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Seven New COST Chemistry Actions

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Chemistry is, on one hand, a central basic science with a distinguished history and success in Europe, and, on the other hand, a very strong industry. In order to maintain and even to improve the position of the European Chemical Science and the European Chemical Industry, a framework for chemists in Europe within COST (European Cooperation in the field of Scientific and Technical Research) was initiated by launching, since 1992, a series of Chemistry Actions. The results of Swiss participating scientists in the first 15 Actions (D1–D15) were presented at the Second Swiss COST Chemistry Symposium, October 15, 1999, during the ILMAC in Basel. The Chemistry Technical Committee, with representatives from 28 European countries, has now selected in a bottom-up approach a series of seven new COST Chemistry Actions (D16–D22; see *http://www.unil.ch/cost/chem/*). In Switzerland, these Actions are financially supported by the Swiss Federal Office for Education and Science (Dr. Eva Klaper, OFES, Hallwylstrasse 4, P.O. Box 5675, CH–3003 Bern. Tel.: +41 31 322 96 67, Fax: +41 31 322 78 54, E-Mail: eva.klaper@bbm.admin.ch, website: *http://www.admin.ch/bbw*). A short description of these new Actions and the addresses of the contact persons in Switzerland are given below.

Keywords: Chemistry Actions · COST

COST D16: Combinatorial Chemistry

Combinatorial chemistry is the art of synthesizing large ensembles of molecules called 'libraries', and screening these libraries for single compounds with useful properties. By relying on diversification and selection to solve chemical problems, combinatorial chemistry aims to reproduce Darwinian evolution in the laboratory. Two reports in 1991, showing that biologically active compounds could be identified in libraries of chemically synthesized peptides, served as triggers for an extremely rapid development of this approach, which today finds applications in areas such as drug discovery and lead optimization, chemical and biochemical catalysis, sensors, and material sciences.

This COST Action has been launched to promote the development of combinatorial chemistry in Europe. The general aims of the Action are:

1) to strengthen the competitiveness of Europe in combinatorial chemistry,
2) to promote education in combinatorial chemistry throughout chemistry,
3) to promote the application of combinatorial approaches in various disciplines and identify new areas amenable to combinatorial chemistry.

Research activities are expected in organic synthesis (reactions on solid supports, scaffolds for drug discovery), catalysis, analytical chemistry (assays for high-throughput screening, analysis of mixtures), sensors, and more.

Duration: September 15, 1999 – September 14, 2004.

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COST D17: Oligomers, Polymers and Copolymers *via* Metal Catalysis

The design of catalysts and catalytic polymerization constitute the heart of modern chemical industry as this approach allows for the stereocontrol of known polymers – thus improving their physical properties – and the discovery of new functional and block polymers, *e.g.* of new materials with specific properties. The main objective of this COST Action is to gather chemists with complementary expertise in the areas of design of single-site polymerization catalysts, heterogenization of single-site catalysts, design of new polymeric materials, characterization and processing of polymers and optimization of manufacturing processes featured by minimal environmental impact.

The program includes the search for polymerization catalysts based on soluble or supported metallocenes and complexes based on early and late transition elements or lanthanides and actinides stabilized by polydentate ligands with N, O, S, P donor-atom sets due to their potential for tolerating various heteroatom functionalities. This feature actually opens up the possibility of processing polar monomers as well as various cheap feedstocks such as CO, CO_2, ROH, RCN, *etc.* in order to obtain various functionalized polymers.

Duration: November 10, 1999 – November 9, 2004.

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COST D18: Lanthanide Chemistry for Diagnosis and Therapy

Lanthanide (III) chelates are becoming increasingly important in biomedical diagnosis. The proportion of Magnetic Resonance Imaging (MRI) scans made after the administration of a Ln(III) chelate is steadily increasing and nowadays is about 50%. A continuing demand for more effective and specific MRI contrast agents exists. The use of lanthanide complexes as luminescent labels for analyses in biological media has attracted a great deal

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of attention, in particular as an alternative to radioimmunoassay. Furthermore, progress in the application of Ln(III) chelates in therapy is impressive; it is expected that within two years, the first Ln(III) chelates for application in photodynamic therapy of cancer and arterial plaque will be introduced on the market.
The main objective of the Action is an increase of the knowledge of the chemistry of lanthanide(III) chelates and to apply this knowledge to the development of novel diagnostic agents and to therapy by an interdisciplinary approach by chemists, physicists, biologists, and physicians. Strong links between academics and industry will reinforce these efforts. The goals will lead to more effective diagnosis and therapy in health care, particularly of the aging population.
Duration: October 1, 1999 – September 30, 2004.
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COST D19: Chemical Functionality Specific to the Nanometer Scale

In recent years, chemists have invested considerable effort into the design and synthesis of new functional materials whose properties are determined by organization or aggregation on the nanometer scale. This Action focuses on the influence of the mode of aggregation/organization on the observed material properties, such as chemical reactivity, molecular recognition, or catalytic activity.
The current challenges in this area include tailoring the properties of nanostructured materials by controlling structures and interfaces, understanding the factors that influence nanostructure stability, and interfacing nanostructures to the macroworld. Current applications of nanostructured materials include dispersions and coatings, materials for separations, drug-delivery systems, catalytic antibodies, data-storage materials, and biosensors.
The Action is divided into three subtopics:
1) synthesis and preparation to create nano objects, where the emphasis is on *control* of the nanostructure,
2) characterization of functionality, especially time-resolved and *in situ* approaches,
3) modeling and simulation methods: prediction of functionality.

Duration: 5 years, starting early 2000.
Contact in Switzerland: Nicholas D. Spencer, Laboratory for Surface Science and Technology, ETH, CH–8092 Zürich
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COST D20: Metal Compounds in the Treatment of Cancer and Viral Diseases

The discovery of the antitumor activity of *Cisplatin*, *cis*-dichlorodiammineplatinum(II), in 1969 and its promising activity against testicular cancer seen in the early seventies, has made platinum-containing drugs a major focus of research. Today, platinum drugs represent an important class of antitumor agents and there is now hardly any clinical regimen of combination chemotherapy that does not contain *Cisplatin* or one of its analogues. Clinical applications now include ovarian cancer, lung cancer, cancers of the head and neck, urothelial cancer and various cancers of the upper gastrointestinal tract, *etc*. Though it became evident already at an early stage that DNA is most likely the crucial target of Pt-containing drugs, their mode of action is not fully understood.
The main objective of this COST Action is to further the development of the chemistry of metal-containing compounds to be applied in cancer chemotherapy and possibly also in antiviral therapy. Studies of the mechanism of action of antiviral nucleotide analogues in the context of nucleic acid polymerases have revealed that metal ions (Mg^{2+}/Zn^{2+}) are crucial. There is a strong possibility that the metal ion-binding properties of diphosphorylated nucleoside monophosph(on)ate analogues are intrinsically associated with their antiviral activity by irreversibly blocking the active site of the polymerase and/or terminating the growing nucleic acid chain. It is thus a further aim of this program to facilitate our understanding of the basic processes involved in antiviral and anticancer actions.
Duration: 5 years, starting early 2000.
Contact in Switzerland: Helmut Sigel, Institute of Inorganic Chemistry of the University, Spitalstr. 51, CH–4056 Basel
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COST D21: Metalloenzymes and Chemical Biomimetics

Approximately 30% of all purified proteins and 50% of all structurally characterized proteins contain one or more metal ions as an essential prosthetic group. These proteins play essential roles in catalysis, transport of electrons and of metal ions, and cell metabolism in general.
The general theme of this Action is to increase knowledge of the chemistry of the metal sites in proteins with a view to applications in chemical, biotechnological, pharmacological, and environmental sciences. The specific sub-topics retained are:
1) structural, mechanistic and spectroscopic studies of metalloenzymes,
2) synthetic studies of mononuclear and polynuclear metal complexes with biomimetic ligands as active site models and biomimetic catalysts,
3) structural and spectroscopic studies on electron transfer proteins,
4) characterization and biological role of metal–protein interactions,
5) activation of small molecules at biological and biomimetic metal centers.

Apart from the obvious biological interest, the understanding to be obtained offers a real possibility of preparing new synthetic catalysts.
Duration: 5 years, starting early 2000.
Contact in Switzerland: Alan Williams, Department of Inorganic, Analytical and Applied Chemistry, University of Geneva, 30 quai Ernest Ansermet, CH–1211 Genève 4
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COST D22: Protein–Lipid Interactions

Protein–lipid interactions are essential features of biological membranes: nevertheless many important questions related to chemistry and physics of lipids and proteins are still not understood. The lack of proper understanding of molecular mechanisms important for the functioning of the biological membranes also hinders practical application in industry. For instance, the application of drug encapsulation in lipid vesicles is hampered by the short lifetime of the drug in the blood circulation caused by lipid bilayer instability. Elucidation of the functions of membrane proteins are of central importance for the development of new medicines. In view of the scope of the field, international contacts are thus of vital importance, not only between academic groups, but also with appropriate R&D groups of *e.g.* biotechnology, pharmaceutical industries.

Due to a broad range of activities and the multidisciplinary character, the field of protein–lipid interactions would gain substantially from a European cooperation, since in one country scientists could not cover all relevant topics essential for adequate understanding of complex phenomena underlying functioning of biological membranes.
The major topics of the current development of protein–lipid interactions and of the COST Action are:

1) structure–function relationship,
2) protein–protein assembly in the biological membrane,
3) membrane domain formation.

Duration: 5 years, starting early 2000.
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Introduction to the COST Symposium

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Keywords: COST

COST (a French acronym for 'Coopération Européenne dans le domaine de la recherche Scientifique et Technique') was set up in 1971 to stimulate and to provide a framework for European cooperation in the field of science and technology. This research forum now brings together 32 European countries. COST is oriented towards pre-competitive research. COST activities currently cover the following areas: computer sciences, telecommunications, transport, oceanography, materials, environment, meteorology, agriculture–biotechnology, food technology, social sciences, medical research, urban civil engineering, chemistry, forests–forestry products, physics, and nanosciences.
Chemistry is a central science with a distinguished history and recent success in Europe (five Nobel prize winners between 1990 and 1999 are European). The chemical industry is one of Europe's most international, competitive and successful industries and contributes to the prosperity and quality of life of modern European society. In order to maintain and even to improve this position, it was decided to use the COST forum to elaborate a strategic scientific scheme for basic research in chemistry in Europe. In this respect, a Technical Committee (TC) in chemistry was formed in 1990. In 1992, through a proposition of the TC, COST decided to launch seven Actions (D1–D7) in the field of chemistry. These Actions were followed recently by eleven new Actions (D8–D18) and four new Actions (D19–D22) will follow in the near future (see list below and the report by A. Merbach on 'Seven New COST Chemistry Actions', in this issue of CHIMIA on p. 43). More information about COST Chemistry is provided at the website *http://www.unil.ch/cost/chem/*.
The COST system is characterized by the bottom-up approach (the initiative comes from the researcher) and by the fact that the funding of the research is national. In Switzerland the main sources of funding for COST Chemistry are the Office of Education and Science, and partially the Swiss National Science Foundation.
The success of the COST Chemistry program is demonstrated by:

- the increasing number of networks: 55 in 1993, 86 in 1994, 113 in 1995, 117 in 1996, involving the participation of 564 research groups corresponding to collaborations between five research groups on average per project from different European countries,
- the number of activities within the networks and the Actions: scientific meetings, workshops, seminars, workshops for young scientists, exchanges of students (short-term scientific missions),
- the high quality of results and publications obtained.

The goal of this symposium was to present the chemical research taking place in Switzerland and in Europe within the COST framework. By inviting ten prominent Swiss and non-Swiss scientists, we have presented the different research fields covered by the eight COST Actions that were running by the beginning of 1999 (Actions D8–D15). The program consisted of 10 invited lectures and 47 posters.

List of COST Chemistry Actions:

A. In Progress

D8: Chemistry of Metals in Medicine (1996–2001)
D9: Advanced Computational Chemistry of Increasingly Complex Systems (1997–2002)
D10: Innovative Methods and Techniques for Chemical Transformations (1997–2002)
D11: Supramolecular Chemistry (1998–2003)
D12: Organic Transformations: Selective Processes and Asymmetric Catalysis (1997–2002)
D13: New Molecules for Human Health Care (1998–2003)
D14: Functional Molecular Materials (1999–2004)
D15: Interfacial Chemistry and Catalysis (1998–2003)
D16: Combinatorial Chemistry (1999–2004)
D17: Oligomers, Polymers and Copolymers *via* Metal Catalysis (1999–2004)
D18: Lanthanide Chemistry for Diagnosis and Therapy (1999–2004)

B. To Be Launched

D19: Chemical Functionality Specific to the Nanometer Scale
D20: Metal Compounds in the Treatment of Cancer and Viral Diseases
D21: Metalloenzymes and Chemical Biomimetics
D22: Protein–Lipid Interactions

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