
News from IUPAC

IUPAC Secretary General Dr. Edwin D. Becker has provided the following three news items of general interest to IUPAC Members and readers of *Chemistry International*:

At the General Assembly in Berlin, the IUPAC Bureau authorized the formation of ad hoc committees to examine the Union's programs in three important areas: Relations with Industry, Education, and Chemical Nomenclature. On behalf of the IUPAC Officers, I would like to summarize the current status of these efforts.

IUPAC-Industry Relations

Dr. Alan Hayes (then President Elect) was given responsibility for organizing this committee. The charge to the Committee is as follows:

- to consider options and then recommend a course of action by which IUPAC could become more attractive to increased participation by scientists in industry,
- to recommend alternative mechanisms by which IUPAC should liaise and interact with industry, including consideration of sensible processes within IUPAC itself, and
- to review the activities and composition of COCI and how it should participate in the outcomes of the two points above.

Committee Membership

Alan Hayes	President, IUPAC (Chairman)
Edwin D. Becker	Secretary General, IUPAC
David Evans	R&D Director, Zeneca Agrochemicals
René-Paul Martin	Past Chairman, COCI
Junshi Miyamoto	Sumitomo Chemicals (Past President, Division VI)
Edwin Przybylowicz	Chairman, IUPAC Finance Committee
Jurgen Reden	European Federation of Pharmaceutical Industries
Luzius Senti	Member, COCI
Rob Taalman	European Chemical Industry Council (CEFIC)
Nelson Wright	Chairman, COCI
John Jost	Executive Director, IUPAC

The Committee held an introductory meeting on 12 November 1999. A number of aspects of current and potential relationships between IUPAC and the chemical industry were discussed. Particular attention was

given to the Long Range Research Initiative of the International Council of Chemical Organizations (ICCA), which is being managed by CEFIC in Europe, the Chemical Manufacturers Association in the USA, and the Japan Chemical Industry Association. This is a global, generic, human and environmental research program aimed at filling gaps in chemical effects research for compounds of commercial interest.

Education Strategy Development Committee (ESDC)

Prof. Joshua Jortner (then IUPAC President) assumed responsibility for organizing this effort and was able to recruit as Chairman of the ESDC Prof. Peter W. Atkins, who is internationally known in the field of chemical education. The charge to the ESDC follows:

One of the Union's long-range goals states: "IUPAC will utilize its global perspective to contribute toward the enhancement of education in chemistry and to advance the public understanding of chemistry and the scientific method." The ad hoc ESDC has been established by the Bureau to provide advice on the ways by which IUPAC should work toward this goal. The ESDC is charged to:

- review IUPAC's current and immediately planned activities in the field of chemical education, including programs of the Committee on Teaching of Chemistry, the other Operational Committees, and the scientific Divisions;
- recommend areas in which IUPAC should and realistically can make meaningful contributions to worldwide chemical education; provide advice as to areas in which IUPAC should not be involved;
- recommend ways by which IUPAC can realistically contribute to the public understanding of chemistry and the scientific method;
- recommend any organizational and/or operational changes within IUPAC to facilitate the implementation of the programs proposed by the Committee; and
- report to the Bureau by 31 August 2000—preferably a final report if feasible, or an interim report otherwise with a final report to follow.

Committee Membership

Peter W. Atkins (Chairman)	UK
Berhanu Abegaz	Botswana
D. Balasubramanian	India
John Bradley	South Africa
Norman Craig	USA

Antonio Monge-Vega	Spain
Julio de Paula	USA/Brazil
Judith Poë	Canada
Kip Powell	New Zealand
Leiv Sydnes	Norway
Natalia Tarasova	Russia
Fabienne Meyers	IUPAC Secretariat

This committee held its first meeting on 20–21 February 2000.

Chemical Nomenclature

Dr. Edwin D. Becker (Secretary General) was given responsibility for initiating a study of IUPAC's programs in the nomenclature of chemicals—organic, inorganic, macromolecular, and biochemical—and developing recommendations for future activities. He decided (with the concurrence of the other IUPAC officers) that the first step should be a broad-based meeting to explore the wide ramifications of the subject. He recruited Dr. Alan McNaught (member of IDCNS and CPEP) to lead this effort. A roundtable discussion on "Representations of Molecular Structure: Nomenclature and its Alternatives" has been organized for Washington, DC on 10–11 March 2000 to bring together nomenclature experts with representatives of various groups that are current or potential users of IUPAC chemical nomenclature (e.g., editors, publishers, database providers, patent and international trade authorities) and individuals from major commercial nomenclature services. This group of about 35 participants from 12 countries is to help define long-range needs and to provide recommendations for future directions for IUPAC work in the field.

Comments and suggestions in these three areas are, of course, welcome. The Executive Committee will monitor progress, and reports will be presented in due course to the Bureau.

Report on IOCD/IUPAC Workshop on Environmental Analytical Chemistry for Regulatory Chemists and Laboratory Managers, Prague, Czech Republic, 16–18 June 1999

Dr. Walter R. Benson (Benson and Associates, 6209 Crathie Lane, Bethesda, MD 20816-1003, USA; E-mail: Wbenson270@aol.com), Chairman of the IUPAC Chemistry and the Environment Division's Joint Working Party with IOCD on Environmental Analytical Chemistry in Developing Countries, has submitted the following report:

The Joint IOCD/IUPAC Working Party on Environmental Analytical Chemistry (JWP) was formed by the

International Organization for Chemical Sciences in Development (IOCD) and IUPAC in 1993 out of a realization that developing countries need scientists and technical personnel with internationally acceptable expertise and laboratories to perform environmental monitoring. These countries struggle with global trade restrictions, standards, and environmental laws on monitoring of pollutants in air, food, water, and solid wastes, but face a severe lack of trained personnel to manage these tasks.

The JWP held this workshop in Prague with the aim of providing updated information on environmental analytical chemistry to analytical chemists and laboratory managers in the Central European countries that participate in official environmental monitoring. In organizing the workshop, the JWP cooperated with the Czech Chemical Society, Deputy Minister Karel Blaha of the Department of Environmental Affairs of the Czech Republic, and Charles University. A local organizing committee consisted of Dr. Pavel Draser, Vice President of the Czech Chemical Society; Profs. Jiri Berek and Karel Stulik of Charles University; and Dr. Frantiska Pavlikova of Merck & Co. of Prague. This committee shared with the JWP the responsibility for inviting participants and speakers from Central Europe. The committee made contact with various chemical societies in Central Europe, while IOCD and IUPAC placed announcements about the workshop on their respective web sites.

Working together, Dr. Draser and Prof. Berek greatly facilitated the success of the workshop by selecting participants; choosing the workshop site at Pruhonice in the midst of a group of hotels and a park; arranging for various workshop services, including use of ten computer workstations and audiovisual equipment; and selecting the caterer and meal menus. They also scheduled a concert by a Czech musical ensemble as a special treat for the workshop attendees.

The JWP was responsible for selecting the topics and appropriate lecturers for presentation of the workshop. Topics selected fell within the following areas:

- sampling procedures used in air, water, food, and soil
- sample preparation procedures
- international methods of analysis used to regulate air, water, food, and soil
- managing a chemical laboratory and proficiency testing of chemists
- using computer networks to locate necessary chemical information and experts

The workshop lecturers, 15 scientists in all, came from the Czech Republic (4); Slovakia (1); Belgium (1); and the United States (9). A total of 36 participants came from the Czech Republic, Latvia, Lithuania, Romania, Slovakia, Ukraine, and the United States; 12 of

these scientists received travel grants from UNESCO. The lecturers made use of handouts and videos. One-half of one day during the workshop was devoted to practical training on computers, using AOAC, EMMI, and other materials. In addition, graduate students from Charles University prepared and exhibited posters in a special session devoted to practical training. Each Central European country represented at the workshop provided a copy of a CD-ROM from AOAC International containing the text of the March 1999 edition of *AOAC International Official Methods of Analysis*.

From 13–15 June 1999, just before the IOCD/IUPAC workshop, the American Chemical Society (ACS) held a Central Europe–United States Workshop on Environmental Chemistry at the same site in Prague. IOCD gratefully acknowledges the assistance afforded to the IOCD/IUPAC workshop by the ACS in agreeing to share some of the lecturers.

Financial and “in kind” support of the workshop was provided by UNESCO, IUPAC, AOAC International, Huels AG of Germany, the Belgian government, several agencies of the U.S. government (EPA, FDA, and NSF), the U.S. National Academy of Sciences, and Merck and SciTech of Prague.

A full report of the workshop, listing the names of all lecturers and participants along with the full program and specific topics, can be obtained by writing to Dr. Walter R. Benson, c/o IOCD (U.S. office), P.O. Box 8156, Falls Church, VA 22041, USA. The next workshop is planned to take place in Africa on official analyses of pollution samples resulting mainly from mining. Contact the IOCD/IUPAC JWP members (see the IUPAC web site at www.iupac.org) for information or to contribute input on subjects, speakers, and funding.

Report on the EURACHEM 10th Anniversary Meeting and the EURACHEM Full Committee Meeting, Helsinki, Finland, 16–19 June 1999

Dr. A. Fajgelj (Quality Assurance Supervisor, International Atomic Energy Agency Laboratories, A-2444 Seibersdorf, Austria; E-mail: A.Fajgelj@iaea.org), Chairman of the IUPAC Interdivisional Working Party on Harmonization of Quality Assurance Schemes for Analytical Laboratories, has submitted the following report:

As a member of the EURACHEM Committee and as the IUPAC liaison person, I attended the annual meeting of EURACHEM. This year, EURACHEM celebrates the 10th anniversary of its founding, and a one-day conference was organized on this occasion. I gave an invited oral presentation on “Current and future programs of IUPAC”.

A network of organizations in Europe, EURACHEM was established in 1989 to provide a system for the international traceability of chemical measurements and to promote good quality assurance practices. It provides a forum for the discussion of common problems and for developing an informed and considered approach to both technical and policy issues. EURACHEM today comprises 18 full members (European and European Free Trade Association [EFTA] countries) and 10 associate members. There are also 11 observer or liaison organizations (AOAC International, Cooperation on International Traceability in Analytical Chemistry [CITAC], EUROLAB, Association of European Institutes for Metrology [EUROMET], Consultative Committee on Amount of Substance [CCQM], European Accreditation [EA], International Laboratory Accreditation Cooperation [ILAC], IUPAC, etc.). The goals of EURACHEM are to:

- promote best practices and develop networks for collaboration,
- develop international comparability of chemical measurements,
- provide a framework for cooperation in establishing traceability,
- establish national EURACHEM groups and provide input to other international organizations, and
- raise awareness among decision makers and develop broad-based education and training.

Most of the work of EURACHEM is carried out by Working Groups (WGs). At the moment, there are four active WGs: Education and Training, Measurement Uncertainty, Reference Materials, and Proficiency Testing. The WGs mainly organize workshops and produce guides. The following guides have been published by EURACHEM alone or in cooperation with other organizations:

- *Accreditation for Chemical Laboratories, Guidance on the Interpretation of the EN 45000 Series of Standards and ISO/IEC Guide 25*, EURACHEM/WELAC Guide (1993)
- *Accreditation for Laboratories Performing Microbiological Testing*, EURACHEM (1996)
- *Quantifying Uncertainty in Analytical Measurement*, EURACHEM Guide (1995)
- *Quality Assurance for Research and Development and Nonroutine Analysis*, EURACHEM/CITAC Guide (1998)
- *The Fitness for Purpose of Analytical Methods, A Laboratory Guide to Method Validation and Related Topics*, EURACHEM (1998).

These guides have gained a large international acceptance and are also followed in the countries that are not official members of EURACHEM.

EURACHEM's program includes workshops on traceability (Bratislava, 1999), QA and computers (Berlin, 1999), reference materials (Berlin, 2000), proficiency testing (Boras, 2000), and sampling (Delft, 2001). The most important work regarding the EURACHEM guides will be the revision of the guide *Accreditation for Chemical Laboratories, Guidance on the Interpretation of the EN 45000 Series of Standards and ISO/IEC Guide 25* (1993), which should reflect the changes of the ISO Guide 25 that is now being transferred to the ISO 17025 Standard.

In the last three years, a strong cooperation between IUPAC's Interdivisional Working Party on Harmoni-

zation of Quality Assurance Schemes for Analytical Laboratories and EURACHEM has been established. As a result, IUPAC's recently published Harmonized Guidelines for the Use of Recovery Information in Analytical Measurement (*Pure Appl. Chem.*, Vol. 71, No. 2, pp. 337–348, 1999) have been endorsed by EURACHEM. Future cooperation was also foreseen at the Workshop on Principles and Practices of Method Validation held in November 1999 in Budapest, Hungary, where EURACHEM was also formally represented.

News and Notices from Other Societies and Unions

The West African Chemical Society: A Catalyst for the Development of African Science

This article, by Prof. Richard-Emmanuel Eastes (Département de chimie, Ecole Normale Supérieure, 24, rue Lhomond, 75005 Paris, France; E-mail: reeastes@voila.fr) and Jean-Paul Pradère (Director of Research at CNRS Laboratoire de Chimie Organique, UMR 6513 au CNRS, Faculté des Sciences et des Techniques, 2, rue de la Houssinière, 44322 Nantes cedex 3, France; E-mail: Jean-Paul.Pradere@chimie.univ-nantes.fr), was originally published in *L'Actualité Chimique* in January 1999 (pp. 30–33) and is reprinted here with their kind cooperation and permission.

Summary

The West African Chemical Society (Société Ouest-Africaine de Chimie [S.O.A.CHIM.]) was established in 1994 by a group of scientists from nine West African countries (Benin, Burkina Faso, Guinea Conakry, Ivory Coast, Mali, Mauritania, Niger, Senegal, and Togo). The aim of the society is to develop chemical sciences in West Africa, both from an educational and research point of view. To this end, the society uses four means of communicating information: seminars, a monthly information bulletin, the *Journal de la Société Ouest-Africaine de Chimie* (published twice a year), and the annual S.O.A.CHIM. Congress, the last two of which took place in Cotonou (Benin) in 1998 and Niamey (Niger) in 1999.

This article offers a report of the congress that took place in Cotonou in August 1998, and attempts to establish the situation regarding chemical sciences in sub-Saharan West Africa. Furthermore, this article stresses how important it is for African universities to forge links with Western laboratories.

Introduction

From 3–7 August 1998, the West African Chemical Society (S.O.A.CHIM.) held its 4th Annual Congress in Cotonou, Benin. Several university department heads and directors of institutes from different African countries took part in this international scientific conference. It also appeared an effort had been made by national delegates to make it financially possible for doctoral students to participate in this conference. Among the hundreds of scientists present at the congress, some of the French-speaking conferees had been invited to shed a different and complementary light on the chosen theme for that year: "Chemistry and Quality of Life". They endeavored to present the results of work that may be used immediately by the African chemistry community, both for research and teaching purposes.

This article, which briefly introduces the S.O.A.CHIM. and its various activities, gives a report of the congress in Cotonou and offers a rapid assessment of research and teaching in sub-Saharan West Africa.

Founding of the West African Chemical Society

The West African Chemical Society was established in Ouagadougou (Burkina Faso) in 1994 by about 100 chemistry, biochemistry, and biology researchers and teacher-researchers from French-speaking universities in the West African cities of Abidjan (Ivory Coast), Bamako (Mali), Conakry (Guinea Conakry), Cotonou (Benin), Dakar (Senegal), Lomé (Togo), Niamey (Niger), Nouakchott (Mauritania), and Ouagadougou (Burkina Faso).

Aims and Objectives of the S.O.A.CHIM.

The S.O.A.CHIM., which is at the heart of a genuine and innovative "southern" attempt at cooperation, aims to unite chemists from West Africa, creating within the group a synergy for the development of chemical sci-

ences. The main objectives of the S.O.A.CHIM. are as follows:

- to contribute to the development of all aspects of chemical sciences;
- to be an information center, a meeting forum, and a place of exchange for its members;
- to ensure the dissemination of results obtained in African research laboratories;
- to consider ways of improving teaching and scientific research despite frequent lack of resources;
- to propose and support any industrial, economic, and professional prospects relating to chemical sciences; and
- to represent the individuals concerned and their disciplines before the public authorities of the different states and before regional, international, and nongovernmental organizations.

Therefore, the S.O.A.CHIM. represents an important attempt at cultural and economic development, as well as a genuine tool for the integration of African chemists into the international community.

Activities of the S.O.A.CHIM.

The S.O.A.CHIM. is organized into divisions according to the main areas of chemical sciences and into more specific subject areas, such as inorganic chemistry, theoretical chemistry, spectroscopy, natural substances, etc. The initiatives of the S.O.A.CHIM. are mainly intended to encourage collaboration on subjects that concern problems with the development of the member countries, including the following:

- extraction and promotion of local natural substances;
- study of methods for limiting and controlling air and water pollution;
- chemistry of agricultural inputs (fertilizers, pesticides, etc.);
- promotion of inorganic raw materials, and geological and mining research;
- chemical and biochemical methods of controlling the quality of foodstuffs; and
- chemistry of pharmaceutical products, etc.

These initiatives are centered around four main areas of exchange:

- workshops, conferences, and seminars;
- S.O.A.CHIM. information bulletin;
- *Journal de la Société Ouest-Africaine de Chimie*, referenced in *Chemical Abstracts*; and
- annual congresses.

Annual Congress of the S.O.A.CHIM.

This event is a veritable scientific congress that enables scientists to expound upon the results of their research.

It is also the ideal occasion for them to discuss their theses and expand their knowledge. This event owes its development to the dynamism of each nation and to the determination shown by the committee members (Chairman: Prof. Y. T. N'Guessan, Ivory Coast; Vice Chairmen: Prof. L. Diop, Senegal, and Prof. C. G. Accrombessi, Benin; and Permanent Secretary: Prof. F. S. Sib, Burkina Faso) to increase international interest. After congresses in Abidjan in 1995, Dakar in 1996, and Lomé in 1997, it was Cotonou's turn in 1998 to welcome about 130 participants, who came not only from the nine West African countries involved in the S.O.A.CHIM., but also from South Africa, Canada, France, and Rwanda.

Sequence of Events at the 4th S.O.A.CHIM. Congress

Presentations at the 4th S.O.A.CHIM. Congress portrayed various research activities developed in West African universities. A large part of the results concerned the promotion of natural products (extraction of essential oils, highlighting active principles linked with African pharmacopoeia, etc.).

In addition to 43 presentations on the congress theme of "Chemistry and Quality of Life", 5 plenary sessions that took place in the large lecture hall in the Faculty of Health Sciences at the University of Cotonou dealt with the following areas:

- New nucleoside analogues: a heterochemical application; Dr. J.-P. Pradère, Faculty of Science and Technical Studies, University of Nantes, France; Part 1: HIV, replication modes, biomolecules, synthesis of nonnucleosidic derivatives; Part 2: Synthesis and activity of 2,3-dideoxynucleosidic derivatives.
- Microscale chemistry in experimental chemistry; R.-E. Eastes, Ecole Normale Supérieure, Paris, France; Part 1: Definition, pedagogical interests, and prospects in Africa; Part 2: Practical demonstrations.
- Chemical pollution: a multidimensional approach to water contamination caused by agricultural activities; Prof. O. Banton, INRS Eau, University of Quebec, Canada.
- Urban pollution: modeling emissions of pollutants in the city of Cotonou; Prof. A. L. Ajavon, University of Benin, Lomé, Togo.

Assessment of the Congress in Cotonou

The Cotonou Congress provided an occasion for productive debates and exchanges between participants. The most successful aspect of the congress was clearly the fact that researchers from several countries working on similar topics were able to meet and discuss their results and opinions. Apart from S.O.A.CHIM. congresses, this kind of exchange is only possible through

articles published in the semiannual *Journal de la Société Ouest-Africaine de Chimie*, which is unable to cover all the work carried out in that part of the world.

Finally, over a period of five days, ceremonial and personal interactions took place in an extraordinarily friendly and enthusiastic atmosphere. Without a doubt, this fervor will be present once again at the 6th Congress in Conakry (Guinea Conakry) in 2000.

Aspects of Chemical Sciences in Sub-Saharan West Africa

The few days spent in the company of the African scientists and the accounts they gave, as well as the experience of cooperation between laboratories and/or universities—illustrated by the particularly active collaboration developed between the University of Abidjan and the University of Nantes¹—enabled us to gain considerable insight into the strengths and weaknesses of the chemical sciences in West Africa. We portray below a brief outline of those details.

Research

It appears that research development differs according to the countries concerned. More disadvantaged countries owe their slow progress to several diverse difficulties relating to low budgets for equipment and operating costs, problems with the supply of chemicals, difficulties with equipment maintenance, etc. Furthermore, many universities do not have the means for analyses that are crucial to the completion of a research project. These shortcomings have direct consequences on the length of time necessary to obtain results at a postgraduate work-experience level and at a doctoral thesis level, and, therefore, on the very nature of the subject matter that it is possible to develop.

When acquiring any research equipment, the decision is also linked to problems involving its maintenance. Prof. C. G. Tea, Dean of the Department of Science of Matter Structure and Technology at the University of Abidjan-Cocody, insists that one should adopt the following strategy: "Before any decision is made concerning the acquisition of equipment, priority should be given to the question of maintenance. Indeed, technical constraints such as power failures and important variations in voltage require the protection of our equipment. These measures regarding equipment protection apply as much to our microcomputers as they do to NMR appliances, if we have them. Furthermore, climatic conditions (humidity and/or heat) should not be overlooked".

The difficulties involved in accessing scientific information should be emphasized. Indeed, many laboratories do not have the financial support to subscribe to the various scientific magazines. Hence, there is a clear need to cooperate with foreign laboratories that have the means to develop the required projects.

Teaching

Despite the lack of resources and teaching staff, African universities welcome a large number of students. As a result, teaching costs prove to be quite high in the field of chemistry—particularly in the cases of Cocody and Abobo-Adjamé Universities in Abidjan (Ivory Coast). Even though teachers at African universities have often been trained in French-speaking countries, most of them are now African, having practically replaced the French teachers that were previously working in the universities in question. In addition, a number of teacher exchanges and teaching partnerships exist between African universities.

With regard to syllabus content, there is a clear tendency to try to incorporate teaching directed toward professional development into master's level university programs. However, although essential to the learning of chemistry at all levels, experimental teaching often remains difficult to implement.

Therefore, bearing in mind the many difficulties that workshop supervisors encounter in certain departments, microscale chemistry² could be a concept worth developing. Indeed, low budgets, irregular supplies of solvents, lack of available equipment, and the large numbers of students to monitor occasionally force workshop supervisors to organize several pairs around one experiment. This problem is repeated regularly for years, owing to lack of chemicals and equipment. Microtechniques using small amounts of products, along with the ingenious ideas that underlie them, seem to be well adapted to these circumstances. Indeed, by reducing the costs, the risks, the time spent to implement experiments, and the amounts of chemicals necessary for each synthesis, microscale chemistry is likely to enable more students to carry out experiments by themselves. Another form of microscale chemistry—different from that which is currently being developed in France—already exists and is now widespread with successful results in southern Africa. As far as West Africa is concerned, projects are already underway to develop experiments using small quantities of simple materials (magnesium synthesis, for example). As part of this initiative, we are also organizing a collection of lightweight materials (syringes, septa, small glass items, various test tubes, spatulas, etc.) and chemicals in small packaging so that they can be sent to several African university laboratories. Every day in our laboratories, we throw away many items too worn to be used for research purposes, but which could still be of great use in the teaching of chemistry.³

External Collaborations

It appears that, unlike the teaching situation, few research projects between Africans in the field of chemistry are currently being developed. On the other hand, a number of French laboratories are collaborating with

their African counterparts. This collaboration, which is sometimes crucial to the survival of research in certain laboratories, can take on different aspects at various levels.

Therefore, the welcoming of African students on a grant into French universities, after having been chosen by written application and recommended by the scientific heads of their own universities, ensures the development of new training and/or the reinforcement of the cooperative action in progress. In the recent past, the work of certain doctoral students has even enabled them to become prize winners for their doctoral theses (awarded by the National Center for Scientific Research [C.N.R.S.]).

Furthermore, the development of integrated research programs, which includes the active participation of African teacher-researchers as part of the program of teacher training, enables expansion of one's knowledge. These initiatives are all the more useful, because teacher-researchers often have heavy teaching loads.

However, during the completion of a cooperative project, the individuals in charge strongly urge that as much of the research program as possible be carried out in the African laboratory. This program may then be continued by the doctoral students (as work-based learning), the researcher, or the African teacher-researcher in the European laboratory involved in the cooperation, which has the necessary techniques and equipment for its development. A third partner, either from academia or from industry, may carry out the tests or measures to promote the developed subject, if necessary. These kinds of strategies are currently being formulated in order to develop new material, such as in the synthesis of biomolecules, the promotion of natural products, etc.

Cooperative programs may also involve laboratories from a number of African and French universities. For example, highlighting the active principles of plants in traditional African medicine (odontology) is the focus of a joint venture between Abidjan-Cocody University and Nantes University. As part of the program, the Faculties of Science and Technology and of Odontology and Pharmacy at the two universities are combining their expertise to complete this project. Moreover, several universities may find themselves working together on the same program.

In general, the needs that have previously been identified regarding teaching, research, and scientific information highlight the real need that these joint ventures represent for our African colleagues. Therefore, as part of this initiative, the chairman of the S.O.A.CHIM. visited France in the spring of 1999 in order to meet the different partners likely to offer their support and the various heads of the Société Française de Chimie (SFC).

Conclusion

Even though it is still young, the S.O.A.CHIM. represents Africa's determination to provide itself with the necessary means for self-development. Therefore, the effort its members put forth to increase interest can only create a feeling of optimism and confidence. Thanks to initiatives of this kind, perhaps one day the following quotation, which appeared at the rear of the conference hall at the University of Cotonou, will become obsolete: "Every child that does not have access to education is the proof that our civilization does not yet live up to human dignity." (E. Portella, a leading dignitary of UNESCO).

Chemists eager to pass on to their African colleagues subjects likely to be of some interest to them, have the opportunity to publish the information in the *Journal de la Société Ouest-Africaine de Chimie*⁴, or they may participate in any future congresses⁵.

Notes

¹Coordinators: Prof. Y. T. N'Guessan and Dr. J.-P. Pradère.

²For more information about microscale chemistry, see: a) Martin, N. H. and Waldman, F. S. The three R's of resource management in the undergraduate organic chemistry laboratory. *J. Chem. Ed.*, Vol. 71, November 1994, No. 11, pp. 970–971; b) Szafran, Z., Singh, M. M., and Pike, R. M. The microscale inorganic laboratory: Safety, economy, and versatility. *J. Chem. Ed.*, Vol. 66, November 1989, No. 11, pp. A263–A267; c) Perlmutter, H. D. and Kapichak, R. K. A multiscale approach to organic chemistry laboratory introduction of kiloscale experiments. *J. Chem. Ed.*, Vol. 69, June, 1992, No. 6, pp. 507–508; d) Silberman, R. G. Running a microscale organic chemistry lab with limited resources. *J. Chem. Ed.*, Vol. 71, June 1994, No. 6, pp. A140–A141; e) Zipp, A. P. Introduction to "the microscale laboratory". *J. Chem. Ed.*, Vol. 66, November 1989, No. 11, pp. 956–957; f) Wood, C. G. Microchemistry. *J. Chem. Ed.*, Vol. 67, July 1990, No. 7, pp. 596–597; and g) Zubrick, J. W. *The Organic Chem Lab Survival Manual: A Student's Guide to Techniques*, 3rd ed. John Wiley, New York, 1992.

³Before sending any items, contact R.-E. Eastes at the following e-mail address: eastes@junie.ens.fr

⁴For information about publishing in the *Journal de la Société ouest-africaine de chimie*, contact: Professeur Faustin Sié SIB, 06 BP 9006 Ouagadougou 06–Burkina-Faso.

⁵To participate in the S.O.A.CHIM. Congress, contact: Professeur Yao Thomas, N'Guessan Laboratoire de Chimie Organique Structurale, Faculté des Sciences et des Techniques, Université d'Abidjan-Cocody, 22 BP 582 Abidjan 22, République de Côte d'Ivoire.

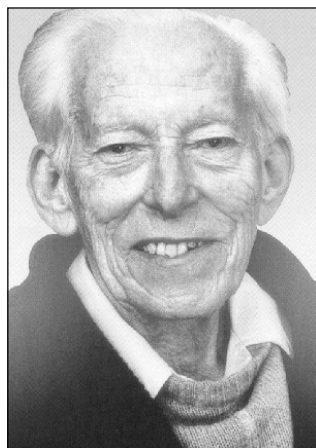
Reports from IUPAC-Sponsored Symposia

39th Microsymposium, Advances in Polymerization Methods: Controlled Synthesis of Functionalized Polymers, 12–15 July 1999, Prague, Czech Republic

This symposium was chaired by Dr. Petr Vlček and organized by the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, one of the most prestigious research institutions in Europe and the organizer of a series of IUPAC microsymposia and discussion conferences within a program called “Prague Meetings on Macromolecules”. On average, two microsymposia and one discussion conference per year are organized.

The Institute of Macromolecular Chemistry in Prague, with its former directors, the late Prof. Otto Wichterle and long-time IUPAC member Prof. Pavel Kratochvíl, is now headed by a new director from a younger generation, Dr. Karel Ulbrich. The directors and their staff organize these meetings to deal with problems related to the research carried out at the Institute. Meetings are attended by distinguished scientists from all over the world. Virtually all leading researchers in macromolecular science have attended at least one—or more often several—of these meetings. The research program of the Institute is sufficiently diversified to encompass the major contemporary topics of these symposia.

Institute Director Ulbrich opened the symposium with his presentation, and Prof. Stanislaw Penczek, Official IUPAC Representative, gave a congratulatory speech on behalf of Prof. Joshua Jortner, President of IUPAC, and Prof. Robert Gilbert, President of the Macromolecular Division of IUPAC.



Prof. Otto Wichterle, former Director of Institute of Macromolecular Chemistry.

The symposium attracted 127 active participants from 29 countries, including 25 from the Czech Republic. There were 9 main lectures, 23 special lectures, and 61 posters.



Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, located in Prague.

Main lectures were presented on both radical and ionic polymerization, as follows:

- K. Matyjaszewski (United States). “Atom transfer radical polymerization as a route to polymers with controlled architecture, compositions, and functionality”.
- M. Sawamoto and M. Kamigaito (Japan). “Controlled synthesis of functionalized polymers by transition metal-mediated living radical polymerization”.
- Y. Yagci (Turkey). “Photoinitiating systems and their use in polymer synthesis”.
- R. P. Quirk (United States). “Anionic synthesis of functionalized polymers using functionalized initiators and electrophilic termination reactions”.
- N. Hadjichristidis (Greece). “Synthesis and characterization of model 4-sulfozwitterionic polymers of variable architecture”.
- A. Hirao (Japan). “Anionic living polymerizations of functional monomers. Precise synthesis of various polystyrenes with monosaccharide residues by means of anionic living polymerization and living functionalization reaction”.
- S. Penczek and A. Duda (Poland). “Polymerization of cyclic esters on covalent metal alkoxides and carboxylates. Importance for polymer synthesis”.
- A. H. E. Müller (Germany). “New well-defined polymer structures *via* living polymerizations”.
- P. J. Lutz (France). “Control of macromolecular architectures *via* various polymerization processes: Advantage and drawback”.

Although any choice of the other lectures would be strictly personal, I should note that interest is focused on radical polymerization allowing several kinetic and



Castle Hradčany in Prague, Czech Republic.

structural features of resulting polymers to be controlled. Thus, mostly nitroxy-mediated polymerization and atom transfer radical polymerization (ATRP) were discussed. These forms of polymerization are not as demanding from the experimental viewpoint as ionic processes, and it was shown that they may lead to graft, block, multiblock, star, and functionalized macromolecules from several classes of monomers. In these processes, termination by macroradical coupling or disproportionation cannot be avoided, but macromolecules of medium molar masses (e.g., up to 10^4 and sometimes higher) can be prepared with well-controlled molar masses and end-groups. By “controlled”, it is understood that, e.g., almost 100% of the end-groups have the desired structure. Control of molar masses means that within a certain range of molar masses, one can obtain a desired and planned molar mass.

The main lectures were given by well-seasoned scientists, although the younger rising stars, such as Profs. Müller, Lutz, and Matyjaszewski, were also present.

In special lectures, both ionic and radical techniques were exposed. Polymers with special properties, further developments in heteromultistar polymers, water-soluble polymers, and molecular recognition in template polymerization were considered the most interesting directions for research.

In addition to the scientific program, the organizers provided social events and a program for accompanying persons that included sightseeing in Prague and a guided tour of the Old Town with a walk over famous gothic Charles Bridge, a visit to the Prague Castle Hradčany, and dinner at the house where Mozart wrote *Don Giovanni*.

All of us have been convinced that we participated not only in a first-class scientific meeting, but also spent

a few happy days in the most beautiful town of Central Europe.

Professor Stanislaw Penczek
Titular Member, Macromolecular Division (IV)
Committee
Associate Member, Commission on Macromolecular Nomenclature (IV.1)
Lódz, Poland

8th International Symposium on
Macromolecule–Metal Complexes
(MMC-8), 5–8 September 1999,
Tokyo, Japan

This symposium was the eighth meeting in the series of symposia on Macromolecule–Metal Complexes (MMC) that have been held every two years, in turn, in Asia, America, and Europe. MMC-8 was attended by 219 participants from 19 countries, including 63 participants from overseas. It was organized by Waseda University and the Division of Macromolecular Complexes of the Japanese Society of Polymer Science.

MMC-8 was intended to provide a forum for exhibitions and discussion about the most recent progress on the bases and developments of macromolecule–metal complexes related to supramolecular assembly, multi-electron transfer reactions, and wide-ranging technologies such as secondary batteries, fuel cells, photoenergy conversion, sensors, catalysis, and microelectronics. The opening ceremony, held in Ibuka Memorial Hall of the International Conference Center, Waseda University, Tokyo, was quite impressive. There were 8 plenary lectures, 33 invited and oral presenta-

tions, 97 posters, and a priority session on batteries and portable fuel cells. Poster sessions and lectures were all well attended, discussions were lively, and the symposium achieved a great success. Outstanding speakers included J.-H. Fuhrhop, Free University of Berlin; K. Levon, Polytechnic University of Brooklyn; D. Wohrle, University of Bremen; N. Oyama, Tokyo University of Agriculture and Technology; F. Ciardelli, University of Pisa; G. A. Sykes, University of Newcastle; and J. Reedijk, Leiden University.

A welcoming reception, a short excursion to Asakusa (a tofu restaurant), including a night view of Tokyo, and the symposium banquet were all well organized, and participants enjoyed them very much.

Symposium President Prof. Eishun Tsuchida, Program Committee Chairman Prof. Masao Kaneko, and Executive Committee Chairman Prof. Hiroyuki Nishide are to be commended for presenting a symposium of the highest quality in terms of topics, speakers, and organization.

Professor Kazuyuki Horie
Titular Member, Commission on Macromolecular Nomenclature (IV.1)
University of Tokyo
Tokyo, Japan

4th IUTOX Congress of Toxicology in Developing Countries (4th CTOX-DC), 6–10 November 1999, Antalya, Turkey

This meeting, sponsored by the Turkish Society of Toxicology along with IUPAC and the International Union of Toxicology (IUTOX), covered a wide variety of topics at a high level and was attended by many of the world's leading toxicologists. It started with a workshop on environmental oestrogens that provided an overview of the problem and stimulated active discussion. The conclusion of the workshop was that the evidence for significant harmful effects of oestrogenic substances in the natural environment is still limited to a few examples and that no definite conclusions can yet be reached about any effect on the human species. Current research in this area will, we hope, clarify matters and alleviate public concern.

The workshop was followed by a series of symposia. Topics included safety issues in developing countries, life styles and health, pesticides, neurotoxicity of drugs of abuse, advances in understanding allergic sensitization, occupational exposure to chemicals in the workplace, risk assessment and chemical management, advances in molecular toxicology, and ecotoxicology. There were plenary lecture sessions on genetic polymorphism, xenobiotic toxicity, and clinical toxicology.

In addition, there were two more workshops on chemical risk assessment in theory and practice and educational needs for developing countries, as well as oral and poster presentations.

So many issues were raised and discussed that one can pick out only a few of special note. A recurring theme was the lack of facilities for local experts to monitor chemical exposures in developing countries. This situation makes it very difficult to enforce legislation for chemical safety, and it may be a particular problem with pesticides made by local manufacturers in developing countries. These pesticides are bought by farmers because they are cheap, but they may contain harmful impurities that are no longer permitted in the developed countries.

Underlying many of the presentations was concern about risk assessment. Toxicology defines the intrinsic hazard associated with a chemical and relates this hazard to exposure in the form of dose-response and concentration-response curves. However, it tells us nothing about risk, which is a function of the way in which a chemical is used and the probability of a person or other organism being exposed to a sufficient amount of a chemical to cause harm. Thus, a certain chemical may be classified as toxic, but this does not mean that it will necessarily cause harm. If little or no exposure to this chemical occurs, or is likely to occur, risk of harm may be negligible. Determining exposure is a challenge for chemists and may require development of new techniques. For example, guidelines for exposure to elements other than carbon are largely set in relation to total elemental concentration. Chemical speciation is ignored at least partly because analytical chemists often do not speciate elemental analysis. For example, arsenic analysis is rarely quoted as arsenite, arsenate, or organic species, although we know that their toxicology is different. Risk assessment based on total arsenic analysis is meaningless.

Other unifying concerns were related to differential susceptibility to the effects of chemicals owing to genetic and environmental differences and the problem of assessing mixed exposures. The effects of diet were given due attention. Ecotoxicology got less attention than it deserves, and the organizers of the next congress of this kind may wish to include more on this area.

The workshop on educational needs for developing countries was particularly interesting. It is clear that at least some developing countries are not short of expertise but, rather, lack the facilities to make full use of the experts available. It also appears that there is a lack of expertise in certain specialist areas and that the international organizations should identify these areas in order to help provide necessary course material. However, there seems to be a lack of coordination between

international bodies in providing such material and in maintaining an ongoing educational program. Perhaps IUPAC and IUTOX could get together with the International Union of Pharmacology (IUPHAR) and initiate a body for coordinating toxicological education at the international level. Such a body could ensure that educational material of recognized quality was available, preferably through the Internet, and could respond to requests for specific courses to be organized.

Nearly 300 people participated in the 4th CTOX-

DC, and it succeeded well in reflecting both our current understanding of important areas of toxicology and the significance of toxicology for safe use of chemicals in both developed and developing countries.

Dr. John H. Duffus

Chairman, IUPAC Commission on Toxicology (VII.C.2)

**The Edinburgh Centre for Toxicology
Edinburgh EH9 2JD, Scotland, United Kingdom**

Awards and Prizes

Guy Ourisson Wins Maison de la Chimie Foundation Prize

Prof. Guy Ourisson, Membre de l'Institut, Président de l'Académie des Sciences, and former IUPAC Secretary General from 1975–1983, has won the Maison de la Chimie Foundation Prize for 2000. This prestigious award, created in 1986, is intended to honor an original work in chemistry of benefit to mankind, society, or nature. This year's award has a value of 150 000 FF. A jury of three former laureates and six scientists whose nationality is other than French chose Prof. Ourisson as the prize winner by majority vote. Prof. Ourisson presented a lecture on his work entitled "Une piste pour les années 2000: vers l'origine de la vie?" at the award ceremony on 18 January 2000 at the Maison de la Chimie in Paris.

Upendra Pandit Receives "Honoris Causa" from University of Milan

Prof. Upendra Pandit, Instituut voor Moleculaire Chemie, Faculteit Der Scheikunde, Universiteit van Amsterdam and President of IUPAC's Division of Organic Chemistry (III) (now Division of Organic and Biomolecular Chemistry) from 1992–1999, has been awarded a prestigious honorary doctorate degree, the "Honoris Causa" in pharmacy, by the University of Milan. Prof. Giorgio Cignarella of the Facoltà di Farmacia, Università degli Studi di Milano presented the award to Prof. Pandit at a ceremony at the university campus in Milan on 25 January 2000.

Ram Lamba Wins American Chemical Society Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring

Prof. Ram S. Lamba, a National Representative from Puerto Rico on IUPAC's Committee on Teaching of Chemistry (CTC), is one of ten 1999 winners of an American Chemical Society Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring. The award honors those who have guided a significant number of students over a sustained period of time. Particular consideration is given in the award selection process to mentors who have encouraged minorities, women, and people with disabilities to embark upon careers in scientific, engineering, and other technical fields.

A professor of chemistry and dean of academic affairs at the University of Puerto Rico at Cayey, Prof. Lamba's "mentees" have included nine university science professors and more than 500 science teachers.

New Books and Publications

New Books from IUPAC

***IUPAC Handbook 2000–2001*. IUPAC (2000), pp. viii + 1–315. ISBN 0-9678550-0-4, USD 25.00.**

The new edition of the IUPAC Handbook, available for sale now from the Secretariat and also posted on the IUPAC web site at www.iupac.org, contains updated listings and information on all aspects of IUPAC's organization.

Included in the new Handbook are current listings of organization and membership for all IUPAC Divisions, Commissions, Committees, Working Parties, and Task Groups. Recently revised lists of IUPAC National Adhering Organizations, Associate National Adhering

Organizations, Associated Organizations, and Company Associates are presented. Historical information on past IUPAC Officers, General Assemblies, and Congresses also appears. Appendixes present information on IUPAC reports published during 1998 and 1999, IUPAC-sponsored symposia and conferences from 1998–2001, procedures for publication of IUPAC technical reports and recommendations, guidelines for drafting IUPAC technical reports and recommendations, and IUPAC copyright policies. Updated IUPAC statutes and bylaws, information about the IUPAC Affiliate Membership Program (AMP), a revised list of IUPAC-approved abbreviations, and updated coding for IUPAC bodies also are provided.

The screenshot shows a Netscape browser window displaying the IUPAC Handbook website. The browser's address bar shows the URL <http://www.iupac.org/handbook.html>. The page features a large 'IUPAC' header and a main title 'IUPAC Handbook'. Below the title, a paragraph states: 'The IUPAC Handbook is the Union reference. The information contained in the Handbook is accessible on the IUPAC web site where it is regularly updated. The on-line version of the contents of the Handbook are provided here.' A section titled 'On-line Contents' lists several links: 'IUPAC Information', 'Officers / Secretariat', 'Past Officers of IUPAC', and 'General Assemblies and Congresses of IUPAC'. Below this, a section titled 'MEMBERSHIP LISTS OF IUPAC BODIES' lists links for 'National Adhering Organizations', 'Associate National Adhering Organizations', 'Associated Organizations', 'Company Associates 2000', and 'Bureau'. A left-hand navigation menu includes links for 'News & Notices', 'Organizations & People', 'Standing Committees', 'Divisions', 'Projects', 'Reports', 'Publications', 'Symposia', and 'AMP'. The browser's status bar at the bottom indicates 'Document: Done'.

Compendium de terminologie chimique. Recommandations IUPAC et Lexique anglais/français, 2^e édition. Préparé par Jean-Claude Richer. Editions Tec & Doc, Paris (1999), pp. viii + 1-646. ISBN 2-7430-0356-1. [French translation of IUPAC "Gold Book", Compendium of Chemical Terminology, 2nd edition. Compiled by Alan D. McNaught and Andrew Wilkinson. Blackwell Science (1997), pp. vii + 1-450]

This French translation of the 2nd edition of the IUPAC "Gold Book" was prepared by Prof. Jean-Claude Richer, Department of Chemistry, University of Montreal, Quebec, Canada. It is available from Editions Tec & Doc, 11 rue Lavoisier, F-75384 Paris Cedex 08, France.

The 2nd edition of the IUPAC "Gold Book" represents a very substantial enhancement of the 1st edition. In the twelve years since publication of the 1st edition, IUPAC has revised and updated most of the original definitions, and has produced new glossaries of terms in many areas of chemistry not previously covered. Around 7 000 entries cover all the traditional areas of chemistry and also growing fields such as stereochemistry, photochemistry, organic class names, atmospheric chemistry, catalysis, biotechnology, chromatography, toxicology, and bioanalytical chemistry. The resulting compendium, like the 1st edition, contains only definitions approved by international consensus, and thus can be regarded as truly authoritative. It is an essential reference resource for chemists everywhere.

New Publication from the Pan American Health Organization

Biodiversity, Biotechnology, and Sustainable Development in Health and Agriculture: Emerging Connections

1998, 248 pages (English; also available in Spanish), ISBN 92-75-11560-5, USD 32.00 (Special offer: USD 22.00); In developing countries: USD 24.00 (Special offer: USD 17.00), Order Code SP 560. PAHO Sales and Distribution Center, P.O. Box 27, Annapolis Junction, MD 20701-0027, USA; E-mail: paho@pmds.com; Tel.: +1 301 617 7806; Fax: +1 301 206 9789; Web site: <http://publications.paho.org/>.

This publication is a compendium of articles prepared by economists, sociologists, lawyers, biological sciences researchers, and other health professionals that explores the connections among biodiversity, biotechnology, and sustainable development in developing countries from the points of view of their different professions. The book focuses on two aspects of special interest to human health: drug discovery and improved nutrition through advances in agriculture.

The first section discusses different bioprospecting ventures—including the now famous agreement between Merck & Co. and Costa Rica's National Institute for Biodiversity (INBio)—and suggests policy options for potential host countries. Subsequent sections explore such issues as costs, scientific and resource requirements, and economic prospects of different drug development models; how biodiversity and biotechnology can team up to establish a high-yield, sustainable agriculture; the legal ramifications of intellectual property rights, fair compensation for indigenous knowledge, and different contractual arrangements; how to assess biodiversity's economic value; and domestic and international policy implications of the use and conservation of biodiversity. A final section discusses whether biodiversity—"green gold"—will, in fact, become Latin America's and the Caribbean's new competitive advantage.

Emerging Connections is a must-read for those setting national biodiversity policies; teams working on the national strategies and action plans needed to implement the Biodiversity Conference; environmentalists; scientists and business people entertaining bioprospecting ventures; lawyers; and nongovernmental organization (NGOs) working on health, sustainable development, or environmental issues.

New Publications from the World Health Organization

Copper, Environmental Health Criteria No. 200

1998, xxii + 360 pages (English with summaries in French and Spanish), ISBN 92-4-157200-0, CHF 72.-/USD 64.80; In developing countries: CHF 50.40, Order No. 1160200. WHO Distribution and Sales, CH-1211 Geneva 27, Switzerland; E-mail: Publications@who.ch; Tel.: +41 22 791 24 76; Fax: +41 22 791 48 57.

This book evaluates the risks to human health and the environment posed by exposure to copper, a malleable metal found naturally in a wide variety of mineral salts and organic compounds, and in the metallic form. Copper is an essential element for all biota. It is widely used in cooking utensils and water distribution systems, in fertilizers, bactericides, fungicides, algicides, and antifouling paints, and in animal feed additives and growth promoters. Industrial applications include use as an activator in froth flotation and sulfide ores, in the production of wood preservatives, in electroplating, and in the manufacturing of azo-dyes.

The report opens with a description of the array of sampling techniques, preparation, and analytical methods available for quantifying copper in environmental and biological samples. Section 2 covers sources of

human and environmental exposure. Natural sources include windblown dust, volcanoes, decaying vegetation, forest fires, and sea spray. Anthropogenic emissions arise from smelters, iron foundries, power stations, and combustion sources such as municipal incinerators.

A section on environmental behavior discusses what is known about the fate of copper released to the atmosphere, water, and land. Data indicate that most copper is released to land; major sources are mining operations, agriculture, solid waste, and sludge from treatment works. Bioaccumulation, which occurs if the copper is biologically available, can lead to exceptionally high body burdens in animals and terrestrial plants. A review of levels detected in different environmental compartments supports the conclusion that, for healthy members of the general population, the major route of exposure is oral, with substantial exposure possible when drinking-water is contaminated with copper.

A section on kinetics and metabolism cites evidence that copper is mainly absorbed through the gastrointestinal tract, where part is excreted through the feces and the remainder is transported to the liver bound to serum albumin. The liver is the critical organ of copper homeostasis. When copper exceeds homeostatic control, its biological toxicity arises from its effects on the structure and function of biomolecules such as DNA, membranes, and proteins.

A review of abundant findings from studies in laboratory animals and *in vitro* test systems shows wide species variations in toxic effects. Rats exposed to single doses by the oral route showed alterations in blood biochemistry and hematology, and adverse effects on the liver, kidney, and lungs. Long-term exposure in rats and mice demonstrated no overt signs of toxicity other than a dose-related reduction in growth. Studies of chronic toxicity and carcinogenicity were judged inadequate for assessment. Limited data on immunotoxicity suggest some impairment of humoral and cell-mediated immune functions in mice. While studies of neurotoxicity have failed to demonstrate behavioral effects, some neurochemical changes have been reported after oral administration.

An assessment of health effects in humans draws on numerous investigations of copper's role as both an essential and a toxic element, and on abundant evidence that adverse effects may arise from both deficient and excessive intakes. Clinically evident deficiency, which is rare in the general population, is characterized by anemia, neutropenia, and bone abnormalities. Copper toxicity, likewise rare in the general population, usually arises following the consumption of contaminated beverages, including drinking-water, or from accidental or suicidal ingestion of high quantities of copper salts. Symptoms include vomiting, lethargy, acute

hemolytic anemia, renal and liver damage, neurotoxicity, and increased blood pressure and respiratory rates.

The evaluation gives particular attention to the clinical features of population groups known to be especially sensitive to copper toxicity. These people include premature infants fed on cow's milk, infants recovering from severe malnutrition, hemodialysis patients, patients suffering from chronic liver disease, and patients with genetically determined disorders of copper homeostasis, such as Menkes disease, Wilson disease, and hereditary aceruloplasminemia. The report also cites evidence from several recent dietary surveys indicating suboptimal copper intake in the mean population. Health effects arising from insufficient copper intake, which may have a role in the pathogenesis of cardiovascular disease, were judged to be more important than adverse effects associated with excessive ingestion.

Polybrominated Dibenzo-p-dioxins and Dibenzofurans, Environmental Health Criteria No. 205

1998, xxi + 303 pages (English with summaries in French and Spanish), ISBN 92-4-157205-1, CHF 66.-/USD 59.40; In developing countries: CHF 46.20, Order No. 1160205.

This book evaluates the risks to human health and the environment posed by exposure to polybrominated dibenzo-*p*-dioxins (PBDDs) and polybrominated dibenzofurans (PBDFs). Of no commercial use, these compounds are generated as unwanted by-products of various industrial and combustion processes and have been detected as contaminants in a number of brominated organic chemicals, many of which are used as flame retardants.

Thermolysis of brominated flame retardants is an important source of emissions, as is the incineration of products containing these flame retardants, most notably scrap computers and business machines. PBDDs and PBDFs have also been detected in emissions of motors using both leaded petrol and unleaded petrol, with and without catalytic converters, and in emissions of diesel engines.

In view of the complexity of these compounds, the problems with analytical procedures, and substantial gaps in the experimental database, the report makes a special effort to determine the extent to which the environmental behavior and toxic effects of PBDDs and PBDFs resemble those of their better characterized chlorinated analogs, polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). An effort is also made to determine the extent to which PBDDs and PBDFs contribute to the overall hazard posed by environmental "dioxins".

The opening sections consider currently available

analytical methods for detection and analysis, and discuss the principal sources of human and environmental exposure. Although data are limited, the available evidence confirms formation of PBDDs and PBDFs during fire accidents, especially when electrical appliances are involved, during the use of flame retardants and fire extinguishers, during waste disposal and treatment, and during combustion processes in engines. Current environmental levels are judged to be much lower than those for the ubiquitous PCDDs and PCDFs. Evidence suggests that occupational exposure may occur in a variety of workplaces. Workers at greatest risk are those employed in the plastic and recycling industry, where brominated flame retardants or products containing them are used; fire fighters; and cleanup personnel associated with fires. Some monitoring results are also available for exposures in workplaces equipped with a number of electrical appliances continually in use, such as displays and computer monitors.

A section on environmental behavior cites evidence that these compounds are similar to their chlorinated analogs, with preferential distribution to carbon- or fat-rich compartments and long persistence. Data on kinetics and metabolism are assessed in the next section, which concludes that these compounds are distributed throughout the body, with major deposits found in liver and adipose tissue, followed by skin and muscle.

Data from experimental studies of toxicity support the conclusion that the thymus, lymphatic tissue, and liver are the principal targets of toxic action. Thymus atrophy and other signs of immunotoxicity were the effects most consistently seen in laboratory animals. Data on human exposures and health effects were judged inadequate to support an assessment of hazards for the general population or a recommended safe level of exposure.

In view of the growing worldwide production and use of brominated flame retardants as additives to a series of polymers, the report concludes that the amount of bromine-containing waste will be increasing in the future, and that electronic scrap from casings and printed circuit boards of computers, flame-retarded with brominated compounds, will reach the waste streams as a potentially major source of release to the environment. As the potential for toxic action of these compounds is judged similar to that of their chlorinated analogs, the report recommends that every effort should be made to prevent environmental pollution with PBDDs and PBDFs. To avoid release in the environment, the report further concludes that brominated flame retardants should be phased out and that all products flame-retarded with bromine compounds should be labeled and disposed of only in properly constituted waste incinerators designed to minimize emissions.

Carbon Tetrachloride, Environmental Health Criteria No. 208

1999, xviii + 177 pages (English with summaries in French and Spanish), ISBN 92-4-157208-6, CHF 42.-/USD 37.80; In developing countries: CHF 29.40, Order No. 1160208.

This book evaluates the risks to human health and the environment posed by exposure to carbon tetrachloride, a volatile liquid previously used in the production of chlorofluorocarbons and other chlorinated hydrocarbons. Production and use have declined considerably following the Montreal Protocol on Substances that Deplete the Ozone Layer. Additional former applications that have also been phased out include use as a grain fumigant, pesticide, vent for oils and fats, metal degreaser, fire extinguisher, and flame retardant.

A review of data on the environmental behavior of this volatile chemical concludes that almost all carbon tetrachloride released to the environment is ultimately present in the atmosphere. Although estimates of atmospheric lifetime vary considerably, 45–50 years is accepted as the most reasonable range. Studies indicate significant global transportation and ubiquitous presence in air. The main degradation site is the stratosphere, where the chemical is photolytically degraded by ultraviolet radiation. Abundant evidence indicates that carbon tetrachloride contributes to both global warming and ozone depletion.

Concerning sources of exposure, studies of concentrations detected in a wide range of indoor and outdoor samples indicate that the general population can be exposed to carbon tetrachloride via air, food, and drinking-water. A review of studies of kinetics and metabolism in laboratory animals and humans cites evidence that carbon tetrachloride is well absorbed from the gastrointestinal and respiratory tracts and distributed throughout the body, with the highest concentrations detected in the liver, brain, kidney, muscle, fat, and blood.

A review of toxicity studies conducted in laboratory mammals and *in vitro* test systems indicates that the liver and kidney are the principal targets of toxic action. The severity of these toxic effects depends on a number of factors, including diet. Studies show that other compounds, including ethanol, can potentiate the hepatotoxicity of carbon tetrachloride. Long-term toxicity studies were judged inadequate to assess the chemical's carcinogenic potential. Carbon tetrachloride produced moderate irritation following skin application in animals.

An assessment of health effects in humans draws on findings from studies in human volunteers and case reports of accidental and suicidal poisoning. These findings confirm toxic effects on the liver and kidney. Acute

symptoms of exposure include nausea, vomiting, headache, dizziness, dyspnea, and death. Liver damage appears after 24 hours or more, while kidney damage becomes evident only 2 to 3 weeks following acute exposure. Studies indicate that hepatic and renal damage can arise from long-term exposure to low concentrations. Available epidemiological studies have failed to establish an association between exposure to carbon tetrachloride and increased risk of mortality, neoplasia, or liver disease.

On the basis of this review, the report established a tolerable daily intake for carbon tetrachloride of 1.42 $\mu\text{g}/\text{kg}$ body weight, and a tolerable daily concentration in air of 6.1 $\mu\text{g}/\text{m}^3$.

Flame Retardants: Tris(chloropropyl) Phosphate and Tris(2-chloroethyl) Phosphate, Environmental Health Criteria No. 209

1998, xix + 106 pages (English with summaries in French and Spanish), ISBN 92-4-157209-4, CHF 27.-/USD 24.30; In developing countries: CHF 18.90, Order No. 1160209.

This book evaluates the risks to human health and the environment posed by exposure to three flame retardants: tris(1-chloro-2-propyl) phosphate (TCPP), tris(1,3-dichloro-2-propyl) phosphate (TDCPP), and tris(2-chloroethyl) phosphate (TCEP). In view of their many similarities, TCPP and TDCPP are covered together. Data on all flame retardants are extremely limited and largely confined to studies of environmental levels and adverse effects detected in experimental animals and *in vitro* test systems.

The monograph on TCPP and TDCPP describes manufacturing processes and summarizes current uses. The vast majority of TCPP is used in rigid polyurethane foams, with main applications in insulation for buildings and in refrigerator casings. TDCPP is likewise added as a flame retardant to polyurethane foam and has some additional applications as a flame retardant for nonwoven fabrics. For both chemicals, studies show that residues are found infrequently and at low concentrations in food items. For TCPP, traces have been detected in industrial and domestic effluents, but not in surface water or drinking-water. Traces of TDCPP been detected in sewage effluent, river water, seawater, drinking-water, water sediment, and fish. In view of the low volatility of both chemicals, the report concludes that human exposure from these sources will be very low and will not present an acute health hazard for the general population. Likewise, no adverse effects on the environment are anticipated from the use of either of these flame retardants.

Experimental studies of TCPP in laboratory animals demonstrate low to moderate toxicity by the oral, dermal, and inhalation routes. Tests indicate that the chemical is neither a skin nor an eye irritant. No studies were

available to evaluate reproductive toxicity, immunotoxicity, or carcinogenic potential. *In vitro* and *in vivo* mutagenicity studies produced negative results.

Toxicity studies of TDCPP show low to moderate acute toxicity by the oral route and low acute toxicity by the dermal route. The report found no evidence of teratogenicity or mutagenicity. A single carcinogenicity study found an increased occurrence of several tumors at all exposure levels tested in both male and female rats. In the absence of data on the mechanisms of carcinogenic action, the relevance of these findings to humans could not be assessed. The limited studies of occupationally exposed workers were judged inadequate for evaluation.

The second monograph evaluates TCEP, a flame retardant with declining uses in the production of liquid polyester resins and in textile back-coating formulations. Traces have been detected in river water, seawater, drinking-water, sediment, fish and shellfish, and in a few food items. Experimental studies show low to moderate acute oral toxicity. In repeat dose experiments, TCEP caused adverse effects on the brain, liver, and kidneys. The report concludes that TCEP is not an irritant to the eye or skin and is not teratogenic, although some adverse effects on the fertility of male rats and mice have been demonstrated. Data indicating low environmental exposures support the conclusion that TCEP poses a very low risk of adverse health effects for the general population. Use of TCEP is not expected to cause any adverse effects on the environment.

Food Safety Issues Associated with Products from Aquaculture, Report of a Joint FAO/NACA/WHO Study Group, Technical Report Series No. 883

1999, vii + 55 pages (available in English; French and Spanish in preparation), ISBN 92-4-120883-X, CHF 14.-/USD 12.60; In developing countries: CHF 9.80, Order No. 1100883.

This report provides an expert assessment of risks to human health that may arise from the consumption of farmed finfish and crustaceans. Representing the consensus reached by a group of 28 international authorities, the report responds to the urgent need for a complete inventory of all potential risks, an evaluation of their significance and severity, and advice on their reduction or control. The assessment takes on particular significance in view of the growing importance of farmed fish as both a major export commodity and a vital source of protein in low-income food-deficit countries.

Produced by WHO in collaboration with FAO and the Network of Aquaculture Centers in Asia-Pacific, the report gives particular attention to practices com-

mon in Asia, where 90% of global aquaculture production takes place. Common fish farming practices, associated risks, and strategies for their control are considered for small-scale rural subsistence farms, as well as for intensive commercial systems.

The report opens with a review of the significance of aquaculture as one of the fastest growing food sectors in the world and an increasingly important source of sustainable food production. A section on global aquaculture production and food supply describes various systems used in fish farming, outlines current trends, and discusses the significance of production in Asia, where aquaculture supplies both low-value staple-food species for domestic markets and high-value cash-crop species for export. The principles of food safety risk analysis are introduced in the next section, which explains how risk analysis functions to identify food safety hazards and determine their relevance for health. The use of risk analysis in the development of food standards to protect health and facilitate trade is also briefly explained.

Against this background, the core of the report provides a complete assessment of all potential biological and chemical hazards. Biological hazards are presented in the categories of parasites, bacteria, and viruses. For parasites, major attention is given to the risk posed by trematode parasites, especially in areas where the consumption of raw fish is common. An evaluation of hazards associated with human pathogenic bacteria considers bacteria naturally present in the aquatic environment and those present as a result of contamination with human or animal feces, giving particular attention to hazards associated with *Salmonella spp.*, *Escherichia coli*, and other enterobacteria. For viruses, the report notes that finfish and crustaceans are not usually associated with the spread of viral foodborne disease. Potential hazards from toxic compounds produced by aquatic organisms are also briefly assessed.

The assessment of chemical hazards considers compounds used in the aquaculture system itself or introduced by acute and chronic pollution of waterways or water sources. Separate evaluations are provided for a large number of agrochemicals, chemotherapeutics, metals, feed ingredients, additives, contaminants, and organic pollutants. Because the risk of infectious disease is an ever-present problem in aquaculture, the evaluation gives particular attention to potential health effects arising from the use of antimicrobial agents, the presence of residues in edible fish tissue, and the possible development of antimicrobial resistance.

Strategies for controlling biological and chemical hazards are presented in the next section, which describes the seven principles of the Hazard Analysis Critical Control Point (HACCP) system, adapted to aquaculture. To illustrate these principles, four critical con-

trol points (site selection, water quality, feed supply, and fish production) in an aquaculture system are discussed. The remaining sections point to the need for considerable further research and set out the main recommendations and conclusions reached during the assessment.

WHO Expert Committee on Specifications for Pharmaceutical Preparations, 35th Report, Technical Report Series No. 885

1999, vi + 156 pages (available in English; French and Spanish in preparation), ISBN 92-4-120885-6, CHF 35.-/USD 31.50; In developing countries: CHF 24.50, Order No. 1100885.

This book provides a progress report on a number of WHO activities intended to support a comprehensive approach to the quality assurance of pharmaceutical products. Although the report has global relevance, its guidance is of particular importance in countries attempting to establish or strengthen a regulatory framework for pharmaceutical products. All recommendations share the ultimate goal of helping regulatory authorities safeguard the health of patients by protecting them from substandard or counterfeit products.

The report has two parts. The first provides a summary of several ongoing activities coordinated by WHO. These include the continuing development of the *International Pharmacopoeia*, the establishment of International Chemical Reference Substances and International Infrared Reference Spectra, guidelines for good manufacturing practices, work on the standardization of nomenclature and terminology, and support to countries seeking to establish drug regulatory legislative systems.

The second and most extensive part consists of nine annexes. The first two provide updated lists of available International Chemical Reference Substances and International Infrared Reference Spectra. The remaining annexes set out international guidelines and recommendations covering a range of activities central to the quality control and regulation of pharmaceutical products. Revised general guidelines for the establishment, maintenance, and distribution of chemical reference substances are issued in line with recent refinements in pharmaceutical and analytical methods, and the continuing need to harmonize the use of comparative standards for pharmaceutical testing and control.

Two subsequent annexes supplement WHO guidelines for good manufacturing practices. The first provides advice on the role, functions, and training of the authorized person, within a manufacturing establishment, responsible for the release of batches of finished products for sale. The second describes good practices for the manufacture of pharmaceutical excipients. Topics covered include self-inspection and quality control,

use and cleaning of equipment, quality control of starting materials, and good practices in production and quality control. Additional guidelines cover the inspection of drug distribution channels as a means of ensuring that quality drugs reach patients, and present a framework, consisting of core activities, goals, and areas where national standards are needed, for promoting good pharmacy practices in community and hospital pharmacy settings.

Additional guidelines on national drug regulatory legislation establish guiding principles for small drug regulatory authorities. General advice on points to consider when drafting national legislation and defining the scope of the marketing authorization procedure is followed by a detailed example of a legislative scheme, including model legislative text and commentary. Intended to assist drug regulators, those drafting legislation, and decision-makers, the guidelines should prove of immediate value to small national drug regulatory authorities with limited human and other resources. Also included is a provisional legislative scheme for the registration of pharmacy personnel. The report concludes with provisional guidelines for developing training programs for the inspection and examination of counterfeit pharmaceuticals.

Cancer Pain Relief and Palliative Care in Children

1998, ix + 76 pages (available in English; French and Spanish in preparation), ISBN 92-4-154512-7, CHF 18.-/USD 16.20; In developing countries: CHF 12.60, Order No. 1150459.

This book provides a comprehensive guide to the relief of pain and other symptoms in children suffering from cancer. Drawing on considerable new knowledge about pain control in children, the book aims to ensure that pediatric oncologists and other health professionals have all the information and arguments needed to relieve pain, improve quality of life, and reduce the distress of patients and their families. Recommended lines of action are specific to the unique way in which children experience pain and respond to both pain-relieving medication and non-drug measures.

Information ranges from a tabular summary of the advantages and disadvantages of different routes for administering analgesics to children, through a list of drugs that should not be used in newborns and infants, to the simple observation that older children may deny their pain for fear of more painful treatment. Advice on the management of symptoms related to the disease process or arising from its treatment is also provided in this comprehensive account.

The book opens with facts and figures indicating the global magnitude of problems related to childhood cancer and the large percentage of patients who will experience severe pain. Reasons for the widespread

inadequacy of pain control are also discussed. These reasons include exaggerated fears of drug addiction, lack of knowledge about the way children perceive pain, misunderstanding of the pharmacodynamics and pharmacokinetics of opioid analgesics in children, use of inappropriate drug doses, and failure to appreciate the value of simple non-drug supportive measures. Readers are reminded that, with commitment and the appropriate use of available technology, most of the world's childhood cancer patients can receive both pain relief and palliative care, even if cure is impossible.

Against this background, the book presents concise clinical advice in two parts. Part 1 discusses the components of palliative care, stressing the need to provide pain relief within the context of a holistic approach that recognizes children's psychological, social, and spiritual problems. A discussion of the main types of pain in childhood cancer makes a distinction between developed countries, where most pain arises from diagnostic and therapeutic procedures, and the developing world, where diagnosis is often late and most pain is therefore disease-related.

The second and most extensive part provides a detailed guide to therapeutic strategies, giving major attention to the correct prescribing of analgesic drugs. A description of the principles of pain assessment in children is followed by practical advice on the use of simple behavioral, cognitive, and supportive pain-relieving measures, many of which can be provided by parents or siblings. Because analgesic drugs are regarded as the mainstay of pain relief, subsequent sections provide precise guidelines for analgesic drug therapy, describe specific drugs and recommended doses for pain relief in different situations, and explain appropriate ways of treating the predictable side effects of opioids. A section dealing with the issue of opioid dependence and tolerance presents facts and arguments that can ease the fears of parents and help ensure that severe pain is treated with adequate doses of opioids.

Other sections explain the use of adjuvant therapy to elevate mood, reduce anxiety levels, or minimize the adverse side effects of the primary analgesic drugs, and discuss the management of pain caused by diagnostic and therapeutic procedures. In line with the call for a holistic approach to care, advice is also given on the spiritual needs of children and families, on care for the dying child, and on related ethical issues, including euthanasia and physician-assisted suicide. The guide concludes with discussions of priorities in professional education, legislative and policy issues, and requirements for the organization of cancer pain relief programs.

Compassionate as well as authoritative, the book should prove useful to all health workers engaged in the care of children with cancer.

Environmental Health Services in Europe 4. Guidance on the Development of Educational and Training Curricula (WHO Regional Publications, European Series No. 84) by Martin Fitzpatrick and Xavier Bonnefoy, WHO Regional Office for Europe, Copenhagen, Denmark

1998, viii + 198 pages (available in English only), ISBN 92-890-1350-8, CHF 45.-/USD 40.50; In developing countries: CHF 31.50, Order No. 1310084.

The commitment made by the Member States of the WHO European Region to developing their environmental health services is gradually bearing fruit. The seeds of this commitment were sown over the last two decades through the European regional policy for health for all. This was followed up by the First European Conference on Environment and Health, held in Frankfurt-am-Main in 1989, which identified the groundbreaking principles underpinning environmental health in the European Charter on Environment and Health. The Second European Conference, in Helsinki in 1994, proved to be a watershed in the development of environmental health services in the Region, presenting a clear path forward that all Member States could follow through the development of national environmental health action plans (NEHAPs).

It was clear that the countries would need support in developing and implementing NEHAPs, and the Regional Office therefore developed a project to produce a series of publications dealing with all aspects of environmental health services management. The first in the series provided an overview of how services are managed throughout the Region, and the second dealt with the variety of policy options that Member States might consider in organizing those services. The third book (WHO Regional Publications, European Series, No. 82) concentrated on the staffing of environmental health services. This fourth volume, which is a companion to the third, provides practical assistance in the education and training of environment and health professionals. This assistance includes identifying relevant learning objectives, developing appropriate teaching methodologies, and proposing a range of curricula for various levels of professionals.

There was tremendous interest on the part of Member States and educational institutes in the development of this publication. The result is a book that is grounded in the realities of Member States who are endeavoring to equip their environment and health professionals to deal with the rapidly changing world in which they work. It also attempts to facilitate environment and health service providers and educational institutions in developing a common understanding of how to address the needs of these professionals.

Safe Management of Wastes from Health Care Activities. Edited by A. Prüss, E. Giroult, and P. Rushbrook

1999, xiv + 230 pages + 4 color plates (available in English; French and Spanish in preparation), ISBN 92-4-154525-9, CHF 72.-/USD 64.80; In developing countries: CHF 50.40, Order No. 1150453.

This handbook provides the first comprehensive guide to the safe and efficient handling, treatment, and disposal of all categories of hazardous waste generated by health care activities. Although the major emphasis is on waste generated by hospitals, guidelines and advice are also relevant to wastes produced in health centers, research facilities, and laboratories, or associated with home care or treatment in doctors' and dentists' practices.

In publishing this handbook, WHO aims not only to promote a sound managerial approach and the use of appropriate technologies, but also to inform countries about the health risks that result from inadequate management of health care waste. With these goals in mind, the book provides both an alert to documented public health and environmental hazards and a catalog of the technical, managerial, and legislative options available for reducing these risks. All components of a waste management policy—whether at the national or institutional level—are considered in detail.

Although recommended policies and procedures have universal relevance, the handbook gives particular attention to conditions in developing countries, where methods for the safe treatment and disposal of hazardous waste may be limited. With these conditions in mind, the handbook includes approaches for gradual improvements together with a catalog of options for waste management that include both simple and highly sophisticated technologies. Throughout, photographs, line drawings, checklists, tables, and step-by-step procedures are used to enhance the practical value of the wealth of guidance provided.

The book opens with a definition and characterization of hazardous health care wastes categorized as infectious waste, pathological waste, sharps, pharmaceutical waste, genotoxic waste, chemical waste, waste with high content of heavy metals, pressurized containers, and radioactive waste. The health consequences of exposure to each category of waste are described in the next chapter, which considers the nature and severity of associated health hazards, factors influencing the likelihood of exposure, persons at risk, and significance for public health. Concentrated cultures of pathogens and contaminated sharps are identified as the waste items that represent the most acute potential hazards to health. Other chapters consider legislative, regulatory, and policy issues, and offer a step-by-step guide to the planning of waste management, including use of a de-

tailed model survey questionnaire for gathering data on waste generation and management practices in hospitals.

Against this background, five chapters offer guidance in a range of specific practices and procedures for safe waste management. Chapters cover strategies for waste minimization, recycling, and reuse; good practices in the handling, segregation, packaging, storage, and transportation of wastes; a wide range of treatment and disposal technologies appropriate for specific categories of waste; and the collection and safe disposal of hazardous wastewater. The remaining chapters discuss costs, health and safety practices for health care personnel and waste workers, the management of spillage and other emergencies, basic principles of hospital hygiene and infection control, and training needs. The final chapter sets out a minimum program of essential waste management practices considered suitable for smaller rural health care establishments and field hospitals in refugee camps and other temporary situations.

***Teacher's Guide: Management of Wastes from Health Care Activities* by A. Prüss and W. K. Townend**

1998, v + 227 pages (available only in English), WHO/EOS/98.8, CHF 35.-/USD 31.50; In developing countries: CHF 24.50, Order No. 1930134.

Contents

- definition and characterization of health care waste
- health impacts of health care wastes
- legislative, regulatory, and policy aspects
- health care waste management planning
- waste minimization, recycling, and reuse
- handling, storage, and transportation of health care wastes
- treatment and disposal technologies for health care waste
- application of treatment and disposal methods to health care waste categories
- collection and disposal of wastewater
- costs related to health care waste management
- health and safety practices for health care personnel and waste workers
- emergency response
- hospital hygiene and infection control
- training
- minimal programs for health care waste management
- guidance levels of activity for procedures in nuclear medicine for a typical adult patient
- chemical destruction methods for cytostatic drugs
- clearance levels for radioactive waste
- procedure to be followed in the event of accidental contamination by mutagenic or carcinogenic products

This volume is a spiral-bound collection of resource materials for use in a three-day training course focused on the safe management of health care wastes. Course materials are aimed at an audience of managers of hospitals and other health care establishments, policy-makers, and professionals involved in waste management. Noting that health care waste has a higher potential of infection and injury than any other type of waste, training materials aim both to heighten awareness of specific hazards and to illustrate the strategies—whether involving national legislation or safe practices at the institutional level—that can minimize these risks. The teacher's guide is a companion volume to the WHO handbook, *Safe Management of Wastes from Health Care Activities*, listed immediately above.

Training materials include ready-to-copy texts for overhead transparencies or slides, lecture notes, handouts, exercises, worksheets, and evaluation forms. Apart from drawing attention to the public health and environmental hazards of health care wastes, material for the course includes abundant technical information on various safe options for waste segregation, storage, collection, labeling, transport, treatment, and disposal.

Specific training materials range from overheads listing the components of national programs for waste management and outlining an action plan, through a handout illustrating technical options for waste treatment, to a worksheet for calculating the costs for construction and operation of an incineration plant. Advice on how to organize and conduct the course is provided together with suggestions for using problem-based approaches and supplementing the materials with locally relevant examples and exercises.

Reports from Commissions

Commission on Thermodynamics (I.2)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 8–10 August 1999

Twenty-one members of the Commission on Thermodynamics (I.2), including national representatives and observers, met for three days of discussions during the 40th IUPAC General Assembly in Berlin. Two new Titular Members, Manuel Ribeiro da Silva and Eckhard Vogel, were elected, and R. Span (Bochum) was appointed to the Subcommittee on Thermodynamic Data.

Several projects were completed and the results published: U. K. Deiters and K. M. de Reuck, Guidelines for Publication of Equations of State, *Chemical Engineering Science*, 1998, **69**, 69 and Fluid Phase Equilibria, 1999, **161**, 205; A. Bolz, U. K. Deiters, C. J. Peter, and T. W. de Loos, Nomenclature for Phase Diagrams with Particular Reference to Vapor–Liquid and Liquid–Liquid Equilibria, *Pure Appl. Chem.*, 1998, **70**, 2233; J. Barthel, R. Neueder, and R. Meier 1998, *Viscosities of Aqueous Solutions*, Part 3c, $\text{AgClO}_4\text{-Cl}_4\text{O}_{16}\text{Th}$, and Part 3d, $\text{CoO}_4\text{S-O}_6\text{SU}$, Dechema Chemistry Data Series Vol. XII; and *Chemical Thermodynamics* (a Chemistry for the 21st Century monograph), edited by T. M. Letcher, Blackwell Science, 1999.

In addition, there are several projects that are close to completion: *Theory of Equations of State for Fluids and Fluid Mixtures*, edited by J. V. Sengers, will be published by Elsevier in mid-2000. Two new volumes in the Experimental Thermodynamics series are being prepared: Volume VI. *Measurement of the Thermodynamic Properties of Single Phases* (editors: A. R. H. Goodwin, K. N. Marsh, and W. A. Wakeham) and Volume VII. *Measurement of the Properties of Multiple Phases* (editors: Th. W. de Loos and R. D. Weir). Publication is expected by 2001. *Conductivities, Transference Numbers, and Limiting Ionic Conductivities*, Part 1d. Carbonates (project leader: J. G. M. Barthel), Dechema Chemistry Data Series, Volume X, is in press, and a further volume on amides is expected in 2001. Ribeiro da Silva presented a final draft of “Thermochemistry of chemical reactions”. Draft copies of papers entitled “Standards in isothermal microcalorimetry”, from Working Group A. (E. Beezer, G. Olofsson, K. Murphy, F. Rouquerol, J. Sipowska, and I. Wadsö), and “Standards for differential scanning calorimetry”, produced by Working Group G (Della Gatta, M. J. Richardson, S. M. Sarge, and S. Stølen) were presented. These papers will be produced in final form for the next

Commission meeting in 2000, for subsequent publication in *J. Chem. Thermodyn.*, *Thermochimica Acta*, and *Calorimetry and Thermal Analysis*. The project “Legendre transforms in chemical thermodynamics” (R. A. Alberty) will be completed after minor revision of the draft manuscript with input from members of the Commission on Electrochemistry. Possible new projects discussed were “Thermodynamics in education” (T. M. Letcher), “Global phase diagrams of fluid mixtures” (U. K. Deiters and T. M. Boublik), and “Guidelines for equations of state II. Mixtures” (U. K. Deiters). The importance of the project on biological buffers was stressed; it is necessary to find a group to work on this.

Unanimous approval was given of the arrangements for the 16th IUPAC International Conference on Chemical Thermodynamics (ICCT), which will take place 7–11 August 2000 in Halifax, Nova Scotia, Canada. In 2002, the 17th IUPAC ICCT will be held 28 July–2 August in Rostock, Germany. A diskette will be prepared to supplement the Guidebook for Organizers of IUPAC ICCTs to assist prospective organizers of these meetings. The Commission discussed the forthcoming change in IUPAC operation. It felt that its activities would translate smoothly to the new scheme, with continuation of the biennial ICCT affording an opportunity for a meeting of all those involved in projects, plus other interested thermodynamicists.

It was reported that the number of journal pages in the *Journal of Chemical Thermodynamics* increased by about 5% from 1997 to 1998 as a result of widening the scope to include papers in fluid phase equilibria, biochemical thermodynamics, polymers, and invited review articles. A special memorial issue for Prof. McGlashan will contain 14 papers and should be published in October 1999.

The Subcommittee on Thermodynamic Data has been active in the following areas: In the series of publications on *Critical Compilation of Vapor Liquid Critical Properties*, paper VII on oxygenated compounds other than alkanols is in an advanced state of preparation. Work on halogenated compounds is being updated with a computer search to cover recent years. Still outstanding are the series of compounds containing nitrogen and polyfunctional groups. The project “Critical compilation of activity coefficients at infinite dilution” (project leader: V. Dohnal) has produced a very large database, and it was decided to terminate the project at this stage. Publication of Volume 14 (Benzene) and Volume 15 (Carbon Dioxide) in the series International Thermodynamic Tables of the Fluid State (project

leader: W. A. Wakeham) is expected in 2000.

The project "Vapor-liquid equilibria and related properties in binary and ternary mixtures of ethers, alkanes, and alkanols" (project leader, J. H. Dymond) was completed following the final workshop held as part of the 15th IUPAC ICCT in Porto, Portugal, 30–31 July 1998. The workshop proceedings were published as a special issue of *Fluid Phase Equilibria*, 1999, **156**, 1–236. A new project "Thermochemical, thermodynamic, and transport properties of halogenated alkanes and their mixtures" (project leaders: U. K. Deiters, J. H. Dymond, A. Heintz, and A. Laesecke) will begin with a workshop that is being organized by E. Matteoli in Pisa 15–18 December 1999. A feasibility study will be undertaken for a project on low-temperature molten salts (organic) with a workshop in 2001.

The Subcommittee on Transport Properties has completed two projects that will be published "under the auspices of the Subcommittee": M. L. V. Ramires, C. A. Nieto de Castro, R. A. Perkins, Y. Nagasaka, A. Nagashima, M. J. Assael, and W. A. Wakeham, "Thermal conductivity of toluene over a wide range of temperature" and M. J. Assael, A. Leipertz, E. Vogel, E. MacPherson, W. A. Wakeham, R. A. Perkins, Y. Nagasaka, C. A. Nieto de Castro, and K. Strom, "Transport property measurement on the IUPAC sample of R134a". Already published is a correlation on the Viscosity of Propane by E. Vogel, C. Kuchenmeister, E. Bich, and A. Laesecke, *J. Phys. Chem. Ref. Data* 1998, **27**, 947. The first stage of a project by M. J. Assael, J. Millat, A. Nagashima, D. Friend, and J. V. Sengers, "Viscosity and thermal conductivity of water and steam", has been concluded with submission of a paper to *J. Phys. Chem. Ref. Data*. Drafts of papers on other completed projects are being prepared by M. J. Assael, "Viscosity of toluene as a function of pressure"; by E. Vogel, "Viscosity of isobutane"; by M. J. Assael and A. Nagashima, "Viscosity and thermal conductivity of D₂O"; and by C. A. Nieto de Castro, "Viscosity of toluene at atmospheric pressure in wide ranges of temperature".

Work is continuing on the following projects: "Viscosity of liquid water", "Transport properties of methane + ethane", "Thermal conductivity of butane", "Viscosity and thermal conductivity of water and steam", and "Viscosity of pentane". The following new projects are underway: "Study of the intermolecular potential of water", "Viscosity of cyclopentane", "Viscosity of alkali halides", and "Investigation of a new high-viscosity standard". A feasibility study will be undertaken for a book on the properties of water, air, and seawater. A new project on transport properties of molten metals (where differences in viscosity of a factor of 10 occur in measurements from different groups) will begin. A new experimental project on viscosity data for toluene

at elevated pressures will probably be set up, because of the large discrepancies that exist in the literature data. The project for an internationally available data bank is now terminated, although the Stuttgart data bank is still being maintained for use by subcommittee members and others.

The subcommittee had a successful meeting on 3–4 September 1999 in Erlangen, Germany. Their next meeting will take place in Boulder, CO, USA in June 2000.

Joint meetings were held as follows: Dr. Fabienne Meyers of the IUPAC Secretariat joined us for a short meeting during which she spoke about the IUPAC web site. Members considered that the Commission should have its own web site to highlight activities and achievements and draw attention to future events. Joint meetings were also held with members of IUCOSPED (IUPAC-CODATA Project on Standardization of Physico-Chemical Property Electronic Data Files), Commission I.1 (Physicochemical Symbols, Terminology, and Units), Commission I.3 (Electrochemistry), and Commission I.7 (Biophysical Chemistry). At each of these meetings, projects of common interest were discussed. With Commission I.1, further additions to the thermodynamics section of the Green Book (*Quantities, Units, and Symbols in Physical Chemistry*) were agreed upon for the forthcoming new edition.

The Chairman thanked all members of the Commission for their contributions and looked forward to the next meeting of the Commission in Halifax, Nova Scotia on 5–6 August 2000.

John Dymond
Secretary, IUPAC Commission on
Thermodynamics I.2

Commission on Chemical Kinetics (I.4)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 8–9 August 1999

The Chairman outlined the new structure and mission of IUPAC that would be put in place following the next General Assembly. The key elements, such as the move to a project-based structure and the reduction in costs of the General Assembly, were discussed in some detail; the general consensus of the members was that the new structure could lead to a more vigorous and accountable organization.

The status of ongoing projects was presented and discussed in light of the future work of the Commission or its successor. It was agreed that the three current data projects, "Evaluated chemical kinetic data for combustion chemistry"; "Aqueous solution kinetics data

for atmospheric chemistry”; and “Kinetic, photochemical, and heterogeneous data evaluation for atmospheric chemistry”, because of their great impact on modeling the production and control of environmental pollutants, would be continued through the next biennium. It was also decided to continue the project “Kinetics data for chemical processes under extreme conditions”, with a focus on supercritical fluid kinetics. The general consensus was that there is now a clear need to proceed by organizing a workshop on data and application needs.

It was also felt that a brief document addressing data needs in the area of free radical thermochemistry from the point of view of the chemical kinetics user community would be extremely valuable. This undertaking might also be of use in initiating a new project with the Subcommittee on Theoretical Chemistry of Commission I.5 to deal with computational aspects and prediction of thermodynamic properties of small free radicals and other critical reaction intermediates.

Dr. M. Rossi was reelected as Chairman and Dr. J. Herron was reelected as Secretary. Profs. D. Baulch and J. Troe and Dr. R. Huie agreed to serve as Titular Members, and Profs. Tibor Bérczes and John Plane have agreed to serve as Associate Members through 2001. Prof. E. Breet was elected as a new Titular Member.

John Herron
Secretary, IUPAC Commission on Chemical Kinetics I.4

Commission on Biophysical Chemistry (I.7)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 8–9 August 1999

“Recommendations for the presentation of NMR structures of proteins and nucleic acids” by J. L. Markley, A. Bax, Y. Arata, C. W. Hilbers, R. Kaptein, B. D. Sykes, P. E. Wright, and K. Wüthrich has been published in *Pure and Applied Chemistry* (Vol. 70, No. 1, pp. 117–142, 1998). To broaden its scientific impact, it has also been published in the *Journal of Biomolecular NMR*, the *European Journal of Biochemistry*, and *Biochemistry*. This important report will help to define how NMR results on macromolecules will be reported in the literature. Hans-Jürgen Hinz and Fred Schwarz reported on the status of their project “Recommendations for the measurement and the analysis of results obtained on biological substances with differential scanning calorimetry (DSC).” Their report contains a discussion of the basis of DSC as applied to biochemical denaturations, how one should use these instruments, and how the results should be analyzed and presented in the lit-

erature. This document is close to its final form. A major addition to the previous version is the inclusion of experimental results for lysozyme unfolding which were obtained from several participating laboratories. In a joint meeting with the Electroanalytical Chemistry Commission (V.5), Daniel Thévenot reported on his project “Electrochemical biosensors: Recommended definitions and classification.” This project, which is concerned primarily with terminology pertinent to electrochemical biosensors, is also close to completion now that the issue of “single-use” and “multiple-use” biosensors appears to have been resolved.

Two additional projects may be completed in the near future: “Redox potential measurements of proteins”, which was reported on by George Wilson, and “Terminology in the field of lipid vesicles (liposomes)”, which was reported on by Helmut Hauser. The latter project would have been completed except for the untimely death of Dimitri Papohadjopoulos, a key member of the working party. Two future projects that the Commission sees value in include “Recommendations for the measurement and analysis of results obtained by isothermal titration calorimetry (ITC)” and “Guidelines for the presentation of the results from computational chemistry.”

Productive, joint meetings were also held with Commission I.2 (Thermodynamics), Commission I.3 (Electrochemistry), Commission I.6 (Colloid, Surface Chemistry, and Catalysis), and Commission V.5 (Electroanalytical Chemistry). Kurt Wüthrich will succeed Helmut Hauser on 1 January 2000 as the Chairman of the Commission on Biophysical Chemistry (I.7).

Robert N. Goldberg
Secretary, IUPAC Commission on Biophysical Chemistry I.7

Commission on Atomic Weights and Isotopic Abundances (II.1)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 8–10 August 1999

The Commission on Atomic Weights and Isotopic Abundances (II.1) met for three days of discussions under the chairmanship of Prof. Ludolf Schultz during the 40th IUPAC General Assembly in Berlin. The standard atomic weights of seven chemical elements have been changed significantly. Based on new determinations of isotopic abundances and reviews of previous isotopic abundances, the standard atomic weight of nitrogen was changed from 14.00674(7) to 14.0067(2), of sulfur from 32.066(6) to 32.065(5), of chlorine from

35.4527(9) to 35.453(2), of germanium from 72.61(2) to 72.64(1), of xenon from 131.29(2) to 131.293(6), of erbium from 167.26(3) to 167.259(3), and of uranium from 238.0289(1) to 238.02891(3). Many of these changes were adopted so that standard atomic-weight values more accurately reflect the values of these chemical elements in naturally occurring materials.

The changes in atomic-weight values will be reflected in the Table of Standard Atomic Weights 1999, which will be submitted for publication in *Pure and Applied Chemistry* (PAC) before the end of the year. Also planned for publication in PAC is a report on fourteen elements that show significant isotopic abundance variation in naturally occurring materials. This report demonstrates that the atomic weight of such elements can be significantly larger than the uncertainties of measurement. Publication of an element-by-element review was discussed and is planned for submission to PAC in 2000. The Commission discussed a glossary of definitions specific to atomic-weight and isotopic-abundance work in order that definitions generated would be submitted to nomenclature commissions for inclusion in future IUPAC documents. A large number of isotopic-abundance measurements in extraterrestrial materials is available; these data will be summarized and a draft will be available at the next General Assembly in Brisbane in 2001.

Tyler B. Coplen II
Chairman, IUPAC Commission II.1, Subcommittee on Natural Isotopic Fractionation

Commission on Nomenclature of Inorganic Chemistry (II.2)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 9–11 August 1999

Commission II.2 (CNIC) reviewed two documents that had been completed in August of 1998 but were found not ready at that time for forwarding to *Pure and Applied Chemistry*. There were some questions concerning the use of “ido” and “ato” in the inorganic radical document by Prof. Wim Koppenol. These matters were resolved and Prof. Koppenol will modify the document to remove inconsistencies. The document by Prof. Koppenol concerning the naming of elements 110 and higher was brought into conformance with the one presented to the Commission in August 1998 by Prof. John Corish, Prof. G. J. Leigh, and Dr. Gerd Rosenblatt. The Commission agreed unanimously that, to avoid confusion in the literature and electronic searching, if a name has been used unofficially for an element and that name is not accepted as the official IUPAC name, then it

should not be proposed for another element at a future date.

The publication date for Red Book II will depend upon how quickly arrangements are concluded with a publisher. A document on muon nomenclature, also by Prof. Koppenol, was revisited and, with minor revisions, was approved to go forward. It will be submitted to Commission V.7 (Radiochemistry and Nuclear Techniques) for comment before proceeding. The organometallic paper by Prof. Albrecht Salzer will be submitted to PAC after IDCNS review.

The revision of Red Book I continues under the direction of Prof. Neil Connelly. This revision will include the chapter on ligand abbreviations, errors will be removed, and the nomenclature will be made consistent for all chapters. A separate project was proposed and accepted for this update of Red Book I under the new IUPAC project-managed system. A progress report on computer-assisted nomenclature was presented, and it showed that it is possible to generate a number of unique structures for convex polyhedra. However, it was noted that purely mathematical solutions were unsatisfactory unless parameters were added to eliminate chemically improbable solutions. A joint meeting was held with the Commission on Nomenclature of Organic Chemistry (CNO) to discuss common areas of concern. Members of both Commissions involved in computer-assisted nomenclature will meet to discuss common goals. At the joint meeting, it was agreed to continue a collaborative effort to produce a book on organometallic nomenclature. CNO will work on main group elements, and CNIC will work on transition metals (Prof. Salzer's document and metallacycles). Additionally, other chapters will be solicited. These two efforts, computer-assisted nomenclature and organometallic nomenclature, are expected to develop into separate projects under the project-funded system. A metallacyclic paper by Prof. Yohsuke Yamamoto was discussed, and further revisions will be made and circulated to the Commission members before the next meeting. The Commission will meet again in August 2000 in Dublin, Ireland.

James B. Casey
Associate Member, IUPAC Commission on Nomenclature of Inorganic Chemistry II.2

Commission on Photochemistry (III.3)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 7–11 August 1999

Six members of the Commission on Photochemistry (III.3), including one observer, met for five days of discussions during the 40th IUPAC General Assembly in Berlin.

During 2000 and 2001, Commission III.3 will continue to function as before. R. G. Weiss and J. Wirz were elected Chairman and Secretary, respectively. The Organic Division Committee will have a Photochemistry Representative, Dr. Silvia Braslavsky. The possibility of funneling perceived needs and interests of the photochemistry community from the presidents of the major photosciences professional organizations through the Divisional Representative was discussed. Meetings concerning common interests and joint projects were held with the Commissions on Physical Organic Chemistry (III.2), Colloid and Surface Chemistry Including Catalysis (I.6), and Chemical Kinetics (I.4).

Reports on the status of ongoing projects in several areas were received. An excellent draft document on "Photochromism" was presented by H. Bouas-Laurent and H. Durr. H. Masuhara presented a first draft of "Highly resolved photochemistry in space and time". J. R. Bolton presented a version of "Ultraviolet disinfection" that should be ready for submission to IUPAC before the end of 1999. This working group carried out all of its interactions by e-mail. The document, *Figures-of-Merit for the Technical Development and Application of Advanced Oxidation Technologies for both Electric- and Solar-Driven Systems*, already accepted as a technical report by IUPAC, will be submitted for inclusion as a standard. Future report projects are being considered in the areas of actinometry (revision of existing document), photodynamic therapies, photolithography, photopolymers and photopolymerizations, single molecule detection, glossary of terms (revision of existing document), supramolecular photochemistry, and glossary of terms in photocatalysis (with Commission I.6).

Richard Weiss
Secretary, IUPAC Commission on Photochemistry III.3

Commission on Microchemical Techniques and Trace Analysis (V.2)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 8–9 August 1999

The Commission meeting was attended by seven of the Commission's sixteen members. Three members had resigned since the last meeting, among them the former chairman. Dr. Ryszard Lobinski was elected Titular Member and new Chairman of the Commission. A new National Representative from Korea had been suggested by the Korean NAO, and Prof. Heon Kang was accepted as a new member of the Commission.

The status of current projects was reviewed. Five projects were canceled because no activity had occurred since the last meeting and the person responsible for them had left the Commission. For the remaining projects, completion before 2001 is foreseen. It was decided not to start any new projects at this stage. A discussion of new projects is being initiated through e-mail, and a final choice will be made at the next even-year meeting in Pau.

The joint project on guidelines for terms related to speciation was the subject of a separate meeting. Comments received from outside experts were discussed, and it was decided to hold a meeting in Brussels in March to work these comments into the final version of the Recommendations to be published in *Pure and Applied Chemistry*.

Lars-Göran Danielsson
Secretary, IUPAC Commission on Microchemical Techniques and Trace Analysis V.2

Commission on Atmospheric Chemistry (VI.2)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 9 August 1999

Eleven members of Commission VI.2, including Observers and National Representatives, met during the 40th IUPAC General Assembly in Berlin. It was the first meeting of Commission VI.2 since the one held during the successful IUPAC Conference on Degradation Processes in the Environment organized in May 1998 in Dubrovnik, Croatia together with the Commission on Water and Soil Chemistry (VI.3).

In Dubrovnik, the proposal for reorganization of IUPAC was announced for the first time, and Commission VI.2, together with Commission VI.3, expressed some concern in a letter sent to the President of the



Members of Commission VI.2 at their August 1999 meeting in Berlin, Germany.

Chemistry and the Environment Division (DCE).

In Berlin, the minutes of the Dubrovnik meeting were accepted with corrections. Concerning the new organization of IUPAC, whereby the commissions cease to exist by the end of 2001, it was decided to go along with the new structure and task forces for new projects coming out of Commission VI.2. The new proposals will be submitted to the DCE during the General Assembly in Berlin and sent in to the Secretariat immediately afterwards.

The ongoing projects (project leaders are given in parentheses) were reviewed.

Commission VI.2 decided to have two continuous projects: i) "Articles on local environmental problems" (Hertel, Zhang, Klasinc), to be published by members in *Chemistry International*, and ii) the Internet web page of Commission VI.2 (Klasinc, Slanina), and concluded that most projects are finished or will be finished by 2001. Completed projects include the following:

- i) "Development of diffusive samplers" (Brown), with a manuscript sent to *Pure and Applied Chemistry (PAC)* for publication
- ii) "Modeling lifetime and degradability of organic compounds" (Klasinc), with conference proceedings to be published in *PAC* and in *Chemosphere*
- iii) "Photocatalytic and catalytic effects on aerosol surface in the atmosphere" (Bazhin), presented and published in ii) and in *Chemosphere*

The project "Distribution and seasonal variation of regional ozone" (Akimoto) has been canceled by the project leader and projects on "Followup workshop measurement techniques in atmospheric chemistry" (Tavares) and "Photochemical reactions of coordination compounds in water droplets in the atmosphere" (Bazhin) have been extended.

Concerning cooperation with other Commissions, on the project with Commission V.8, "Chemicals in the atmosphere: Solubilities in aqueous media" (Schwartz), a book is in preparation with Wiley. The project with

Commission I.4, "Aqueous solution kinetics data for atmospheric chemistry", will continue with a new leader from Commission VI.2 (Pienaar).

The new proposed task force projects and their leaders and duration (given in parentheses) are as follows:

- 1) "Glossary of atmospheric chemistry" (Schwartz, 1999–2001)
- 2) "Workshop on atmospheric deposition in Israel 2000" (van Grieken, 1999–2001)
- 3) "Local radiation balance: Influence of aerosol" (Slanina 1999–2002)
- 4) "Workshop on local air pollution in developing countries in Guanzhou" (Zhang, 1999–2001 or 2000–2002)
- 5) "Assessment of human exposure to outdoor pollution" (Hertel, 1999–2002)

Project 1 is a revision of the glossary published by J. Calvert in *PAC* in 1990; Projects 2–5 will be pursued in cooperation with Commission VI.3; with ECN and EU; interdivisionally and with IOCD and WHO; and with EU, respectively.

For 2000–2001, the membership of Commission VI.2 was recommended to comprise four Titular Members (the Chairperson acting also as member of the DCE Division Committee), five Associate Members, eight National Representatives, and three Observers.

Leo Klasinc
Secretary, IUPAC Commission on Atmospheric Chemistry VI.2

Commission on Soil and Water Chemistry (VI.3)

Summary of Minutes of Commission Meeting at IUPAC General Assembly, Berlin, Germany, 8–10 August 1999

In addition to the regular meeting of Commission VI.3, joint meetings with representatives from Commissions VI.1, VI.2, and VI.4 were organized.

The major achievement of the meetings was the restructuring of the Commissions' projects to focus on a limited number of projects that in the future will be carried out by project teams of varying composition. The Commission will be terminated on 31 December 2001, and a project-driven structure will replace it. The link of titular membership to funding will be broken, and funding for participation in each project will be determined on an ad hoc basis. For the biennium 2000–2001, the current Commission and the current project and funding systems will continue largely unchanged. However, intensive planning must take place to ensure a smooth changeover for 2002.

In light of these changes, the incoming President of the Division on Chemistry and the Environment (DCE), Prof. Dr. Werner Klein, made a strong appeal to focus on interdivisional projects that are likely to obtain more funding. Examples of interdivisional projects that are potentially of interest to Commission VI.3 may be found in the area of green/sustainable chemistry. Commission VI.3 was challenged to take up part of the work to be done within this new IUPAC initiative. It was noted that under the new structure, it is quite possible to solicit and include participation of other organizations in the field.

In anticipation of the new IUPAC structure, Commission VI.3 has already installed one Task Force, headed by Dr. J. Lintelmann. A draft report from this Task Force was prepared and discussed during the Commission VI.3 meeting. In addition, proposals for three new Task Forces were prepared in advance of the meeting and evaluated according to the new IUPAC reviewing system. During the Berlin meeting, Commission VI.3 decided to propose to DCE that two additional new Task Forces be initiated in the following areas:

- In situ treatment of polluted soil and water, with emphasis on the use of genetically engineered microorganisms (proposed project leader: Dr. R. Mandelbaum)
- Airborne and remote monitoring of water quality: Evaluation of remote sensing techniques for real-time control of water quality in surface water bodies (proposed project leader: Dr. A. Dekker)

Interdivisional cooperation will be sought for projects on quality chemical data and reporting practices and on biosensors.

To facilitate these interdivisional projects, Commission VI.3 members will contribute to the following projects of other DCE Commissions:

- Atmospheric deposition in drinking water reservoirs (VI.2)
- Soil sorption (VI.4)
- Pesticide residues (VI.4)
- Bioavailability (VI.4)

Another major achievement of Commission VI.3 was the organization of the IUPAC-sponsored conference on Environmental Degradation Processes held 24–28 May 1998 in Dubrovnik, Croatia. Approximately 100 participants from academia, industry, and regulatory agencies attended this very successful conference. Manuscripts from the seven invited speakers were published in the July 1998 issue of *Pure and Applied Chemistry (PAC)*, and contributions from the remaining speakers were published as a special volume of *Chemosphere* (January 1999 issue). A final report, containing the main findings and recommendations for further followup, will be prepared by Dr. A. Sabljic and Dr. W. J. G. M. Peijnenburg before the end of 1999. The following items were identified as possible future projects:

- Impact of environmental characteristics on biodegradation
- Long-term stability: How to measure very long half-lives (> 1 year) of persistent chemicals
- Persistence of chemicals in deep groundwaters, with focus on fate of pesticides in relation to impact on top underground layer
- Use of Quantitative Structure–Activity Relationships (QSARs) and Quantitative Structure–Biodegradation Relationships (QSBRs) in wastewater treatment. Prof. Y. Wang will prepare an outline for possible future activities in this field.

W. J. G. M. Peijnenburg
Secretary, IUPAC Commission VI.3

Conference Announcements

Advanced Principles of Toxicology,
24 April–5 May 2000,
Guelph, Ontario, Canada

This two-week, graduate equivalent open learning course at the University of Guelph is designed for professionals working in toxicology-related fields. It is jointly organized by the University of Guelph's Centre for Toxicology and Department of Environmental Biology and the Canadian Network of Toxicology Centres.

This course is an advanced survey covering many aspects of toxicology. It is designed for people in in-

dustry, government, or education who are planning to work or are currently working in areas related to toxicology. Learners will receive basic background information in important traditional areas in toxicology, as well as in areas that are currently developing. This background information will include principles, definitions, and basic information, and it is designed to bring participants up to current levels of understanding of toxicology as it applies to both the human health and environmental areas of toxicology. This graduate level equivalent course normally requires that learners have a bachelor's or master's degree with course work in

statistics, chemistry, and biology.

Toxicology topics covered will include mechanism of toxic action, toxicological principles (mammals), human health risk assessment, developmental and reproductive toxicology (mammals), endocrine modulators, epidemiology, ecotoxicology (plants), carcinogenicity, ecotoxicology (animals), and ecotoxicological risk assessment.

For more information on course content, contact Dr. Len Ritter or Dr. Keith Solomon, Tel.: +1 519 837 3320; Fax: +1 519 837 3861. For information about registration, contact Office of Open Learning, University of Guelph, 159 Johnston Hall, Guelph, Ontario, N1G 2W1, Canada; Tel.: +1 519 767 5000; Fax: +1 519 767 1114; Web site: www.open.uoguelph.ca/.

6th World Congress on Environmental Health, 5–9 June 2000, Oslo, Norway

This meeting, held on behalf of the International Federation of Environmental Health (IFEH) has the theme "Healthy Environments—The Local Challenge". It will offer a comprehensive professional program and an exhibition covering key issues concerning environmental health in the 21st century. A variety of social activities will add a creative framework for a meeting place for professionals, experts, and scientists; politicians and decision makers of various sectors and levels; and grassroots workers, activists, and other local partners involved in the design and implementation of strategies, concepts, and projects associated with environmental health. The deadline for submission of abstracts is 20 September 1999.

For further information, contact Øystein Peder Solevåg, Senior Executive Officer, Norwegian Board of Health, P. O. Box 8128, Dep, N-0032 Oslo, Norway; E-mail: oystein.solevaag@helsetilsynet.dep.telemax.no; Tel.: +47 22 24 90 74; Fax: +47 22 24 95 91; Web sites: <http://www.fmh.no> and <http://www.helsetilsynet.no/>.

17th International Conference on Raman Spectroscopy (ICORS 2000), 20–25 August 2000, Beijing, China

This conference, to be held at Peking University, will address all topics related to advances in Raman spectroscopy and Brillouin and Rayleigh scattering. Manufacturers of Raman and related instruments will present their products in an associated exhibition. Satellite meetings will be held as follows: Progress in Surface Raman Spectroscopy: Theory and Practice, 17–19 August, Xiamen, Fujian; Spectroscopy of Super-Thin Films and Related Systems, 27–30 August, Xi'An,

Shanxi; Spectroscopy of Superlattice, HTSC, and CMR Materials, 27–30 August, Kunming, Yunnan Province.

For more information, contact Prof. Hetian Zhou, Secretary General, Department of Physics, Peking University, Beijing 100871, China; E-mail: icors@pku.edu.cn; Tel.: +86 10 6275 1750; Fax: +86 10 6275 9117; Web site: <http://www.pku.edu.cn/others/icors/icors.htm/>.

27th International Conference on Solution Chemistry (27ICSC), 26–31 August 2001, Vaals, Netherlands

The scientific program for this meeting will include sessions on molecular liquids, nonelectrolyte solutions, electrolyte solutions, ionic liquids, molten salts and metals, and colloids in liquids. Each field will be represented by three invited talks on theory, computer simulation, and experimental aspects.

For additional information, contact Dr. Christian Dux, Conference Secretary of 27th ICSC, Institute of Physical Chemistry, RWTH-Aachen, D-52062, Aachen, Germany; E-mail: 27icsc@liquid.pc.rwth-aachen.de; Tel.: +49 241 80 4752 or +49 241 80 4712; Fax: +49 241 8888 327 or +49 241 8888 128.

International Conference on Photophysics and Photochemistry (PP 2000), 19–21 October 2000, Oeiras, Portugal

This meeting will take place in honor of the 75th birthday of Prof. Ralph S. Becker. The scientific program will focus on fundamental aspects of photochemistry, photophysics, and photobiology, such as photoinduced electron and proton transfer, photoisomerization, photochromism, photosensitization, single molecule spectroscopy, polymer stabilization and dynamics, transient spectroscopy, and related topics. The conference will have a limited number of 120 participants, and it will include 5 plenary lectures, 12 invited and contributed lectures, and 2 poster sessions.

For more information, contact Organizing Committee PP 2000, ITQB, Apartado 1327, P-2781-901 Oeiras, Portugal; E-mail: pp2000@itqb.unl.pt; Tel.: +351 21 446 9727 or +351 21 446 9712; Fax: 351 21 441 1277; Web site: <http://www.itqb.unl.pt/pp2000/>.

Conference Calendar

Visit <http://www.iupac.org> for complete information and further links.

NEW designates a new conference since the last issue.

2000

Materials Science

8–9 April 2000
Preconference Workshop
10–12 April 2000
UNESCO School and Conference
on Macromolecules and Materials
Science, Stellenbosch, South
Africa.
*Prof. R.D. Sanderson, UNESCO
Associated Centre for Macromol-
ecules and Materials Institute for
Polymer Science, University of
Stellenbosch, Private Bag XI,
Matieland 7602, South Africa.*
Tel.: +27 21 808 3172
Fax: +27 21 808 4967
E-mail: rds@land.sun.ac.za

High-Temperature Materials Chemistry

10–14 April 2000
10th International Conference on
High-Temperature Materials
Chemistry, Aachen, Germany.
*Prof. Klaus Hilpert,
Forschungszentrum Jülich GmbH,
Institut für Werkstoffe der
Energietechnik (IWE 1), 52425
Jülich, Germany.*
Tel.: +49 2461 61 3280
Fax: +49 2461 61 3699
E-mail: k.hilpert@fz-juelich.de

Mycotoxins and Phycotoxins

21–25 May 2000
10th International IUPAC Sympos-
ium on Mycotoxins and
Phycotoxins, Sao Paulo, Brazil.
*Dr. Myrna Sabino, Instituto
Adolfa Lutz, AV Dr. Arnaldo 355,
Sao Paulo, Brazil, 01246-902.*
Fax: +455 (11) 853 3505
E-mail: Myrna@Sti.COM.BR

Polymer-Based Technology

21–26 May 2000
9th International Conference on
Polymer-Based Technology
(POC'2000),
Tianjin, China.
*Prof. Zhang Zhengpu
Institute of Polymer Chemistry
Nankai University
94 Weijin Road
Tianjin 300071, China*
Tel.: +86 22 2350 1386
Fax: +86 22 2350 4853
E-mail:
zhangzpz@sun.nankai.edu.cn

Flow Analysis

25–29 June 2000
8th International Conference on
Flow Analysis, Warsaw, Poland.
*Prof. Marek Trojanowicz, Depart-
ment of Chemistry, University of
Warsaw, Pasteura 1, 02-093
Warsaw, Poland.*
Tel/Fax: +48 22 822 35 32
E-mail: trojan@chem.uw.edu.pl

Organic Synthesis

1–5 July 2000
13th International Conference on
Organic Synthesis (ICOS-13),
Warsaw, Poland.
*Prof. M. Makosza, Institute of
Organic Chemistry, Kasprzaka
44, 01-224 Warsaw 42, PO Box
58, Poland.*
Tel.: +48 22 631 8788
Fax: +48 22 632 6681
E-mail: icho-s@ichf.edu.pl

Chemical Sensors

3–5 July 2000 (new dates!)
8th International Meeting on
Chemical Sensors
(ES-IMCS'2000), Basel, Switzer-
land (new place!).
*Prof. Milena Koudelka-Hep,
Institute of Microtechnology,
University of Neuchatel, Switzer-
land.*
Conference Secretariat: *Phillipa
Orme.*
Tel/Fax: +44 1235 868811
E-mail: p.orme@dial.pipex.com

Physical Organic Chemistry

8–13 July 2000
15th International Conference on
Physical Organic Chemistry
(ICPOC 15), Göteborg, Sweden.
*Prof. P. Ahlberg, Organic Chemis-
try, Department of Chemistry,
Göteborg University, SE-412 96,
Göteborg, Sweden.*
Tel.: +46 31 7722900
Fax: + 46 31 7723843
E-mail:
Per.Ahlberg@oc.chalmers.se

Macromolecules

9–14 July 2000
38th International Symposium on
Macromolecules (MACRO 2000),
Warsaw/Lodz, Poland.
*Prof. Stanislaw Penczek, Polish
Academy of Sciences, ul.
Sienkiewicza 112, 90363 Lodz,
Poland.*
Tel.: +48 42 81 9815
Fax: +48 42 684 7126
E-mail:
spenczek@bilbo.cbmm.lodz.pl

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To apply for IUPAC sponsorship, conference organizers should complete an Advance Information Questionnaire (AIQ). The AIQ form is available at <http://www.iupac.org> or by request at the IUPAC Secretariat, and should be returned between 2 years and 12 months before the conference. Further information on granting sponsorship is included in the AIQ and available online.

Coordination Chemistry

9–14 July 2000

34th International Conference on Coordination Chemistry (34-ICCC), Edinburgh, Scotland.

*Prof. P. Tasker, Chairman
Dr. John F. Gibson, Secretary
The Royal Society of Chemistry,
Burlington House, London W1V
0BN, UK.*

Tel.: +44 171 440 3321

Fax: +44 171 734 1227

E-mail: gibsonj@rsc.org

Polymers in Medicine

17–20 July 2000

40th Microsymposium on Polymers in Medicine, Prague, Czech Republic.

*Dr. Jaromir Lukas, Institute of
Macromolecular Chemistry,
Academy of Science of the Czech
Republic, Heyrovskeho nam. 2,
162 06 Praha 6, Czech Republic.*

Tel.: +420 2360341

Fax: +420 2367981

E-mail: sympo@imc.cas.cz

Polymer Networks '2000

17–21 July 2000

15th Polymer Networks Group Meeting "Polymer Networks '2000", Cracow, Poland.

Prof. H. Galina, Rzeszow University of Technology, Faculty of Chemistry, W. Pola Str.2, PL 35-959 Rzeszow, Poland.

Tel.: +48 17 628 057

Fax: +48 17 854 3655

E-mail: hgal@prz.rzeszow

Photochemistry

22–27 July 2000

18th IUPAC Symposium on Photochemistry, "Photochemistry into the New Century", Dresden, Germany.

*Prof. Dr. Silvia E. Braslavsky,
Max-Planck Institut für
Strahlenchemie, Postfach 101365,
D-45413 Mülheim an der Ruhr,
Germany.*

Tel.: +49 (208) 306 3681

Fax: +49 (208) 306 3951

E-mail: braslavskys@mpi-muelheim.mpg.de

Organometallic Chemistry

23–28 July 2000

19th International Conference on Organometallic Chemistry (XIX ICOMC), Shanghai, China.

*Profs. Li Xin Dai and Chang Tao
Qian, Chairmen, Prof. Xue Long
Hou, Secretary, Shanghai
Institute of Organic Chemistry,
Chinese Academy of Sciences,
354 Fenglin Road, Shanghai
200032, PR, China,*

Tel.: +86 21 641 63300

Fax: +86 21 641 66128

E-mail: xlhou@pub.sioc.ac.cn

Solubility Phenomena

25–28 July 2000

9th International Symposium on Solubility Phenomena (9th ISSP), Hammamet, Tunisia.

Prof. Najia Kbir-Arighuib, National Institute for Scientific and Technical Research, P.O. Box 95, Hammam-Lif, 2050 Tunisia.

Tel: +216 1 430 215

Fax: +216 1 430 934

E-mail: arighuib@planet.tn

Chemical Education

5–10 August 2000

16th International Conference on Chemical Education: Chemistry for a Healthier Planet (16 ICCE), Budapest, Hungary.

*Prof. Alajos Kalman, Chairman,
Prof. Gabor Naray-Szabo,
Department of Theoretical
Chemistry, Lorand Eotvos
University, Pazmany Peter st. 1b,
H-1117 Budapest, Hungary.*

Tel.: +36 1 209 0555, ext. 16-30

Fax: +36 1 209 0602

E-mail: mail2.mke@mtesz.hu

Chemical Thermodynamics

6–11 August 2000

16th IUPAC Conference on Chemical Thermodynamics, Halifax, Nova Scotia, Canada.

*Prof. M. A. White, Department of
Chemistry, Dalhousie University,
Halifax, Nova Scotia B3H 4J3,
Canada.*

Tel.: +1 902 494 3894

Fax: +1 902 494 1310

E-mail:

Mary.Anne.White@DAL.CA

Thermal Analysis and Calorimetry

14–18 August 2000

12th International Congress on Thermal Analysis and Calorimetry, Copenhagen, Denmark.

*Dr. O. Toft Sorensen, Materials
Research Department,
Riso National Laboratory DK-
4000, Roskilde, Denmark.*

Tel: +45 4677 5800

Fax: +45 4677 5758

E-mail: o.toft.sorensen@risoe.dk

Chemical Sensors

27–30 August 2000 (new dates!)

EUROSENSORS XIV, the 14th European Conference on Solid-State Transducers, Copenhagen Denmark (new place!).

*Dr. Siebe Bouwstra, Chairman,
Mikroelektronik Centret DTU,
Building 345 East, DK-2800
Lyngby, Denmark.*

*Euroensors XIV Secretariat: Van
Hauen ApS, Amaliegade 36, DK-
1256 Copenhagen K, Denmark.*

Tel.: +45 33140050

Fax: +45 33145750

E-mail:

euroensors@vanhauen.dk

Biotechnology

3–8 September 2000

11th International Biotechnology Symposium, Berlin, Germany.

Prof. G. Kreysa, DECHEMA e.V.— c/o 11th IBS, Theodor-Heuss-Allee 25, 60486 Frankfurt/Main, Germany.

Tel.: +49 69 7564 235 / -249

Fax: +49 69 7564 176 / -304

E-mail:

biotechnology2000@dechema.de

Nuclear and Radiochemistry

3–8 September 2000

5th International Conference on Nuclear and Radiochemistry (NRC5), Pontresina, Switzerland.

Prof. H. W. Gäggeler, Chairman, Mrs. R. Lorenzen, Secretary, Paul Scherrer Institut, CH-5232 Villigen-Ost, Switzerland.

Tel.: +41 56 310 2401

Fax: +41 56 310 4435

E-mail: ruth.lorenzen@psi.ch

Analytical Chemistry

3–9 September 2000

EUROANALYSIS XI, Lisboa, Portugal.

Prof. Maria Filomena Camões, Chair, Dr. Cristina Oliveira, Secretary, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade de Lisboa, Edifício C1-5^o Piso, P-1700 Lisboa, Portugal.

Tel.: +351 1 3906138

Fax: +351 1 3909352; 7500088

E-mail: euroanalysisxi@fc.ul.pt

Natural Products

4–8 September 2000

22nd International Symposium on the Chemistry of Natural Products, Sao Paulo, Brazil.

Dr. M. Fátima das G.F. da Silva, Universidade Federal de Sao Carlos, Depto. de Quimica, Via Washington Luiz, km 235, CP676, Sao Carlos, Sao Paulo, Brazil.

Tel.: +55 16 274 8208

Fax: +55 16 274 8350

E-mail: dmfs@power.ufscar.br

Medicinal Chemistry

18–22 September 2000

XVI International Symposium on Medicinal Chemistry, Bologna, Italy.

Prof. C. Melchiorre, Università di Bologna, Dipartimento di Scienze Farmaceutiche, Via Belmeloro 6, I-40126 Bologna, Italy.

Tel.: +39 051 259 706

Fax: +39 051 259 734

E-mail: camelch@alma.unibo.it

Trace Elements in Food

9–11 October 2000

Warsaw, Poland.

Prof. B. Szteke, Chairman, Dr. R. Jedrzejczak, Secretary, Institute of Agricultural and Food Biotechnology

ul. Rakowiecka 36

02-532 Warsaw, Poland.

Tel.: +48 22 606 3876

Fax: +48 22 4904 28

E-mail: jedrzejczak@ibprs.waw.pl

Food Packaging

8–10 November 2000

2nd International Symposium on Food Packaging—Ensuring the Safety and Quality Food, Vienna, Austria.

Liên-Anh Tran, ILSI Europe, 83, Avenue E. Mounier, Box 6, B-1200, Brussels, Belgium.

Tel.: +32 (2) 771 0014

Fax: +32 (2) 762 0044

E-mail: anh@ilsieurope.be

Polymers

20–24 November 2000

7th Latin-American Symposium on Polymers (SLAP'2000) and 5th Ibero American Congress on Polymers, Havana, Cuba.

Dr. Ricardo Martínez, Dr. Waldo Argüelles-Monal, IMRE, Universidad de La Habana La Habana 10400, Cuba.

Fax: +53 7 33 42 47

E-mail: slap@imre.oc.uh.cu

Visas

It is a condition of sponsorship that organizers of meetings under the auspices of IUPAC, in considering the locations of such meetings, should take all possible steps to ensure the freedom of all bona fide chemists from throughout the world to attend irrespective of race, religion, or political philosophy. IUPAC sponsorship implies that entry visas will be granted to all bona fide chemists provided application is made not less than three months in advance. If a visa is not granted one month before the meeting, the IUPAC Secretariat should be notified without delay by the applicant.

2001

Chemistry and Chemical Engineering

16–20 April 2001

IV International Congress on Chemistry and XIII Caribbean Conference on Chemistry and Chemical Engineering, Havana, Cuba.

Prof. Alberto J. Nunez Selles, Sociedad Cubana de Química, Ave 21&200, Atabey, Apdo. 16042, CP 11600, Havana, Cuba.

Tel.: +537 218 178

Fax: +537 336 471

E-mail: cqf@infomed.sld.cu

CHEMRAWN XIV

9–13 June 2001

Chemrawn Conference—Toward Environmentally Benign Processes and Products, Boulder, Colorado, USA.

Dr. Dennis L. Hjeresen, Environmental Management Program, Los Alamos National Laboratory - Mail Stop J591, Los Alamos, NM 87545.

Tel.: +1 505 665 7251

Fax: +1 505 665 8118

E-mail: dennish@lanl.gov

IUPAC 41st General Assembly

29 June–8 July 2001
Brisbane, Australia.
IUPAC Secretariat.
Tel.: +1 919 485 8700
Fax: +1 919 485 8706
E-mail: secretariat@iupac.org

IUPAC 38th Congress / World Chemistry Congress 2001

1–5 July 2001
Brisbane, Australia.
Congress Secretariat, P.O. Box 177, Red Hill Q 4054, Australia.
Tel.: + 61 7 3368 2644
Fax: + 61 7 3369 3731
E-mail: wcc2001@ccm.com.au

Scattering Methods and Polymers

NEW

9–12 July 2001
20th Discussion Conference on Scattering Methods for the Investigation of Polymers, Prague, Czech Republic.
Dr. Jaromir Lukas, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovskeho nam. 2, CZ-162 06 Praha 6, Czech Republic.
Tel.: +420 2 204 0332
Fax: +420 2 367 981
E-mail: sympo@imc.cas.cz

Polymer Membranes

NEW

16–19 July 2001
41st Microsymposium on Polymer Membranes, Prague, Czech Republic.
Dr. Jaromir Lukas, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovskeho nam. 2, CZ-162 06 Praha 6, Czech Republic.
Tel.: +420 2 204 03332
Fax: +420 2 367 981
E-mail: sympo@imc.cas.cz

Phosphorus Chemistry

29 July–3 August 2001
15th International Conference on Phosphorus Chemistry, Sendai, Japan.
Prof. Masaaki Yoshifuji, Department of Chemistry, Graduate School of Science, Tohoku University, Aoba, Sendai 980-8578, Japan.
Tel.: +81 22 217 6558
Fax: +81 22 217 6562
E-mail: yoshifj@mail.cc.tohoku.ac.jp

Analytical Sciences

6–10 August 2001
International Congress on Analytical Sciences 2001 (ICAS2001), Tokyo, Japan.
Prof. Tsuguo Sawada, Chairman, Department of Applied Chemistry, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan.
Tel.: +81 3 5841 7236 (or 7237)
Fax: +81 3 5841 6037
E-mail: icas2001@laser.tu-tokyo.ac.jp

Biodiversity

3–8 November 2001
3rd IUPAC International Conference on Biodiversity (ICOB-3), Antalya, Turkey.
Prof. B. Sener, Department of Pharmacognosy, Faculty of Pharmacy, Gazi University, P.O. Box 143 06572, Maltepe-Ankara, Turkey.
Tel.: +90 312 212 2267
Fax: +90 312 213 3921
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Sweeteners

13–17 November 2001
2nd International Symposium on Sweeteners, Hiroshima-Shi, Japan.
Prof. Kasuo Yamasaki, Institute of Pharmaceutical Sciences, Faculty of Medicine, Hiroshima University Kasumi, Minami-ku, Hiroshima 734-8551, Japan.
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