chemistry, materials, medicine & health, physics, from NanoSTAG and from invited experts from outside COST. The presentations were discussed and put on the NanoSTAG web site www.nanoforum.org for further communication also with interested people from inside and outside COST.

Nanomaterials

"Nanomaterials and nanomanufacturing: challenges for Europe",
Arthur ten Wolde, VNO-NCW (NL)

"Single molecule studies" Frans de Schryver, (D14), KULeuven (B)

"Hybrid functional nanofilms by self-assembly and Langmuir-Blogett techniques with clay minerals" Robert Schoonheydt, (D15), KULeuven (B)

"On the role of self assembly in corrosion protection" Peter Nagy,
(NanoSTAG), Institute for Materials Science and Technology, Budapest (HU)

"Supercritical solvents for preparation of nanoparticles" Kjeld Schaumburg,
(D17, NanoSTAG), University of Copenhagen (DK)

"Fabrication of functional nanostructured materials using colloidal chemistry; challenges and restrictions" Heinrich Hofmann, (523), Ecole Polytechnique Fédérale de Lausanne (CH)

"Nanoceramics" Barbara Malič, (528), Jožef Stefan Institute, Ljubljana (SI)

"Probing the mechanical properties of carbon nanotubes" Chris Van Haesendonck, (P5, NanoSTAG), KU Leuven (B)

"Tailoring of nanoparticles for electronic application" Heinz Fissan,
(NanoSTAG), Gerhard Mercator University Duisburg (D)

"Nanoelectronics Research at IMEC" Marc Van Rossum, IMEC, Leuven, (B)

"Biobleaching - a result of interfacial processes between bacteria and metal sulfides" Wolfgang Sand, (520), University of Hamburg (D)

"Biomaterials: versatile building blocks in nanotechnology" Dietmar Pum, (NanoSTAG), Universität für Bodenkultur, Vienna (A)

Simulation

"Molecular dynamics computer simulations in nanostructured materials" Helena van Swygenhoven, (523), Paul Scherrer Institut, Villigen, (CH)

"Computational nanotechnology for information and communication technology" James Greer, National Microelectronics Research Centre, Cork, (IE)

Nanometrology

"Foreseen needs for metrology in support of nanotechnology" Kim Carneiro, Danish Institute of Fundamental Metrology, Lyngby (DK)

"Use of image quantification procedures including texture analysis for measurement in nanometrology" Richard A. Lerski, (B11), Ninewells Hospital and Medical School, University of Dundee, (UK)

Ethical, legal and social aspects

"Impact assessment of nanoscience and nanotechnology: mapping of uncertainty and ignorance" Roger Strand, Centre for the Study of the Sciences and Humanities, Bergen University (NO)

"Medical application of nanotechnology" Ineke Malsch (NanoSTAG), Malsch Technoevaluation, Utrecht (NL)

Another joint Working Group meeting was organised by the COST Materials Action 523 "Nano-structured materials" and the COST Physics Action P5 "Mesoscopic electronics" April 25-27, 2002 also at the Catholic University of Leuven. **"Individual and assembled nano-particles and quantum dots"** The main information is found on the web site: www.fys.kuleuven.ac.be/vsm/IANQ/main.html. More than 120 experts took part at this meeting - including invited speakers from USA and Japan.

3.3 Presentation of national research programs outside Europe

At the begin of the plenary meeting of NanoSTAG national research programs were presented on October 30, 2001 at the Castle of Arenberg, KULeuven: USA, Canada and Russia. These presentations were rounded by surveys from the European Commission, Information Society and Research.

"Strategy and Implementation of the National Nanotechnology Initiative"
Mihail C. Roco, Arlington, **USA**

"The Emerging Canadian Nanoscience and Nanotechnology Initiative"
Dennis Salahub, Ottawa, **Canada**

"Government Programs supporting Nanotechnologies in Russia"
Pavel K. Kashkarov, Moscow, **Russia**

"Nanoscience and nanotechnology at the European Commission"
Simon Bensasson, **DG INFSO**, Brussels
Heico Frima, **DG RTD**, Brussels.

3.4 Working Group NanoForum

Chairman: Prof. Saul Tendler, University of Nottingham (GB)

Background

In 1998 there was a decision by the COST Ad Hoc working Group on Nanoscience (AHGN) to create a new COST nanoscience information facility and service "NanoForum" centred upon a web site. "NanoForum" should meet the need for stimulation and horizontal co-ordination of interdisciplinary nanoscience research within Europe.

In 1999 a prototype was established <http://www.nanoforum.org> by Verein Deutscher Ingenieure (VDI), supported by a grant from the Commission (STY/99-4012).

In its mandate in 2000 the CSO asked NanoSTAG to go on with the NanoForum. The input from NanoSTAG members to NanoForum was limited e.g. on national activities on nanoscience research.

1. Meeting of NanoForum

The NanoForum subgroup of NanoSTAG met on July 14, 2000 in Brussels. There were representatives from NanoSTAG, Framework Programme: Quality of Life, Information Science and Technology and GROWTH; as well as from Euspen, Institute of Nanotechnology, VDI and the University of Nottingham. The main topic was how to create a better coherence amongst European networks and - particularly - web-sites on nanotechnology. There was the demand for a portal network / web-site on nanotechnology of clearly European dimension. The non-EC parties were encouraged to work on a proposal for co-operative action, and to submit it to a FP programme, most likely GROWTH. The base should be the NanoForum web site, however, with bigger critical mass and deliverables.

2. Meeting of NanoForum

A consortium - including some members of NanoForum - successfully applied for a Thematic Network in Growth (FP5) also called NANOFORUM, using the "same" web site www.nanoforum.org . However, the contract negotiations were not yet terminated at this date. (The effective start was in July 2002). Another success story for COST.

The NanoForum subgroup of the NanoSTAG met on January 22, 2002 in Brussels. There were representatives from NanoSTAG and Framework Programme GROWTH. It was agreed upon that NANOFORUM will provide a "window" for special events of the NanoSTAG - until the end of the mandate of the NanoSTAG. Later on NANOFORUM would be open for COST initiatives in the field of nanoscience and nanotechnology like for other national or European initiatives. It was clearly stated that NANOFORUM will not stimulate or coordinate nano - related COST Actions. Nevertheless, **there should be close links between future activities in COST and NANOFORUM to the benefit of COST.**

Some further information on NANOFORUM is given in Annex V.

3.5 Working Group NanoFuture

Chairman: Prof. Gabriel Crean, University of Corck (IE)

Background

The mandate for the NanoSTAG foresaw - similar to NanoForum - as follow up of the AHGN a subgroup dealing with exploratory, interdisciplinary workshops targeted towards stimulation of research in basic interdisciplinary aspects of nanosciences and leading to a coherent and dynamic European nanoscience landscape.

1. Meeting of NanoFuture

The NanoFuture subgroup of NanoSTAG met June 14, 2001 in Brussels. Dr. Gerd Bachmann, Prof. Gabriel Crean and Prof. Kjeld Schaumburg were present. The program of a joint Working Group meeting from different COST domains was drafted. It took place on October 29, 2001 at Castle of Arenberg of KULeuven (see 3.2, clearly a success story).

2. Meeting of NanoFuture

The NanoFuture subgroup (somewhat enlarged with further members from NanoSTAG) met again December 10, 2001 in Brussels - together with Dr. Ramon Compañó from DG INFSO. Dr. Compañó represents nanotechnology actions within DG INFSO and in particular all themes related to emerging devices. The DG INFSO activities in this respect are mainly clustered around the "Nanotechnology Information Devices (NID" initiative.

The main point was the discussion of a workshop on "Nano-electronics" in Porvoo (FIN), June 6-7. It was decided to merge this workshop - for mutual benefit - with the 10th meeting on "Nanotechnology Information Devices (NID)" July 1-3, 2002 in Helsinki, supported by DG INFSO. The focus of the workshop should lie on "molecular electronics" including polymer electronics as a scientific challenge to the advanced Si technology. At the end of the workshop there should be a panel discussion with representatives from different technologies in order to identify bottlenecks and propose solutions for the end of Moore's law? When will advanced EUV technologies be supporting Si technology down to 30 nm and molecular electronics stays with 15 nm where is the attractiveness of investing a lot of money in a completely new technology like molecular electronics? Multiple logic devices!?"

The COST contribution had to be cancelled due to limited input from the NanoFuture group and the NID event took place as an independent conference. In spite of the failed collaboration between COST and DG INFSO, both sides expressed their openness to organise a joint event in the future. As the NID workshops take place twice a year (February and July), Dr. Compañó offered to the COST representatives to join next events.

By written procedure the NanoFuture subgroup was discussing beginning 2002 a workshop on "Biological and pharmaceutical aspects of nanoscience" (BioMed) in Copenhagen (DK) September 3-5, 2002. Again to limited input from the NanoFuture group this workshop had to be cancelled.

3.6 Achievements compared to the mandate

The terms of reference COST 218/00 are reviewed and critically commented.

- NanoSTAG will draw initial expertise from amongst the members of the Ad Hoc Group for Nanosciences and Nanotechnologies (AHGN): *fulfilled*.
- NanoSTAG will ensure continuity through representation from relevant Technical Committees and Management Committees: *fulfilled to limited extent*.
- Scientific credibility will be maintained by supplementing when appropriate, with scientific expertise to cover the various fields in the nanosciences: *fulfilled*.
- NanoSTAG will seek representation from other international organisations and institutions with an active interest in nanosciences and technologies, for example the Framework Programme: *fulfilled*.
- the Commission COST Secretariat shall provide all necessary secretarial and administrative support to NanoSTAG: like for Actions, *fulfilled to limited extent*.
- Active members of 'NanoForum' and 'NanoFuture' initiatives shall be invited to continue with their participation: *fulfilled*.
- NanoSTAG should build on existing experience, activities and structures within

COST and, where feasible, outside COST: *fulfilled to limited extent*

- NanoSTAG shall provide co-ordination of COST interests in interdisciplinary nanoscience through:
 - identification of emerging science-driven issues which would benefit from specific international co-operation: *fulfilled to limited extent*.
 - provision of advice to the Technical Committees of COST and where necessary the CSO on such emerging issues, and to assist existing domains in more effective delivery of interdisciplinary co-operation: *fulfilled to limited extent*.
 - assistance to the Technical Committees and Actions in order to provide more effective co-ordination of activities across the nanosciences, and to identify opportunities for collective dissemination: *fulfilled to limited extent* (joint WG meeting, 523/P5)
 - to seek the widest expertise, comment and views on nanoscience issues and to develop COST as a focus for stimulation of interdisciplinary European co-operation in this emerging field: *fulfilled to limited extent*.
- NanoSTAG should have no responsibility for promoting new COST Action proposals, or in any way replacing or duplicating the functions associated with the existing Technical Committees. The principal mode of operation would be to assist existing structures, adopt and promote new interdisciplinary Actions, by focusing on broader co-ordination issues in a horizontal fashion: *fulfilled*
- The work of the NanoSTAG should build on deliverables proposed by the Ad Hoc Working Group on Nanoscience. NanoSTAG should assume a direct responsibility for the “steering” and validation of the ‘NanoForum,’ and ‘NanoFutures’ initiatives: *fulfilled*;

identify new national and international developments and give advice to both the Technical Committees and the CSO on how to deal with these development: *fulfilled to limited extent*.
- The work of the NanoSTAG should build on deliverables proposed by the Ad Hoc Working Group on Nanoscience. NanoSTAG should
 - create a comprehensive glossary of technical terms and definitions: *not fulfilled, as there are equivalent glossaries available (see e.g. the web site of ION <http://www.nano.org.uk> or PHANTOMS <http://www.phantomsnet.com>).*
 - establish a published series of periodic ‘state of the art’ reviews, focusing on emergent and interdisciplinary topics or addressing critical barriers in the science: *not fulfilled, as there are equivalent series available (see e.g. the web site of ION <http://www.nano.org.uk>).*
 - explore the benefits of introducing new COST nanoscience awards and ‘fellowships’ to extend and focus the existing short terms scientific missions

programme: *not fulfilled, as there are already many initiatives.*

- The realisation of deliverables should be subject to the financial constraints of COST. NanoSTAG should explore possibilities to secure additional resources from other programmes: *fulfilled to limited extend.*

- The results of the NanoSTAG shall be made available to all COST Member States: *fulfilled.*

"fulfilled to a limited extent" is due to missing the appropriate infrastructure and to decreasing enthusiasm among the NanoSTAG members in the last year of the mandate.

4. Future stimulating and monitoring of nanoscience and nanotechnology activities within COST

At the brainstorming meeting October 25, 2002 different views on the needs for future "coordination schemes" of nanoscience and nanotechnology activities inside (and outside) of COST were presented and discussed.

COST Technical Committee on Chemistry

Ladislav Petrus, on behalf of Gérard van Koten, presented the views of TC Chemistry. (Please see <http://www.unil.ch/cost/chem>). He emphasised the need for horizontal coordination of activities in order to create synergies, to initiate joint Working Group meetings or Workshops, to find and to practice a common COST strategy towards ESF and FP6.

COST Chemistry Action D 19 "Chemical functionality specific to the nanometer scale"

Marie-Isabelle Baraton presented the views of D 19. She emphasised the need for continuous personal contacts in order to cross scientific borders and to coordinate work sharing cooperation and dissemination of results and ideas and therefore pledged for a new (!) horizontal ad hoc group. However, a new ad hoc group should consist of very committed people from different disciplines in order to find a COST specific way in the exploding "nano-field" as well as to support the Actions and TC's to the benefit of the ERA. This means hard work! Therefore there must be an appropriate financial and logistic support of the ad hoc group.

COST Physics Action P5 "Mesoscopic electronics"

Poul E. Lindelof presented the views of P5. He recalled at first the interdisciplinary character of physics and the limited means of the COST scheme (meetings, STSM etc.) compared with an overwhelming administration by the Commission (RTD), which according to Prof. Lindelof would have been unbearable without the excellent work of the Scientific Secretaries in the COST organisation. At second he reminded that it was **a pioneering action of the CSO** to recognise this emerging field and to set up the ad hoc Nanoscience & Nanotechnology group (AHGN) January 1998 and then the Nanoscience and Technology Advisory Group (NanoSTAG) March 2000. However, the expectations were not fulfilled. On one hand the explosion of the "nano-field" overrun this initiative and the means of NanoSTAG

were no more the appropriate ones. On the other hand there is meanwhile multidisciplinary in each laboratory which exceeds a critical mass. Therefore he sees no need for a new ad hoc group. The TC's should take the appropriate initiatives for interdisciplinary coordination and strategy. The (saved) money should be given to the Actions. (Furthermore the bilateral East - West cooperation should be strengthened à la INTAS but including Western labs.)

COST Materials Action 523 "Nano-structured materials"

Heinrich Hofmann presented the views of 523. He admitted that coordination of multidisciplinary activities is difficult - but worthwhile. There were several joint working Group meetings of 523 with Actions in other COST domains (Physics, Medicine & Health), which were judged very successful as it stimulated new cooperations across the COST domains and common Expressions of Interests for the EU Framework Programme 6. There are now more and more national and international networks. COST as a whole should define its position and come up with an appropriate strategy. This task might be achieved by a new (!) ad hoc group.

COST Strategy Issues Group (SIG) of the CSO

Eberhard Seitz presented SIG on behalf of its Chairman John Bartzis. The main tasks of SIG concerning this brainstorming meeting are "assistance to TCs in the promotion and organisation of "cross boundary" workshops and seminars" and "Stimulation of joint activities with other European RTD fora" as well as to advise the CSO on the following issues: "- strategic and longer term issues concerning COST objectives, definition and /or implementation; - exploration of new frontiers in creative research."

Thus SIG could take over many tasks of a new COST ad hoc group in the "nano-field" together with more active TC's and MC's as well as with a more active use of the NANOFORUM web platform (if the composition of SIG would be appropriate. So far there is no permanent scientific representation e.g. from TC's and Scientific Secretaries, which appears to be necessary for long term strategic issues, its assessment, monitoring and evaluation. Personal opinion of E.S.)

COST Ad hoc Group on Biomaterials (BioMat) of CSO

Eberhard Seitz presented BioMat on behalf of its Chairman Luc P. Balant. There was at first the request from TC Materials (in close cooperation with TC Medicine & Health) for a coordination of biomaterials activities within COST. This was at second supported by seven other TC's and at third approved by the CSO in setting up a small (!) ad hoc group with rapporteurs from the relevant TC's (mostly its Chairpersons), some biomaterials experts, the Chairman of SIG and the Scientific Secretary (altogether 15). The main tasks are:

- identification of emerging science-driven issues which could benefit from specific international co-operation
- provision of advice to TC's of COST and, where necessary, the CSO on such emerging issues
- assistance to existing domains in more effective delivery of interdisciplinary co-operation
- identification of the possibilities of co-operation to promote both scientific and organisational initiatives from COST, taking into account its bottom up approach.
- identification of the possible interlinks with other national & international

- organisations and initiatives
- BioMat shall deliberate on the possibility of creating a biomaterials information facility and service.

BioMat could serve as a model also for handling the "nano-field".

Framework Programme 6, DG Research

Ben Tubbing presented the nanoscience and nanotechnology activities in the European Commission, DG RTD. He referred to the web site www.cordis.lu/nanotechnology which provides up to date information. He explicitly mentioned not only the new instruments Integrated Projects and Network of Excellence but also the targeted (smaller) research projects dealing with more risky research topics and smaller project groups.

Framework Programme 6, DG Information Society

Ramon Compañó presented specific examples of running and finished DG INFSO projects. He presented the "Nanotechnology Information Devices" (NID) initiative and he invited interested COST members to join. Although the running IST projects do not accepted novel contractors, this is not true for the Nanoelectronics Network, called PHANTOMS, that regularly accepts novel members. The current PHANTOMS network is planned to become a legal entity in the near future, being established as non-for-profit organisation at the services of scientist. Nanotechnology research groups contributing to information processing or storage are invited to send their application to (www.phantomsnet.coM) and benefit for free services. The last service introduced is a software hub for modelling devices at the nanoscale. The so-called PhantomsHUB (www.phantomshub.com) comprises currently more that ten simulation codes which can be tested online.

Although a first attempt to organise a common event failed in the past, **NanoSTAG and the IST representatives** repeated their **interest to collaborate** in the future.

General discussion

The achievements of the NanoSTAG, its strengths and weaknesses, as well as the pros and cons for a new (!) COST "nano-group" were discussed. Finally it was decided firstly to ask every participant to name

- 1) 3 major strengths and weaknesses of the NanoSTAG,
- 2) 3 scenarios for future monitoring,
- 3) how should the scenario be implemented.

Secondly, in order to enlarge the basis for a recommendation to the CSO to contact those who are now responsible for nanoscience and nanotechnology activities within COST, namely the respective TC and MC Chairpersons.

There was no doubt that the chemistry domain should play a major role in future horizontal "nano-activities" within COST.

4.1 Scenarios for future management of nanoscience and nanotechnology activities within COST

The results from this first questionnaire to the NanoSTAG members: **Advantages and Disadvantages, Future Scenarios, Means**, are summarised as follows:

4.1.1.a) What are the major advantages of the NanoSTAG?

- The multidisciplinary character and easy information transfer between different COST domains; e.g. transdisciplinary workshops and the presentation of the achievements of national programmes and networks (e.g. realised in the KULeuven meeting 28.-29.10.01).
- The representation of most disciplines dealing with nanoscience and nanotechnology research by professional experts.
- The repetitive personal contacts among the delegates to the NanoSTAG. These delegates being the spear heads of their nations with respect of information gathering and distribution could play an important role in their own countries in catalysing contacts between their own scientists with potentially interesting colleagues of other countries, thus intensifying their own relations network.
- The intensive and permanent contact to FP5 representatives.
- The Thematic Network "NANOFORUM" in FP5 based on preparatory work from the NanoSTAG subgroup NanoForum and its experience with the NanoSTAG web site www.nanoforum.org.
- The professional support by a Scientific Secretary.
- The (principal) possibility to implement new interdisciplinary topics, beside the "classical" ones, promoted by COST Technical Committees.

4.1.1.b) What are the major disadvantages of NanoSTAG?

- Life sciences, like biophysics, biochemistry, microbiology and medicine, as well as industrial expertise were not sufficiently enough represented in NanoSTAG.
- Only a few delegates were really engaged in the NanoSTAG activities, some just waited on something to happen.
- With the cancellation of the announced workshops on nanoelectronics and biomedical applications, due to the lack of engagement, the NanoSTAG lost the option of establishing itself as organiser for a series of highly ranked European workshops (started with the Leuven meeting).
- The communication between delegates in between the meeting was weak.
- The cooperation with European national communities was weak, the NanoSTAG was not visible.
- The „service activity“ for CSO, TC's and MC's was poor with respect to coordination of cooperation between domains and Actions, evaluation of new, running

and terminating Actions, periodic “state of the art“ reviews focusing on interdisciplinary topics, creation of a database of technical terms and definitions.

- One or two meetings per year proved to be insufficient to ensure an efficient work and close cooperation between members.
- The electronic communication possibilities were not enough exploited.

4.1.2. Which scenarios/missions do you propose for future monitoring?

Preface:

The field of nanoscience and nanotechnology changed dramatically during the last few years. Therefore if there is a new horizontal activity like the NanoSTAG it should be adapted to these changes:

- Almost all European countries have national programs dedicated to nanoscience and nanotechnology research.
 - There are more COST Actions in different COST domains dealing with nanoscience and nanotechnology research aspects.
- The 5th Framework Programme of the Commission approved the above mentioned Thematic Network NANOFORUM which partly fulfils the NanoSTAG tasks.
- The 6th Framework Programme of the Commission explicitly mentions nanoscience and nanotechnology as one of its thematic priority areas, a call will include Integrated Projects as well as Networks of Excellence.

Furthermore there is the new Strategy Issues Group (SIG) of the CSO as platform also for interdisciplinary communication within COST.

Scenarios:

Pro:

Further strengthening of COST in this field necessitates a new horizontal activity servicing CSO, TC's and MC's as well as its European research community.

New tasks:

- give evidence of complementarities and synergies within different national activities and promote international cooperation on selected topics, in view of the fact that some progress has been made, however, being still at the very beginning,
- develop COST as a focus for stimulation of interdisciplinary European cooperation in the field of nanoscience and nanotechnology research,
- evaluate new proposals, running and terminating COST Actions, from the point of view of interdisciplinarity and coordination - in close cooperation with the respective TC and with the SIG,
- organise multidisciplinary workshops, with invited lecturers on selected (“hot”) topics, especially those developed by COST Actions, further meetings in series as already initiated with the Leuven meeting,
- strengthen the presence of COST in the development of a coherent European nanoscience and nanotechnology research,
- inform regularly the members of the European Parliament and decision making members of Governmental Offices on the importance of Nanotechnology and

progresses made - in their own countries, on a European level, world-wide. Develop the form and language to reach these people.

- prepare regularly a short paper in easily readable and understandable language with picture(s) and graph(s) which shows the progress made on the worlds scene in general and on the European and national scene in particular. But: non multa, sed multum, i e just enough that governmental people want to read it. One double page should be enough, but issued several times a year, not just once - in order to keep them interested in the matter.

- stimulate research and cooperation in interdisciplinary areas, towards new frontiers of nanoscience and nanotechnology, as a follow-up of the above meetings,

- encourage respective achievements in education, e.g. involvement of students and young researchers, PhD fellows,

- strengthen the cooperation with FP6 in order to improve synergy and complementarity in the European Research Area, investigate emerging topics especially those where no Integrated Project nor Thematic Network will be active,

- study and maintain a monitoring position on the special nanoelectronic problem (see 2.3) in order to initiate adequate actions, thus the scientific leaders of the main EU funded nanoelectronics networks and the new Intregated Projects should be present or invited to the new horizontal group. This holds also for other "emerging" topics on one hand and for the new Networks of Excellence and its representation as well.

- use the Thematic Network "Nanoforum" with its web site www.nanoforum.org as permanent platform for all its ("new NanoSTAG") activities.

- improve the selection of people to be their countries delegates. It is not enough to have just a delegate at NanoSTAG, inactive there and inactive in their home-country, but at least represented. That cannot be it.

Contra:

There is no need for a new horizontal group within COST.

COST TC's and MC's take advantage of all cross fertilisation and coordination (joint activities) with other TC's and MC's where and when they feel it necessary and feasible. This is its genuine responsibility. They use the new Strategy Issues Group (SIG) of the CSO as platform for communication within COST. They use their own web sites and the new Thematic Network NANOFORUM and its web site www.nanoforum.org as platform for the communication with interested experts outside their TC's or Actions.

4.1.3 How should this scenario (pro) be implemented (participation, composition etc)?

There should be a clear definition of the tasks and deliverables, a time schedule and milestones, for a three years period of this new working group (WG).

This WG should be much smaller than NanoSTAG, i.e. up to 15-18 experts, and meet at least three times per year.

TC's and MC's should send delegates to this WG. These delegates form the core group. These delegates should be "proactive" Rapporteurs between the WG and their committees, with clear expertise and responsibility not only in interdisciplinary nanoscience and nanotechnology research but also in its professional and strategic management, furthermore well informed about their own national programs i.e. act also Rapporteur for their countries (mandate from CNC's).

Chair and Scientific Secretary might come from the COST domain with most activities in nanoscience and nanotechnology, i.e. chemistry.

A program committee (5 people) should be established and should be responsible for preparing the meetings and the dissemination of the results.

Further experts, with different nationality than the core group members, might be nominated by the CSO/CNC, acting as Rapporteurs for their countries. Together with the core group they form the plenary group. They will be informed about the WG activity at the yearly plenary meetings and via electronic communication, especially the WG web site.

The secretarial and financial support should be similar to that for MC's, i.e. including the organisation of joint Action or WG meetings and workshops, with invited external experts, with STSM between different Actions and domains, with publishing and dissemination.

Travelling costs of "further experts" might - as a second choice - come from national sources, which would then strengthen the relation to the national communities.

4.2 Questionnaire to TC and MC Chairpersons

An extract of the scenarios for future management of nanoscience and nanotechnology research activities within COST was transmitted to relevant TC and MC Chairpersons for further discussion:

Pro: (new) Strategic Group on Nanoscience and Nanotechnology (working title NanoTech)

- **composition:** experts from respective TC's and MC's (one each)
delegates from FP6 and ESF
delegates from CSO, SIG Chairperson
invited experts from outside COST for specific topics
a subgroup of NanoTech may act as task force
- **task:** to promote COST interests in multidisciplinary nanoscience and nanotechnology research , more explicitly
- to identify emerging science-driven issues which could benefit from specific international co-operation
- to advise TC's, MC's and SIG and, where necessary, the CSO on such emerging issues
- to promote both scientific and organisational initiatives for interdisciplinary, multi domain activities within the COST scheme, taking

- into account its bottom up approach
- to identify possible links with other national & international organisations, networks and initiatives
- to set up a NanoTech web site with links to web sites of TC's and MC's of COST and - most important - to the Thematic Network NANOFORUM and its website

Reply from TC and MC chairpersons

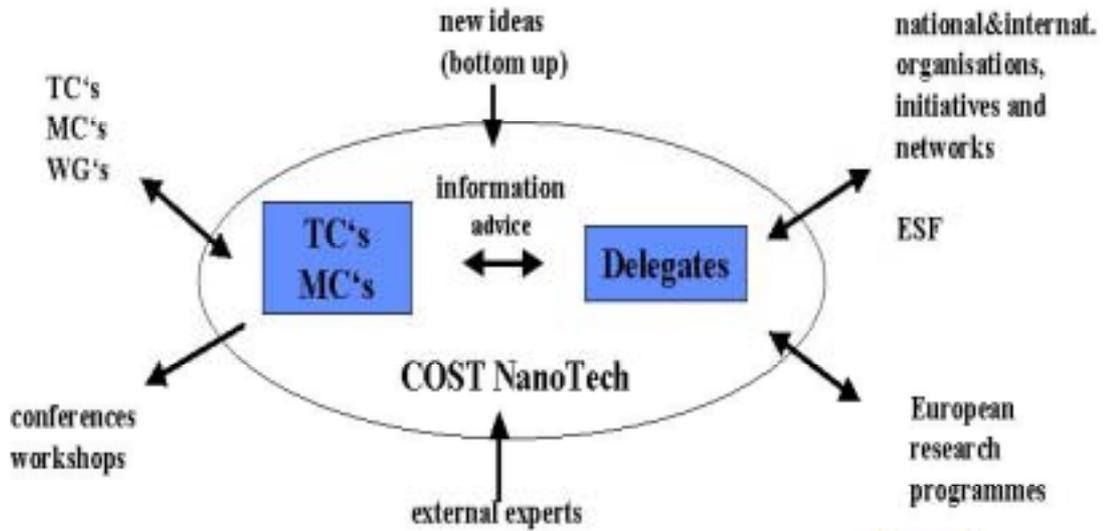
Most of the TC and MC chairpersons were interested in participating in a new horizontal group like NanoTech and will send a delegate from its committee. The profile of this delegate was "sharpened" during the discussion with the chairpersons:

- expertise in the respective sub-field of nanoscience and / or nanotechnology
- interest/expertise in research management strategies
- commitment to act as Rapporteur between the respective committee and NanoTech.

The new group NanoTech was also called "think tank", "brainstorming" or "innovation" committee. To come up with strategies was felt more important than coordination. It should not try to "manage" the whole vast field of nanoscience and nanotechnology but rather concentrate on a few horizontal topics, to be defined by the group. The paperwork of NanoTech members should have a "low profile".



Strategic Group on Nanosciences and Nanotechnologies **NanoTech**



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EUROPEAN COMMISSION
RESEARCH DG - EUROPEAN RESEARCH AREA : STRUCTURAL ASPECTS

COST

November 29, 2002

Contra:

TC's and MC's do not see the necessity for a supplementary Strategic Group on Nanoscience and Nanotechnology NanoTech.

They manage all multidisciplinary topics themselves and co-operate with SIG (with different composition).

Reply from TC and MC chairpersons

One TC chairperson, who is not in favour of a new horizontal group, fears interference with TC responsibilities (though the task of NanoTech clearly excludes this interference - like in the case of BioMat). This chairperson instead suggests to transmit the task of horizontal strategies, coordination etc in the field of nanoscience and nanotechnology to one TC (without saying to which TC).

One MC chairperson instead of a new group suggests cluster meetings between different Actions.

4.3 Synergy and complementarity with ESF and FP6

The term "synergy" is used in the positive sense of added value through coordination / integration. The term "complementarity" characterises a dynamic process of complementing each other, which assumes a sound knowledge and respect. Synergy and complementarity have to be explored and exploited.

European Science Foundation (ESF)

Key player is the ESF Standing Committee for Physical and Engineering Sciences (PESC) with:

New programs:

Nanotribology (NANOTRIBO)

Exploratory workshops in 2003

Atomistic modelling of growth, structure and electrical properties of high-k gate dielectrics

Perspectives and applications of oxide-based ultra-thin films and nanoparticles

Liquid crystal colloid dispersions

Microwave and optical behaviour of nanogranular ferrioxides

ESF Collaborative Research Programs (EUROCORES)

Self-organised nano-structures (SONS)

There are "Forward Look" activities planned in "Nanosciences and the future development of IT" as well in "Nano-medicine". For updated information please see www.esf.org

Survey of Networks in Nanotechnology by the EU Commission

The development of a strong European position in the field of nanoscience and nanotechnology and the establishment of a European nanotechnology industry, requires a concerted approach at the European level.

The **European Commission** is committed to supporting the development of a real **European Research and innovation Area (ERA)**. This ambitious project places a strong emphasis on the establishment of a coherent and optimised use of European research resources. **Research networking**, which facilitates the development of synergistic interactions, in particular between EU and Member State activities, will play a prominent role therein.

In this context the European Commission's Fifth Framework Programmes Growth, Quality of Life and IST, launched a survey to identify the state-of-the-art of networking in nanotechnology in Europe. The survey has three principal objectives:

- To provide a service to the scientific community, by providing information about "who does what and where".
- To collect information which will be of use to research policy making in relation to the development of the ERA, by the EU or by Member-States or Associated States.
- To facilitate co-ordination of research activities and information exchange between organisations and administrations.

An electronic questionnaire was developed. It was distributed through members of the respective Programme Committees, National Contact Points, nominated contact persons - and the COST Secretariat.

A dedicated database has been built. Data have been analysed and validated in direct contact with the co-ordinators of the networks. The results were firstly published in May 2001, the last (updated) publication was in May 2002, at which time the database contained 86 national and international networks. The data are published in the form of a down-load ZIP file on the Commission web-site www.cordis.lu/nanotechnology.

The data for these networks consists essentially of:

- **General information:** network name, objectives and co-ordinator information
- **Scientific information:** areas of nano-science / technology addressed
- **Partner information:** detailed information on partners for networks

Among the 50 **international networks** there are 16 managed by the Commission, including **15 COST Actions**. (Unfortunately the input and the updating of the relevant data from COST Actions was limited.)

This effort by the Commission was very helpful for those European researchers (before June 7, 2002) submitting expressions of interests for the 6th Framework Programme, especially for networks of excellence. Finally, once more with the call for proposals for networks of excellence (but also for integrated projects) for the 6th Framework Programme, launched by the Commission December 17, 2002, **the**

creation of international networks in the field of nanoscience and nanotechnology was enormously stimulated.

Further information on nanoscience and nanotechnology activities in the 6th Framework Programme is given in Annex V.

ESF, EU FP6 and COST

These initiatives from the ESF and the Commission indeed call for a **common strategy on synergy and complementarity** with COST activities in the field of nanoscience and nanotechnology.

It is not enough to have guest speakers from the corresponding programs/initiatives - like in the past (at COST TC Materials and Physics). Also the (one way) formal procedure of interservice consultation, asking the Commission for comments on proposals for a new COST Action is, - though necessary - is also not sufficient (and unsatisfactory as there is no consultation of e.g. COST TC's by the Commission).

A real (permanent) **cooperation between responsible persons** is necessary in order to establish complementary and synergy and to benefit from it.

The meetings of an **informal Interservice Group on Nanotechnology** on a monthly or two monthly basis, attended by Commission officials related to nanotechnology from different units in DG Research and DG Information Society - including the SO for COST NanoSTAG - , might serve as example for a platform of exchange of information. All main Commission activities (e.g. the network initiative, the brochure on nanotechnology, the web site on nanotechnology, the call for EoI, its analysis) were - at least shortly - informally (!) discussed (in order to reach common understanding between DG RTD and DG INFSO, a very good practice!). Now, being no more managed by the Commission, **COST would be out of this cooperation/coordination**, if there would be no special request from COST/ESF.

The Thematic Network NANOFORUM could be used as platform - not only for stimulation and horizontal co-ordination of interdisciplinary nanoscience research within Europe - but also for communicating nonconfident results of those interservice group meetings. (See also annex V).

Thus "the wheel has not to be invented once more" for the cooperation/coordination of COST activities with ESF and FP6 activities in the field of nanoscience and nanotechnology, however, before talking to responsible persons at ESF and FP6 **COST should come up with a common strategy!** A new advisory group with appropriate tasks might be helpful. Representatives from ESF and FP6 welcomed such an initiative.

5. Recommendation for a new Strategic Group on Nanoscience and Nanotechnology (NanoTech)

The Nanoscience and Nanotechnology Advisory Group (NanoSTAG):

considering that:

- Almost all COST member states strengthened significantly its support for national research activities in the field of nanoscience and nanotechnology research, in the end in order to create new products based on nanoscience and nanotechnology innovations
- There is an increasing number of COST Actions related to this field - already strengthening the ERA - and an interest of respective TC and MC Chairpersons in a horizontal strategic coordination
- The CSO is improving the COST mechanisms, especially the restructuring the scientific domains, according to the Assessment Panel Report
- The European Science Foundation (ESF), active in this field since several years recently approved a Programme on Nanotribology and started a EUROCORES Programme on Self-Organised Nano-Structures
- The European Community will provide increased funding of multinational research and networking through the 6th Framework Programme of the European Commission e.g. in the Thematic Priority Area 3 “Nanotechnology and nanoscience, knowledge-based multifunctional materials and new production processes and devices”
- There are synergies and complementarities especially to ESF and Commission activities in this field to be exploited to the benefit of the ERA

recommends to the CSO to set up for a three years period a

Strategic Group on Nanoscience and Nanotechnology (working title NanoTech)

- composition:

- experts from respective TC's and MC's (one each)
- experts from FP6 and ESF
- delegates from the CSO, including the SIG Chairperson
- Scientific Officer from COST Scientific Secretariat (preferentially from the chemistry domain) with professional assistance to NanoTech
- invited experts for specific topics

- a subgroup of NanoTech may act as task force in order to prepare the NanoTech activities and disseminate its results
- the profile of the expert should comprise:
 - expertise in the respective sub-field of nanoscience and / or nanotechnology
 - interest/expertise in research management strategies
 - commitment to act as Rapporteur between the respective committee and NanoTech.

- **task:** to promote COST interests in multidisciplinary nanoscience and nanotechnology research , more explicitly:
 - to identify emerging science-driven issues which could benefit from specific international co-operation, special attention is given to proposals from COST TC's and MC's
 - to advise TC's, MC's and SIG and, where necessary, the CSO on such emerging issues
 - to promote both scientific and organisational initiatives for interdisciplinary, multi domain activities within the COST scheme, taking into account its bottom up approach; e. g. to bridge between more basic research from physics, chemistry etc. and more applied research from materials, information technologies and medicine etc. in order e. g. to find future research directions and results and to gain experience
 - to raise the interest of young researchers for nanoscience and nanotechnology by granting an awards for outstanding diploma thesis'
 - to identify possible links with other national & international organisations, networks and initiatives
 - to cooperate with representatives from ESF, 6th Framework Programme on a regular basis in order to establish synergies and complementarities within the ERA, e.g. in the existing Commission' Interservice Group on Nanotechnology
 - to set up a NanoTech web site with links to web sites of TC's and MC's of COST as well as to the Thematic Network NANOFORUM and its web site www.nanoforum.org

6. Concluding remarks

The COST Nanoscience and Nanotechnology Advisory Group (NanoSTAG), as an initiative of the Committee of Senior Officials (CSO), made a successful second step along the road to the creation of a more coherent European community of the field of nanoscience and nanotechnology research. A number of personal observations made along the way are worthy of mentioning. These include:

- the fact that the NanoSTAG itself, has been a success by drawing together experts from 19 European countries - both inter-, multi- and transdisciplinary and forward looking as well as experts from the EU Framework Programme and ESF;
- the establishment of an own web site www.nanoforum.org as communication platform and the organisation of several meetings where experts from different Actions of different domains exchanged their views, once including experts from outside COST (USA, Canada and Russia). By this means the NanoSTAG has re-affirmed the potential for COST to play a key role in the creation of a European nanoscience and nanotechnology community;
- recognising the enormous stimulation of research networks in this field by the EU Commission's calls for expression of interests and for proposals for the 6th Framework. Nevertheless, due to an increased but still limited budget for this field several good (!) proposals will not be supported. COST should develop a strategy - together with others - support some of these or part of these bottom up initiatives under the slogan "small is beautiful" and COST is flexible;

On a personal level, I would like to say that I was honoured to chair NanoSTAG. I have been gratified by the goodwill and enthusiasm shown by many of the members of the NanoSTAG. I am convinced of the importance of this field, both in terms of future nanoscience research potential and of the potential future benefits through the application of nanotechnology research, at a European level. Nevertheless it is a good practice to hand over the chairmanship after a period of time. As to my view, the chemistry domain should (again) play a prominent role.

I would like to pass on my thanks to the Commission COST Secretariat for its essential support, at the beginning by Dr. Oliver Pfaffenzeller, then mainly by Dr. Eberhard Seitz, and would recommend unreservedly, both this report and all its recommendations to the Committee of Senior Officials.

Prof. Dr. Jaroslav Cihlar



Annexes

Annex I Mandate of NanoSTAG

**European Cooperation
in the field of Scientific
and Technical Research
- COST -**

Secretariat

**Brussels, 1 March 2000
(OR. en)**

COST 218/00

NOTE

Subject : Draft Terms of Reference of the COST Nanosciences and Technology Advisory Group (NanoSTAG)

1. The NanoSTAG is created for a period of three years, starting with the day of the approval of the mandate.

The CSO will decide whether to extend the mandate of the NanoSTAG for an additional period of time and, in that case, review these Terms of Reference, subject to a satisfactory evaluation of the work of the Group and an impartial and independent assessment of the need to continue such a Group.

2. The NanoSTAG will report to the CSO on an annual basis.
3. The NanoSTAG will elaborate a work programme for the period of the mandate.
4. The NanoSTAG will be composed along the following lines
 - the NanoSTAG will draw initial expertise from amongst the members of the Ad Hoc Group for Nanosciences and Nanotechnologies (AHGN), and
 - will ensure continuity through representation from relevant Technical Committees and Management Committees.

- Scientific credibility will be maintained by supplementing when appropriate, with active scientific expertise sufficient to cover the varied fields in the nanosciences;
 - the NanoSTAG will seek representation from other international organisations and institutions with an active interest in nanosciences and technologies, for example the Framework Programme;
 - the Commission COST Secretariat shall provide all necessary secretarial and administrative support to the NanoSTAG;
 - active members of the ‘NanoForum,’ and ‘NanoFutures’ initiatives shall be invited to continue with their participation.
5. The Group should build on existing experience, activities and structures within COST and, where feasible, outside COST.
 6. The Group shall provide co-ordination of COST interests in interdisciplinary nanoscience through:
 - identification of emerging science-driven issues which would benefit from specific international co-operation;
 - provision of advice to the Technical Committees of COST and where necessary the CSO on such emerging issues, and to assist existing domains in more effective delivery of interdisciplinary co-operation;
 - assistance to the Technical Committees and Actions in order to provide more effective co-ordination of activities across the nanosciences, and to identify opportunities for collective dissemination ; and
 - to seek the widest expertise, comment and views on nanoscience issues and to develop COST as a focus for stimulation of interdisciplinary European co-operation in this emerging field.
 7. The Group itself should have no responsibility for promoting new COST Action proposals, or in any way replacing or duplicating the functions associated with the existing Technical Committees. The principal mode of operation would be to assist existing structures, adopt and promote new interdisciplinary Actions, by focusing on broader co-ordination issues in a horizontal fashion.
 8. The work of the NanoSTAG should build on deliverables proposed by the Ad Hoc Working Group on Nanoscience. It should
 - assume a direct responsibility for the “steering” and validation of the ‘NanoForum,’ and ‘NanoFutures’ initiatives;
 - identify new national and international developments and give advice to both the Technical Committees and the CSO on how to deal with these development;
 - create a comprehensive glossary of technical terms and definitions;

- establish a published series of periodic ‘state of the art’ reviews, focusing on emergent and interdisciplinary topics or addressing critical barriers in the science;
 - explore the benefits of introducing new COST nanoscience awards and ‘fellowships’ to extend and focus the existing short-term missions programme.
9. The realisation of deliverables should be subject to the financial constraints of COST. The Group should explore possibilities to secure additional resources from other programmes.
 10. The results of the Working Group shall be made available to all COST Member States.
-

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Annex III National Programmes and web sites

Austria:

<http://www.bit.ac.at/Nanotechnologie>

Belgium:

Université Catholique de Louvain

<http://www.nano.be>

Katholieke Universiteit Leuven

<http://www.fys.kuleuven.ac.be/vsm/ini>

Finland:

http://www.tekes.fi/julkaisut/Nanotechnology_Final_Report.pdf

VTT and eight Universities are carrying nanoresearch, together with around 20 companies

France:

Le club nanotechnologie: <http://www.clubnano.asso.fr>

Réseau de recherche en Micro et Nano Technologies: <http://www.rmnt.org>

Minattec : Pole d'Innovation en Micro et Nanotechnologies. MINATEC, CEA Leti, INPG, Grenoble, France: <http://www.minattec.com/index0.htm>

F. R. Yugoslavia:

www.ff.bg.ac.yu/QMF/qsq.htm

www.phy.bg.ac.yu/people/z_popovic.html

Germany:

Information on nanotechnology

<http://www.vdi.de/vdi/organisation/schnellauswahl/techno/arbeitsgebiete/fue/physik/02055/index.php?param=physik>

<http://www.vdi.de/vdi/organisation/schnellauswahl/fgkf/kfnt/index.php>

Publication on nanotechnology

<http://www.nanonet.de/nanode/index.php3?br=veroeffentlichung&a=NanoDE&b=BMBF-Veroeffentlichungen&nav=nav7>

<http://www.nanomat.de>

Duisburg

<http://www.uni-duisburg.de/FB9/AMT>
<http://ttphysik.uni-duisburg.de/sfb445/welcome.html>

Hungary:

- University of Debrecen
- Eötvös Loránd University
- Research Institute for Technical Physics and Materials Science
- Chemical Research Center Hungarian Academy of Sciences
- Bay Zoltan Foundation for Applied Research

Italy:

NEST: the National Enterprise for nanoScience and nanoTechnology
(National research centre dedicated to nanoscience and nanobiotechnology)
www.nest.sns.it

NNL: National Nanotechnology Laboratory
(Cross-disciplinary nanotechnology facility for nanometer scale research)
www.nnl.it

The Netherlands:

National research programme in nanotechnology, NanoImpuls, approved in December 2003. The programme will be co-ordinated by the Applied Research council STW www.stw.nl. The three main nanotechnology centres of excellence in the Netherlands will receive funding to improve their infrastructure and do research:

MESA+ Research Institute at the University of Twente, www.mesaplus.utwente.nl

DIMES at the University of Delft www.tudelft.nl

Biomade linked to the University of Groningen www.biomade.nl

Other Universities and the research centre TNO will participate in the NanoImpuls programme.

There is another large program NEXT at the University of Delft www.dimes.tudelft.nl

Another proposal nanoned, led by MESA+ Research Institute, www.nanoned.nl, is under preparation.

Also the research funding councils NWO and FOM are investing in nanotechnology research projects www.nwo.nl, www.fom.nl

Further information on nanotechnology in the Netherlands and in other European countries will be published on www.nanoforum.org from mid January 2003 onwards.

Norway:

Norwegian Research Council (NRC):

<http://www.forskningsradet.no/english/>

The NRC has established a research program on nanotechnology and new materials (NANOMAT):

http://www.forskningsradet.no/omnfr/strategi/hva_gjor_vi/budsjett_og_arsrapport/store_prog_2004-materialteknologi-nanomat.html (in Norwegian)

SINTEF:

Microtechnology Laboratory: <http://www.oslo.sintef.no/ecy/>

Norwegian University of Science and Technology:

<http://www.ntnu.no/satsingsomraader/materialer/english.htm>

Romania:

National network on nanotechnology, coordinated by the National Institute for Microtechnology, Bucharest.

www.imt.ro/NANOTECHNET_PUB/En/default.asp

Publications in the field of nanosciences/nanotechnologies: Some of the institutes of the network have their own web site with relevant information (e.g. National Institute of Materials Sciences, Bucharest)

-Micro and Nanostructures (Series in Micro and Nanoengineering), ed. D. Dascalu et al., Editura Academiei Romane Bucuresti, 2001, 241 pages

-CAS 2002 Proceedings, vol. 1 (2002 Int. Semiconductor Conference, 25th edition, Oct.8-12, 2002, Sinaia, Romania) IEEE catalogue number 02TH8618

Slovakia:

<http://www.fp6-eu.sav.sk/113.html>

summarises the Slovak Academy of Sciences proposals in materials science for participation in FP6 projects.

NANOSMART, a Centre of Excellence of the Slovak Academy of Sciences (SAS) on nanostructural materials, was established on 1 October 2002. It coordinates research in six institutes of the SAS.

Slovenia:

SINANO network www.ijs.si , www.imt.si , www.ki.si , www.ses-ng.si , <http://rcul.uni-lj.si/kem/index.html> , www.fmf.uni-lj.si/indexa.html

References:

Self-assembly of subnanometer diameter single wall MoS₂ nanotubes, M.Remskar, A.Mrzal, Z. Skraba, A. Jesih, M. Ceh, J. Demsar, P Stadelman, F. Levy and D.Miahailovic, Science 292, 479 (2001)

A structural study of amorphous alkoxide-derived lead titanium complexes, B.Malic, I. Arcon, M. Kosec, A. Kodre, *J. mater. res.*, 12, 2602-2611 (1997)

Spain:

Spanish activities in nanotechnology is found on the page of the network NANOSPAIN, momentarily at www.cmp-cientifica.com . It contains information on about 80 Spanish groups active in Nanotechnology and on recent publications.

Switzerland:

Swiss National Science Foundation programme in nanosciences
www.snf.ch/nfp/nfp36/progress/inhaltsv.html

United Kingdom

Institute of Nanotechnology

<http://www.nano.org.uk>

Birmingham

<http://npri.bham.ac.uk/>

Bristol

<http://spm.phy.bris.ac.uk>

Cambridge IRC

<http://www-g.eng.cam.ac.uk/nano>

<http://www.nanoscience.cam.ac.uk/>

Newcastle

<http://www.inex.org.uk>

Nottingham

<http://www.nottingham.ac.uk/pharmacy/research/LBSA/index.html>

London Nanotechnology Centre

<http://www.london-nano.ucl.ac.uk/lcn/index2.htm>

Oxford IRC

<http://www2.physics.ox.ac.uk/cm/CurrentResearch.html>

Sheffield

<http://www.shef.ac.uk/chemistry/staff/leggett>

The Network for the Exploitation of Science and Technology
<http://www.nest.ac.uk/>

Annex IV



COST Nanoscience & technology advisory group (NanoSTAG)

Brussels, 29 March 2000
OP(00)-nano5

Towards a European Research Area Comments of the COST Nanoscience & technology Advisory Group

0. Prolegomenon:

- Nanotechnology deals with the controlled manipulation of matter with structural elements of the 1-100 nanometer range. Nanoscience is defined as the scientific bases and principles underpinning developments in nanotechnology. Nanoscience deals e.g. with supramolecular assemblies of molecules, clusters of atoms, nano-structured devices.

1. Background:

Nanotechnology will be one of the key enabling technologies of the 21st century, as it holds the potential for nanomachines, computers or other devices operating at the nanoscale.

Exciting developments are underway, ranging from materials with novel properties (e.g. ultra high-strength materials) to electronic devices.

- At present, nanoelectronics is the driving force for nanoscience, due to the foreseeable end of the classical CMOS technology to produce chips. Equally significant drivers are the need for post-genomic technologies and a range of novel materials for generic application. Numerous other applications are emerging such as new drug design or functional materials which build upon recent nanotechnology related research in biology, chemistry and medicine. It is already introduced concept like nanobiotechnology combining knowledge of biological systems and solid state physics.
- In a recent report to the US Congress, Neal Lane, President Clinton's assistant for Science and Technology, states that nanotechnology will have a profound impact on economy and society similar to information technologies or genetics. In line with the recognition of its strategic importance for the USA, the US government has announced an increase of direct governmental funding by 83% from 2000 (270 M\$) to 2001 (495 M\$).¹
- The US funding is difficult to compare to the European one, as the latter comprises the financial efforts of the Commission and the Member States. Mostly the larger countries have specific programmes for nanotechnology. At the Commission, there is no budget specifically devoted to nanotechnologies in the fifth Framework Programme (5FP), except the 25M€ allocated for nanoelectronics at DG INFSO. However, approximately 100-120 M€ is expected to be spent in the 5th FP if one takes account funding on a project by project basis (including networks and other activities). Extrapolating from these numbers, public funding in this area is of the order of 500 - 600 M€ for the timeframe of the framework or 125 - 150 M€ per year. It has to be taken into consideration, however, that this sum as well as being inferior to the equivalent US investment it is also, for its largest part, not co-ordinated in a meaningful way.

¹ See White House press release at http://www2.whitehouse.gov/WH/New/html/20000121_4.html. and US report « Nanostructure Science and Technology » which can be found at <http://itri.loyola.edu/nanobase/>

2. The European nanoscience community

- Nanoscience and –technology are multidisciplinary fields. They draw on all sciences with an interest in nanoscale systems, i.e. biology, chemistry, physics, electronics, materials science etc.
- On the basis of the work of an ad-hoc working group on nanoscience and –technology the COST Committee of Senior Officials (CSO) have recognised a critical need for co-ordinating and aligning the European nanoscience and –technology activities.
- In the end of 1999 the CSO established a nanoscience and –technology advisory group (NanoSTAG) for a period of three years as a tool to deal with the demands of the emerging nanoscience and –technology research.

3. COST Nanoscience and –technology advisory group (NanoSTAG)

- NanoSTAG will, by providing graded information and access to its networks, be actively supporting European initiative co-ordinating nanoscience and nanotechnology.
- The expertise of the group, consisting of scientists and administrators, covers most of the nanoscience and nanotechnology spectrum. It represents a meta-network for SWOT analyses and constitutes an advisory body for decision-makers.
- NanoSTAG will help co-ordinate COST Actions within EU and with national activities in the field of nanoscience.
- NanoSTAG is about to set up an information facility (NanoForum) on European nanoscience and nanotechnology. This facility is meant to provide complete, up-to-date information on EU and national research in this field and will be easily accessible via a WebPage
- A series of workshops on nanoscience and technology is envisaged (NanoFutures). Answering to the needs identified by the group the workshops may have exploratory character or help co-ordinate activities. (roadmaps) The NanoFutures activity will be directed to lead to roadmaps on critical nanoscience topics as final, tangible outcome.²
- Finally, the group will address communication problems between different domains with an interest in nanoscience by establishing a glossary of technical terms in the field of nanoscience. It will thus contribute to the harmonisation and simplification on the linguistic level.

4. Bottlenecks

- The European nanoscience and –technology research community is too fragmented. The EC research activities are too compartmentalised. For example, interesting research topics cover often one or more Commission programmes, mainly Growth, Quality of Life and IST. A concerted, strategic effort would be necessary to co-ordinate the European activities, to improve the visibility and to guarantee an efficient allocation of research funds.
- A lack of trained personnel is imminent. Good research staff will be in scarce supply. The European institutes would need to be improving their competitiveness in attracting the most talented researchers on a world-wide job market. In parallel, Europe needs to motivate its young people to go into science.
- For the fiscal year 2000, 32% of the US nanotechnology funding was earmarked for pure fundamental research. The percentage proposed for 2001 is even higher (170 M\$ out of 495M\$).

² An example of a high-quality roadmap in a critical nanotechnology area is the “Technology roadmap for nanoelectronics” by R. Compañó, L. Molenkamp and D.J. Paul, European Commission 1999 IST programme

To be competitive in the medium and long term a high level of funding of basic research is necessary.

- During the implementation of nanotechnologies bottlenecks in instrumentation or in theories, simulation models will be identified. It is vital that these be addressed immediately. If the topic due complexity or cost requires a European action they should be implemented in a programme like COST, which is co-ordinating national research means on a “bottom-up” approach.

5. Towards a European research area

- The COST initiative “NanoSTAG” as a European-wide co-ordination tool is in line with the aims of the communication “Towards a European research area”.
- Amongst the possible specific themes for action proposed in annex I of the ERA brochure points 2.1 (More co-ordinated implementation of national and European research programmes) and 6.3 (making Europe attractive to researchers of the rest of the world) are paramount for the nanoscience and –technology research community.
- Cross programme co-operation is feasible as can be shown by the recent co-ordination of activities between COST and the Future and Emerging Technologies (FET) unit of IST. It was agreed to have a common event on the working of magnetic devices (COST P5) and the FET (IST) initiative on nanoelectronics. The workshop took place in Pisa in February 2000. Half of the COST P5 members were at the same time members of the FET initiative and this reduced their costs and saved time. In addition, the other participants benefited from meeting scientists they normally do currently not work with.

More informal coordination of this kind would liberate significant financial and human resources.

- A better linkage between the different programmes and mechanism to automate the collaboration would be desirable.
- To attract more young foreign researchers a well-heelled, flexible and unbureaucratic post-doc programme would be beneficial.
- The proposed themes 1.1, 1.3, 2.2, 3.3, 4.1, 6.1, would help to improve the European competitiveness in this emerging key technology. In particular intellectual property issues and the support of start-up companies need to be addressed.

6. Societal aspects

- In the knowledge-based society science and technology are at the base of the creation of wealth. Knowledge underpins the prosperity of Europe and will be the currency of the 21st century.
- The economic well being of Europe is at stake by the decline of science literacy within Europe. The ambitious aim to make Europe the best performing economy of the world, recently pronounced by R. Prodi, is threatened if this trend continues.
- Ultimately, this trend can only be reversed on a societal level. It would be necessary to create a vision, to modernise the education, to rethink the status and the role of scientists within society and to enter the discussion with the public. The Commission could greatly help in this process, e.g. by measures to improve the dissemination to the public. As a major, ambitious step one might imagine to set up a TV programme devoted to science which would be broadcast in all EU countries.

- Nanotechnology will pose new problems for pollution and environment, as well as health regulations. This aspect should be addressed from the outset in order to avoid unfounded negative trends in the public opinion.

Prof. Jaroslav Cihlar
Chair of NanoSTAG
Member of CSO

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Annex: COST Actions related to nanoscience

	Action	Domain	Duration	Number of Countries
516	Tribology	Materials	6/94-6/00	23
518	Molecular materials and functional polymers for advanced devices	Materials	6/96-6/00	18
P1	Soft condensed matter	Physics	7/97-7/01	16
P3	Simulation of physical phenomena in technical applications	Physics	9/97-9/01	18
D11	Supramolecular chemistry	Chemistry	1/98-1/03	15
523	Nano-structured materials	Materials	2/98-2/04	21
P5	Mesoscopic physics	Physics	10/98-10/02	13
D15	Surfaces and interfaces	Chemistry	11/98-11/03	17
D14	Functional molecular materials	Chemistry	1/99-1/04	18
525	Advanced electroceramics: grain boundary engineering	Materials	6/99-6/05	13
D19	Functionality specific to the nanoscale	Chemistry	3/00-3/05	9
D22	Protein-lipid interactions	Chemistry	Open for signatures	

Annex V

PHILIPPE BUSQUIN
MEMBER OF THE EUROPEAN COMMISSION

RUE DE LA LOI, 200 - B-1049 BRUXELLES
WETSTRAAT, 200 - B-1049 BRUSSEL

Brussels, **12 -05- 2000**
D(2000) - 1078

Professor Jaroslav Cihlar
BRNO University of Technology
Institute of Materials Engineering
Technicka 2
CZ - 616 69 Brno

Dear Professor Cihlar,

I wish to thank you and the members of the Nano Science and Technology Advisory Group of COST for the valuable and thorough response you have contributed to the Communication "Towards a European Research Area" which I have read with considerable interest.

It is with great satisfaction that I see NanoSTAG take the initiative of co-ordinating the European research activities in Nano Science, which fits perfectly within the initiative of the "European Research Area".

I recognise the importance of nanotechnology as a key enabling technology of the 21st century. For the European industries to remain competitive in a global market we cannot afford to lose out on this and the other key technologies.

I realise that the fragmentation of the European activities in this area is a major obstacle to the efficiency and coherence of European research. A better linkage of the European programmes and improved co-ordination with national activities needs to be reached.

The "Growth" programme is now starting to map centres of excellence, research teams and main actors in the field of nanotechnology with the final aim of contributing to networking their activities in the most effective and efficient manner. Within this exercise, all COST Actions related to nanotechnology will be contacted.

We need to embark on a strategy for nanotechnology in Europe. A high-level workshop on this topic will be organised in October 2000 at Toulouse to define the main lines of strategy.

It is important to enter a fruitful discussion on the creation of a competitive European nanotechnology community and an interlinked, high-quality nanotechnology research infrastructure. Hence I would encourage you and NanoSTAG to continue your collaboration, and I would invite you to contribute to the workshop in Toulouse.

Yours sincerely,



Philippe Busquin

Annex VI Nanoscience and Nanotechnology in the EU Framework Programme 6 and NANOFORUM Thematic Network

Nanotechnology in the 6th Framework Programme is contributing to the creation of the European Research Area and to innovation (2002 to 2006)

Nanotechnology is a growing field, where the resources needed are significant in terms of human creativity, scientific infrastructures and available funds, but where private investment is still limited. To benefit from the opportunities offered by nanotechnology, both scientific and technical challenges must be met: to increase our basic understanding of the nano-world; to create new materials, devices and processes; to integrate nano components in micro and macro applications; to establish new tools and techniques for industrial manufacture. There are also many challenges at a structural level: to maximise the efficiency of publicly funded pre-competitive research; to educate the next generation of students, researchers and technicians; to enhance societal awareness and perception; to develop standardisation and metrology for increased precision and accuracy; and so on. These challenges call for the creation of Europe-wide industry/research alliances of significant scale for which a European-wide approach is demanded.

The 6th Framework Programme will contribute to the creation of the European Research Area. It will have both a strategic and structuring character. Research projects with a strategic, high added value for Europe will be supported. A set of initiatives will be launched for structuring European research and reinforcing its foundations. Efforts will be put to renewing the enthusiasm in Europe for science and technology, and to achieving enhanced critical mass through an enlarged international co-operation. Researchers (in academia, industry, centres, ...) will be called to play a more prominent role in solving today's challenges in society for improving the quality of life of European citizens and boosting Europe's competitiveness within a sustainable growth.

A wide range of actions is supported within the 6th Framework Programme. First of all integrated projects and network of excellence, but also other type of projects according to needs and rules. Research projects will normally comprise both academic and industrial partners, and focus on multi-disciplinary aspects. Specific information for those interested in nanotechnology (researchers, press, civil servants, investors, citizens, ...) can be found at: www.cordis.lu/nanotechnology

In the 6th Framework Programme, the main funding channel for research projects and networks is within eight thematic priority areas, collectively constituting "Focusing and Integrating Community Research". Of further particular interest is "Structuring the European Research Area", which concerns research and innovation, human resources and mobility, research infrastructures and science and society, as well as "Strengthening the Foundations of the European Research Area" for co-ordination and simplification.

To know more ...

Focusing and Integrating Community Research

Thematic Priority Area 1 Life sciences, Genomics and Biotechnology for Health

Contacts: Biotechnology and Applied Genomics:
Mr Alfredo Aguilar-Romanillos (alfredo.aguilar-romanillos@cec.eu.int)
Mr Torbjoern Ingemansson (torbjoern.ingemansson@cec.eu.int)
Fundamental Genomics:
Mr Indridi Benediktsson (indridi.benediktsson@cec.eu.int)

Thematic Priority Area 2 Information Society Technologies

Contacts: Mr Dirk Beernaert (dirk.beernaert@cec.eu.int)
Mr Ramón Compañó (ramon.compano@cec.eu.int)
Mr Bernard Netange (bernard.netange@cec.eu.int)

Thematic Priority Area 3 Nanotechnologies and Nanosciences, Knowledge-based Multifunctional Materials and New Production Processes and Devices

Contacts: Mr Renzo Tomellini (renzo.tomellini@cec.eu.int)
Ms Luisa Prista (luisa.prista@cec.eu.int)
Mr Hervé Péro (herve.pero@cec.eu.int)

Thematic Priority Area 4 Aeronautics and Space

Contacts: Mr Alain Chappe (alain.chappe@cec.eu.int)
Mr Paolo Salieri (paolo.salieri@cec.eu.int)

Thematic Priority Area 5 Food Quality and Safety

Contacts: Mr Jürgen Lucas (jurgen.lucas@cec.eu.int)
Mr Guillermo Cardon (guillermo.cardon@cec.eu.int)

Thematic Priority Area 6 Sustainable Development, Global Change and Ecosystems

Contacts: Mr William Borthwick (william.borthwick@cec.eu.int)
Mr Pekka Jarvilehto (pekka.jarvilehto@cec.eu.int)

In the Thematic Priority Area 8, for horizontal research involving SMEs

Contact: Mr Sebastiano Fumero (sebastiano.fumero@cec.eu.int)

Structuring the European Research Area

Human Resources Contact: Ms Gordana Popovic (gordana.popovic@cec.eu.int)

Research infrastructures Contact: Mr P. Moschopoulos
(panayotis.moschopoulos@cec.eu.int)

Science and Society Contact: Mr Maurizio Salvi (maurizio.salvi@cec.eu.int)

Strengthening the Foundations of the European Research Area

COST

Contact: Mr Markku Warras (markku.warras@cec.eu.int)
Mr Eberhard Seitz (eberhard.seitz@cec.eu.int)

<http://cost.cordis.lu/>

Mapping of excellence

Contact: Ms Christiane Bernard (christiane.bernard@cec.eu.int)

<http://www.cordis.lu/nanotechnology/src/structuring.htm>

More information concerning nanotechnology available on the website at:

www.cordis.lu/nanotechnology (e.g. concerning networks, funded projects, international co-operation, national programmes, financing innovation, etc).

Pallone: For the Press: <http://www.cordis.lu/nanotechnology/src/pressroom.htm>

DG INFSO:

<http://www.cordis.lu/ist/fethome.htm>

www.phantomsnet.com

NANOFORUM Thematic Network

Objectives: The Thematic Network will provide a comprehensive source of information on all areas of Nanotechnology to the business, the scientific and social communities.

The main vehicle for the thematic network will be a dedicated web site *Nanoforum* organisation. *Nanoforum* will encompass partners from different disciplines, bring together existing national and regional networks, share best practice on dissemination national, EU-wide and Venture Capital funding to boost SME creation, provide a means for the EU to interface with networks, stimulate Nanotechnology initiatives in European underdeveloped countries, stimulate young scientists, publicises good research and form a network of knowledge and expertise.

The Nanotechnology Thematic Network *Nanoforum* aims to provide a linking framework for all nanotechnology activity within the European Community (only the 15 member states?). It will serve as a central location in order to have access to and to gain information about research programmes, technological developments, funding opportunities and future activities in nanotechnology within the nanotechnology community. *Nanoforum* will provide direct links to regional network web sites. Combined with conferences, workshops, publications and press releases *Nanoforum* will enhance European co-operation. *Nanoforum* will promote nanotechnology and its development. The rapid developments in areas of nanotechnology could provide revolutionary solutions for many current day problems from health and environment issues to the manufacturing industry. It is imperative that Europe becomes a producer of these new technologies and not simply a consumer.

Project Reference: G5RT-2002-05084

Contract Type: Thematic network contracts

Start Date: 2002-07-08

End Date: 2006-07-07

The Nanoforum Thematic Network is proposed to run for four years with EU funding and then to become self-financing. In the initial stages Nanoforum designs and implements the web site Nanoforum.org. This web site will be used to build up a user base. Nanoforum will also implement a programme of coordinated trans-European activities including summer schools, workshops, investment days and local meetings and seminars. Nanoforum will provide an important source of information to the general public about the impact of nanotechnology. Many nanotechnologies with important applications are still resident in the research base, and Nanoforum aims to pull this technology through to industry by encourage technology transfer activities and providing support and mentoring for new business start-ups. This active outreach into the EU community shall promote nanotechnology and fast track the development of the scientific, industrial and social aspects of nanotechnology.

Contractors.

1. The **Institute of Nanotechnology (IoN)** is the main contractor. The **IoN** is a registered charity that has been self-sustaining since its inception in 1997. The other contractors are:
2. **VDI-TZ Germany** – the German Engineering Society and coordinator of NANONET
3. **CMP Cientifica SL (CMPC)** -Coordinator of PHANTOMS
4. **CEA/LETI**- is a research centre in micro and nanotechnologies, the leader of "Minatec", a centre of excellence in micro and nanotechnologies involving other research organisations (CNRS, universities, industries) in Grenoble and as well as other European research teams
5. **Nordic Nanotech** – A newly established organisation working out of the Danish microelectronics centre bringing together engineering and other disciplines to provide an outlet for commercialisation of emerging applications in nanotechnology

Subcontractor

Malsch TechnoValuation - A consultancy organisation in the area of science and technology policy.