Contents

Erratum

In the March 2002 issue of *Chemistry International* (Vol. 24, No. 2), the article "Bureau International des Poids et Mesures: Establishing Standards in the Physical Sciences" contained editorial errors in the formatting of numbers and units. Commas were incorrectly used to separate the digits into threes in all the long numbers that were used. It is, however, recommended to use a space, not a comma, to space the digits, because the comma is reserved for a decimal marker in many countries. Also, the unit of measure hertz was incorrectly spelled using a capital "H." A capital letter on the name of a unit should, however, not be used, in order to distinguish the man or woman from the unit.

Executive Director's Column

IUPAC and You

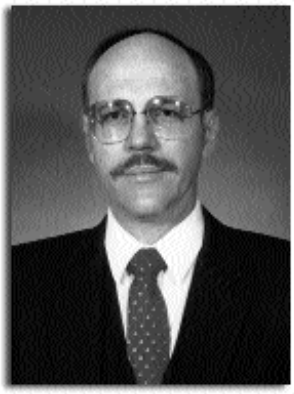
IUPAC is a volunteer organization that depends on the skill, knowledge, and enthusiasm of the volunteers who carry out the projects that are its reason for existence. I urge all of the readers of *Chemistry International* to consider how they can participate in the work of IUPAC. Some of you are now, or have been in the past, active participants in IUPAC; others have never participated in any IUPAC activities. The new, project-based organization of IUPAC's work makes participation easier.

The previous Commission-based system depended to a great extent on volunteers who were asked to participate by invitation of current members of a group. The new system is, we believe, more open to chemists who are not known to current IUPAC members.

There are two relatively straightforward ways to volunteer. The first is to find an existing project and contact the Task Group chairman for that project. Lists of current projects can be found on the IUPAC Web site. Simply follow the links from the homepage to the Division whose activities interest you and follow the link called Projects. There you will find a list of current projects, as well as descriptions of each project and contact information for the members of the Task Group, including the chairman. Once you find a project in which you are particularly interested, simply send an e-mail to the Task Group chairman (preferably with a copy to the Secretariat) explaining how you feel you can contribute to the work of the project. Since most of the work of Task Groups is done by correspondence, usually by e-mail, anyone should be able to contribute in some way. Sometimes, the Task Group may be seeking additional active participants; in other instances, most of the work must be carried out by a limited number of people, but often comments, suggestions, and reviews of preliminary drafts of documents can be very helpful.

IUPAC has changed the way it operates to encourage more involvement, but encouragement is all we can do—the rest is up to you.

The second way to volunteer is to submit a project proposal for consideration by the appropriate Division Committee or Standing Committee. Complete information on what kinds of projects are suitable for support by IUPAC, as well as information on the project approval system and guidance on how to submit a project, can be found on the Web site. I urge all of you to consider submitting projects that will contribute to standardization in terminology, nomenclature, and symbols; to evaluated data; and to methods and other areas of IUPAC interest.



John W. Jost
IUPAC Executive Director

You can also contribute to IUPAC's mission by helping to disseminate the results of IUPAC's work. Urge your national chemical magazines and specialized journals to publish IUPAC recommendations so that scientists around the world can be encouraged to use them in their work. Ask your library at work to subscribe to IUPAC's Journal of *Pure and Applied Chemistry* so that you and your colleagues have access to new reports and recommendations. To be fully informed on new developments from IUPAC, I urge all those who have not yet subscribed to our e-newsletter to visit the Web site and register. The process is simple and practically painless!

We are also interested in contributions to *Chemistry International.* These can take the form of letters to the editor, news items regarding activities in your country that might be of interest to our international readers, or longer articles on subjects of interest to the worldwide community of chemists. Brief reviews of Web sites and books are also welcome. I especially urge IUPAC Task Groups to provide progress reports on their work so that others can contribute to the success of your project. As always, the editor has the right to decide what is suitable for publication.

The future success of IUPAC depends, as has its past success, on the work of dedicated volunteers. IUPAC has changed the way it operates to encourage more involvement, but encouragement is all we can do—the rest is up to you. Put the "You" in IUPAC by volunteering, by spreading the word about IUPAC to your colleagues, and by applying IUPAC's recommendations in your scientific work.

John W. Jost is executive director of IUPAC.

Affiliate Members will find enclosed with this issue their certificate and card for 2002–2003.
www.iupac.org/affiliates/index.html

IOCD: 20 Years of Building Capacity in Chemistry in Developing Countries

by Jean-Marie Lehn, Elkan R. Blout, and Robert H. Maybury*

The International Organization for Chemical Sciences in Development (IOCD) is celebrating the 20th anniversary of its founding by awarding the Pierre Crabbé–IOCD Prize, in honor of its founder, the late Pierre Crabbé. Over the years, Crabbé and his successors have managed to create and maintain specific and practical activities, provide vital technical services, and deliver promising results. Now rich with experience, this organization is planning for the road ahead.

In 1981, Pierre Crabbé, a Belgian chemist working at UNESCO in Paris, called together a group of distinguished scientists from 15 countries to discuss scientific research in developing countries. He had joined the UNESCO staff after years of creative research in steroid chemistry with Carl Djerrasi at the Syntex company in Mexico. Their work had culminated in the synthesis of the first steroid oral contraceptive, the now well-known birth control pill. The years of working in Mexico had opened Crabbé's eyes to the many barriers that hinder the efforts by scientists in developing countries to carry on research, such as inadequate laboratory equipment, a lack of up-to-date books and journals, and long periods of isolation from mainstream scientific activities. His vision of how these barriers might be lowered was to engage scientists from developing countries in collaborative research with scientists from industrialized countries.

Crabbé gave concreteness to his vision by bringing a group of scientists to Paris, where they formed the International Organization for Chemical Sciences in Development (IOCD). A charter and bylaws were drafted and deposited with the Belgian Ministry of Justice, and officers were appointed as follows: President, the late Glenn T. Seaborg, a Nobel Laureate of the Lawrence Berkeley Laboratory; Vice President and Treasurer, Elkan R. Blout, Dean of Harvard School of Public Health; and Director, Pierre Crabbé.

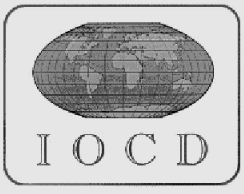
The IOCD initially formed two scientific working groups and placed them at the core of IOCD. The Working Group on Fertility Regulation, headed by Dr. Josef Fried of the University of Chicago, linked specialists in the chemistry of fertility regulation with chemists in developing countries in order to synthesize new compounds to be tested as antifertility drugs. The Working Group on Tropical Diseases, chaired by Dr. Sydney Archer of the Renssalear Institute, linked specialists in synthetic organic chemistry with chemists in developing countries, with the aim of synthesizing compounds to be tested as chemotherapeutic agents for the treatment of tropical diseases.

Under the inspired leadership of Pierre Crabbé, these working groups launched vigorous collaborative research with generous funding from donor agencies such as the World Health Organization (WHO), the Mellon Foundation, and the United Nations Fund for Population Activities. They set high expectations in their work, aimed to build research capacity among the scientists in developing countries, and sought to make substantive contributions to the world body of scientific knowledge. Dr. Pino Benagiano, a WHO official at that time, commented that IOCD's Working Group on Fertility Regulation in the Male had "unique status" in the global search for an effective male fertility regulator.

This promising early period of IOCD came to an abrupt and tragic halt in mid-1987 when Pierre Crabbé was struck and killed by a car in the street near his home in Brussels. The IOCD Executive Committee was confronted with the need to find a person who could quickly take up Crabbé's work and maintain the momentum of IOCD's activities. Their search brought them to Dr. Robert Maybury, a chemist recently retired from 20 years with UNESCO. He accepted the IOCD's invitation to become the executive director, bringing a wide range of contacts built up during his many years of service in the field.

Maintaining the Momentum of IOCD's Program (1987 to Present)

One of Maybury's first tasks was to establish the Working Group on Plant Chemistry, with Sir Leslie Fowden, director of the Rothamsted Experimental Station in England, as



its chairman. The working group focused its capacity-building efforts on convening workshops for natural-products chemists in developing countries. The members of the working group—outstanding specialists from industrialized countries—provided instruction in relevant laboratory techniques to selected natural-products chemists from countries in the region where the workshops convened. The first workshop convened for one week in 1990 in Nairobi, Kenya. Twelve natural-products chemists from East African countries had an opportunity to learn selected, simple bioassay techniques: the brine-shrimp toxicity test, assays for antisickling, the potato-disc bioassay, and antimicrobial screening. The second such workshop was held in 1992 in Ghana with participants from West African countries, and the third in 1994 in Uruguay for South American participants. In 1994, Dr. Kurt Hostettmann, director of the Institute of Pharmacognosy and Phytochemistry at the University of Lausanne, Switzerland, became chairman. He created a new international symposium—focused on the medicinal plants of a particular geographic region—that was held along with the workshop on bioassay techniques, but which was open to scientists from throughout the world.

In 1992, in response to increasing requests from African natural-products chemists for chemical and biological analyses, IOCD invited the directors of several well-equipped African laboratories to a meeting to discuss ways to respond to these requests. IOCD realized that although no one laboratory possessed all of the sophisticated instruments needed for the full range of requested analyses, collectively they did. In response, the group of directors set up the Network for Analytical and Bioassay Services in Africa (NABSA) and selected Dr. Berhanu Abegaz of the University of Botswana to be coordinator. Initially, IOCD provided financial assistance, but now other donors are assisting NABSA.

Front row: M. James Cosentino, Jean-Marie Lehn (President), Robert Maybury (Executive Director)
Back row: Jacques Perié, Walter Benson, Fred Opperdoes, Stephen Matlin, Lester Mitscher

An IUPAC-IOCD Working Party has organized workshops, in many different countries, that provide analytical chemists and laboratory managers with up-to-date information and methods pertaining to environmental analytical chemistry.

In 1997, when Dr. Sidney Archer—the original leader of the Working Group on Tropical Diseases—passed away, Dr. Fred Opperdoes of the Research Unit for Tropical Diseases in Brussels assumed the role of chairman. He introduced a highly innovative change in the group's program by arranging for the admission of IOCD to observer status in the European Union's cooperative research program known as COST (Cooperation in Science and Technology). This status enables IOCD to invite several younger research scientists from developing countries to participate in the annual COST congresses on tropical diseases. IOCD covers the full cost of their travel, room, and board. These scientists have opportunities to present research reports and to explore possible research collaboration with leading specialists attending the congresses.

Under Maybury's leadership, IOCD added two environmental programs. In 1993, it signed an agreement with IUPAC to form the Joint Working Party on Environmental Analytical Chemistry. Dr. Walter R. Benson, a retired U.S. Food and Drug Administration scientist, became the program's chairman. The Joint Working Party has organized workshops, in many different countries, that provide analytical chemists and laboratory managers with up-to-date information and methods pertaining to environmental analytical chemistry.

The second program, the Biotic Exploration Fund, was created in 1996 with a grant from the U.S. National Academy of Sciences. Based on an idea of Dr. Thomas Eisner of Cornell University, the program helps developing countries introduce bioprospecting programs using biodiversity resources. Because bioprospecting often involves a country's indigenous peoples who are the guardians of its biodiversity resources, IOCD prudently adopted a Policy on Access to Genetic Resources and Benefit Sharing to guide its work of promoting bioprospecting. This put IOCD in full compliance with the U.N.'s 1992 Convention on Biological Diversity. IOCD scientists have to date collaborated with responsible groups in South Africa, Kenya, Uganda, and Guatemala,

in making plans to eventually implement bioprospecting. The chairman of the Biotic Exploration Fund, Dr. Charles Weiss, was formerly the science and technology advisor at the World Bank and is now a full professor in Georgetown University's School of Foreign Service in Washington, D.C.

With funds from UNESCO, IOCD recently set up the project Books for Development. Through this project, IOCD collects scientific books and arranges for their shipment to university libraries in African countries. Dr. James Cosentino, vice chair of the IOCD Working Group on Medicinal Chemistry, initiated and continues to direct the project. He accepts books from many sources, but has also reached agreement with university libraries in Pennsylvania, USA, to donate their unneeded books.

IOCD Starts Along the Road Ahead

In addition to marking the 20th anniversary of IOCD's founding by awarding the Pierre Crabbé–IOCD Prize, we as IOCD's officers also see this as an opportune time to give thought to the future of IOCD's program. This requires looking back as well as ahead and seeking answers to such questions as: What improvements do we need to consider making in our ongoing activities? Is there an unexplored potential of IOCD? What new directions in the program should we consider in unlocking this potential?

We will pursue this search for answers through a three-part strategy. The first part calls for a critical analysis of IOCD's 20-year record of capacity building among scientists in developing countries, thereby discerning which activities were clear successes and which had shortcomings. The strategy's second part requires our sincere effort to seek the views of the scientists in developing countries with whom we wish to work, asking them to point out problems they face and asking them how IOCD can help them find solutions. As the third part of this strategy, we intend to consult with the two international organizations with which we are affiliated—IUPAC, of which we are an Associated Organization and the International Foundation for Science (IFS), of which we are a member organization—about possible collaboration in the deliberations on our future. Both organizations have extensive international experience in responding to the needs of scientists in developing countries.

The interactions we have had to date with IUPAC, which have been useful but limited, are nevertheless indicative of the benefits we can expect from broader collaboration. A particularly useful interaction is our cosponsorship with IUPAC of the Joint IOCD/IUPAC Working Party for Environmental Analytical Chemistry. We found IUPAC receptive to our repeated requests for funds in support of the workshops. In regard to these workshops, we believe closer collaboration with IUPAC could prove most beneficial in the study of two workshop-related issues.

The first arises from the decision of all of our working groups to adopt the workshop as the *modus operandi* for its capacity-building efforts. Our original approach had been to establish collaborative research with scientists in developing countries. We are confident that collaboration with IUPAC would greatly assist us in developing a rationale for turning to the workshops as a way to build capacity.

The second issue concerns the need to supplement the feedback we seek from workshop participants on such matters as topics to be covered, time required to cover the topics, and appropriate instructional methods and aids (lectures, videos, books, computer programs, laboratory experiments, etc). In addition, we need information about local problems and needs of the countries where workshops are held. Collaboration with IUPAC could help us devise appropriate surveys and research studies for gathering this kind of information.

IOCD scientists have to date collaborated with responsible groups in South Africa, Kenya, Uganda, and Guatemala, in making plans to eventually implement bioprospecting.

We have a similar interest in benefiting from the wealth of experience found in IFS by broadening our collaboration. We find IFS's own words encouraging in this respect. In a recently completed study, *IFS Member Organization: Revisiting and Revitalizing their Role*, IFS makes clear its intentions to strengthen its collaboration with member organizations. IOCD can also benefit from IFS' assessment of the impact of its activities on the achievements and career development of several hundred IFS grantees in Africa. We intend to consult with the recently appointed acting director of IFS, Dr. Jacques Gaillard, about the possibilities of broader collaboration.

Clearly, as IOCD continues to branch out in new directions, the spirit of its founder lives on. The Pierre Crabbé-IOCD Prize of USD 10 000 will be awarded to the person "who has made the most significant contribution during the past two years to the encouragement of better science and education in a developing country." The submission deadline was 31 March 2002.

*Jean-Marie Lehn, IOCD President, Nobel Laureate, is professor at Université Louis Pasteur, Strasbourg, France; Elkan R. Blout is IOCD Vice President and Treasurer; and Robert H. Maybury is IOCD Executive Director. *E-mail: iocd@igc.org*

Validated Analytical Methods—AOAC's Experience Over 100 Years

by Albert Pohland

The AOAC INTERNATIONAL is an organization devoted to the validation and use of chemical and microbiological analytical methods. It was organized in 1886 as the Association of Official Agricultural Chemists by a group of chemists whose interest was in harmonizing methods of analysis for fertilizers. The first president was Dr. Harvey W. Wiley, the director of the Bureau of Chemistry of the U.S. Department of Agriculture. Dr Wiley's interests turned eventually to foods, and specifically, to additives then used commonly in foods. Dr. Wiley was able to show that many of these food additives were significantly toxic and harmful to consumers when ingested. Because of Dr. Wiley's pioneering work on food additives, the U.S. Congress passed the 1906 Pure Food and Drug Act, which resulted eventually in the establishment of the U.S. Food and Drug Administration (FDA).

Of course, Dr. Wiley realized that to provide regulatory control over food additives, or any contaminant for that matter, one had to develop good analytical methodology and show that these methods, when used in more than one laboratory, gave equivalent results. In addition, it was necessary to be able to estimate the expected variability to be encountered between qualified laboratories using the method. Today we refer to this as the method reproducibility, relative standard deviation, or uncertainty. Based upon the pioneering efforts of Dr. Wiley, the procedure by which one measures a method's capabilities through the conduct of a collaborative study (round-robin, ring test, or multilaboratory collaborative study) were developed through a cooperative effort of government, industry, and academic scientists over a period of many years. The function of the AOAC was to independently evaluate the results obtained in such studies. Within the AOAC, an Official Methods Board (OMB) was established to serve this peer-review function.

When the OMB was convinced that methods could yield equivalent results when performed by competent analysts, they were termed "official methods." The first compilation of official methods was published in 1920 as the *Official Methods of Analysis of the AOAC* (OMA). The 17th edition of this compendium was published in June 2000 and contains over 2000 methods. When the FDA was established in the 1930s, the Bureau of Chemistry was moved into the new agency. The FDA wrote into its regulations that "it is the policy of the U.S. Food and Drug Administration in its enforcement programs to utilize the methods of analysis of the AOAC as published in the latest edition of their publication, *Official Methods of the Analysis of the AOAC* International, and the supplements thereto . . . when available and applicable."

As time passed, within the FDA the focus shifted away from food additives to food contaminants, so that the OMA soon contained official methods for pesticides, heavy metals, industrial chemicals, animal drugs, cosmetics and colors, natural toxicants, and more. Each category of methods became a chapter in OMA. At the same time, the procedures for validation of methods were continually improved. Details of the validation procedures used by the AOAC in its method validation programs may be found on the AOAC Web site. These procedures were eventually harmonized through IUPAC and are today internationally accepted. Many of the AOAC methods are now incorporated in Codex standards as "reference methods."

In 1979, as a result of an effort to "privatize" some parts of the U.S. federal government, the AOAC was converted into a nonprofit, nongovernmental organization. Whereas at one time 80%–90% of the AOAC membership was government employees, today only about 20% is government, with about 65% industrial. Almost 50% of the members reside outside of the United States. These members value AOAC as a source of validated analytical methods, as a publication outlet for scientific papers, and as a venue for interacting with analytical chemists, microbiologists, and food scientists worldwide.

In recent years, the need for microbiological methods and the validation of such methods has resulted in an increasing number of microbiologists within the AOAC. In 1990, this fact, along with an increasing international membership, motivated the AOAC to change its name to AOAC INTERNATIONAL, with AOAC referring to the Association of Analytical Communities.

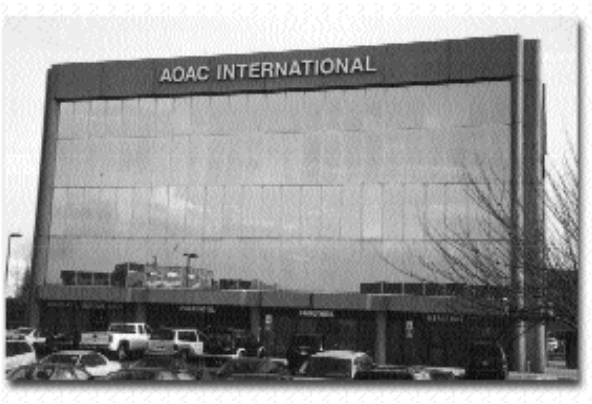
As an organization of chemists and microbiologists, the AOAC continues to focus on the crucial issues sur-

rounding validation of analytical methods. The AOAC has recently initiated a multiyear collaborative effort to develop an Internet-accessible, electronic database of methods used in the analysis of foods, which are categorized according to the degree to which they have been validated. The AOAC has recently established three task forces focused on the development and validation of analytical methods for the following: (1) dietary supplements, (2) food allergens, and (3) agricultural biotechnology (i.e., methods for analysis of foods for genetically engineered organisms).

The AOAC is a member-responsive organization, providing many products and services:

- For the research scientist, the *Journal of AOAC INTERNATIONAL* is a highly respected outlet for publication.
- For the laboratory manager, the Technical Division on Laboratory Management and a Technical Division on Reference Materials offers training in laboratory quality assurance and laboratory certification, and, most important, provides A2LA-certified, laboratory-proficiency testing programs.
- For all members, AOAC provides—through the AOAC Web site and through the highly regarded member journal, *Inside Laboratory Management*—a connection to approximately 4000 individuals worldwide, in government, industry, and academia.

All of these products and services are available through the AOAC Web site.



The AOAC headquarters building in Gaithersburg, Maryland, USA.

The importance of validated analytical methods in world trade, in providing local and international product regulation, in informing consumers through product labels, and in protecting consumers from terrorist acts, cannot be underestimated. The AOAC has been, and will be in the future, a principal source of such validated methods.

Albert Pohland is director of the Office of International Activities at AOAC INTERNATIONAL.

www.aoac.org

African Association of Pure and Applied Chemistry ◆ AOAC International ◆ Calorimetry Conference ◆ Chemical Heritage Foundation ◆ Eurachem ◆ European Federation of Biotechnology ◆ European Federation of Chemical Engin… mistry Assoc… opean Chem… ies ◆ Intern… tional Assoc… ydrate Organ… fect ◆ Intern… on for Therm… nation Chem… try ◆ Intern… ion of Clinic… mistry ◆ International Mechanochemical Association ◆ International Organization for Biotechnology and Bioengineering ◆ International Organization for Chemical Sciences in Development ◆ International Organization of Crystal Growth ◆

Attention IUPAC Associated Organizations!

Let other readers of *Chemistry International* know about your organization—what it does, its history, recent activities.
Send your submission to edit.ci@iupac.org.

Associated Organizations are international organizations that share common goals and interests with IUPAC. Currently over 30 organizations are IUPAC Associated Organizations. Inquiries about becoming an Associated Organization of IUPAC should be directed to the Executive Director at secretariat@iupac.org.

Small-Scale Chemistry

by J.D. Bradley

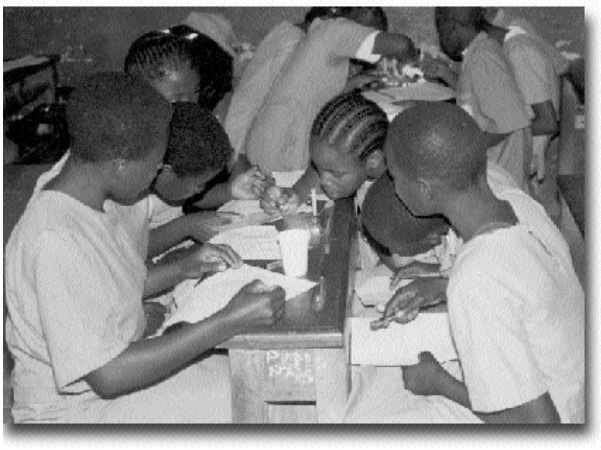
It is widely believed that practical work is an essential part of chemistry education. However, in most countries there is no provision for such personal experiences, and even at universities, provision is limited. This problem has been recognized for many years by both UNESCO and IUPAC, and a number of initiatives were taken to address it. The microchemistry program started in 1997 aims to address the problem through promoting a small-scale, low-cost approach, and done by means of introductory workshops for chemistry educators in different countries. The concept has been received enthusiastically in nearly 40 countries now, and pilot projects have been initiated in several of these. This year, UNESCO and IUPAC have renewed their collaboration on this project. In his lecture at the 8th International Chemistry Conference in Africa (8th ICCA), 30 July–4 August 2001, in Dakar, Sénégal, Prof. Bradley presented the project and its outcomes. His lecture entitled "UNESCO/IUPAC–CTC Global Program in Microchemistry" is published in July 2001 issue of *Pure and Applied Chemistry* (Vol. 73, No. 7, pp 1215–1219) and reproduced below.

A revolution in chemistry education has begun. Practical work is an integral part of science education. Ask any science educator, and you can be almost certain he or she will agree. The implication that practical activity is, therefore, a frequent component of science teaching is usually left an unspoken assumption. The following quotes surely reflect a universal opinion and expectation:

"Experimental work is a defining characteristic of the natural sciences . . . wherever possible, practical work should involve active student participation."[1]

". . . chemistry is fundamentally an experimental subject . . . education in chemistry must have an ineluctable experimental component."[2]

Yet, the reality in science education is quite otherwise. Ask any honest educator, and the appalling reality will invariably be disclosed. In the majority of school science classrooms, there is no practical activity. In rich societies, you may find virtual substitutes; in poor societies, you will find blackboard descriptions. The latter will freely acknowledge that the real experience cannot be afforded; the former will cite concerns about safety and environment. When really pressed, many teachers in both contexts will admit they are not really prepared (trained) for it. At the university level, difficulties are also evident. Almost everywhere, the burden is felt of providing practical experiences for increasing numbers of students in a context of increasing costs of chemicals and equipment. In poorer countries, the battle has been lost: practical work has been ossified and eroded to the extent that students graduate with little practical experience and little understanding of science.



Students doing microchemistry at Lycee Gen.Leclerc,Yaounde.

This situation is not something that has developed recently.[3] Both UNESCO and IUPAC have known about it for decades. At UNESCO, low-cost equipment for science education has been on the agenda for action as long as people can remember: it has principally been focused on primary and secondary education.[4] At IUPAC, the Committee on Teaching of Chemistry (CTC) took up the challenge at a tertiary level, focusing on low-cost instrumentation for chemistry.[5,6] The history of these endeavors is a matter of record, and it would be good to evaluate their long-term impact on science education.[7]

During the past five years, a new onslaught on this historic problem has been mounted in a cooperative program of UNESCO (Basic Sciences Division) and IUPAC–CTC. The central thrusts of the program have been to disseminate awareness of the benefits of small-scale, low-cost chemistry equipment; to facilitate meaningful consideration of how the capabilities of the equipment match the requirements of the curriculum; and to help initiate pilot projects that permit classroom-based assessment of the applicability of the approach.

Small-Scale, Low-Cost Equipment

The equipment used in this program was developed in South Africa and is based on the use of plastic microw-

ell plates with two sizes of microwells. With this comes some familiar plastic items for handling solids (microspatulas), liquids [propettes (Beral pipettes), syringe], and gases (gas collecting tube); some specially designed items (e.g., two types of well-lids) for more complex reaction set-ups; some silicone tubing; a short piece of glass tubing; a glass rod; and a microburner. These items are packed into a plastic "lunch-box" to constitute a basic student kit. With this kit, a wide range of basic chemistry experiments can be carried out, very simply and quickly. With the addition of a few more items, numerous experiments in electrochemistry, organic chemistry, and/or volumetric analysis can be performed.[8,9]

This equipment is now embodied in a host of experiment descriptions and supported by packs of preprepared chemicals. The concept has been introduced and disseminated in different countries by means of two-day workshops. The workshops begin with an introductory exposition of the ideas, but the main component is hands-on experience interspersed with discussions. A videotape demonstration is also usually included. Normally, cautious interest is provoked by the introduction, hands-on activity then begins a little nervously, but within a half-hour, confidence and excitement become palpable. Invariably, the majority of participants—usually school teachers, science inspectors, and a few university lecturers—hail the experience as promising a solution to the problem of practical work provision.

The concluding discussion is often sobering, because it is here that the question "What now?" is addressed. While the majority may be persuaded that the solution can now be imagined, the fact remains that there are obstacles. The established curriculum needs to be scrutinized, the textbooks must be considered, the examinations must be taken into account, and, finally, the cost, which is low, but not zero. At this final session, all these problems surface, and there needs to be a conscious effort by individual participants to make a decision to tackle these problems.

Matching Up To The Curriculum

In the workshop, a selection of experiments is offered to illustrate the scope and limitations of the approach. These experiments are almost universally included in curricula. To tackle the question of the extent to which a national curriculum can be supported by the new-style equipment, most teachers and inspectors welcome an extensive listing and description of experiments that can be done with it. Books containing descriptions of about 100 experiments, including teacher notes, have been prepared in English. To facilitate wider access, translation into other languages has been encouraged. Often a local chemistry graduate who is enthusiastic about the concept, proposes to undertake this. This has led to translation into French,[10] Russian, Arabic, Estonian,

UNESCO/IUPAC-CTC Global Program.

Persian, and Portuguese at the present time, with other languages in the offing. A decision to undertake such translation is often the next crucial step toward wider interest (including government interest) in the concept.

Therefore, some free copies of the book of experiments are distributed at the end of the workshop, and, if required, a CD-ROM version is distributed also. After some time has been spent on studying the full range of experiments, it is usually concluded that the equipment can satisfy a substantial fraction of a school's curricular needs. Some may argue that not everything is possible and therefore nothing should be done, but such views are a small minority. Some, too, may yearn for a traditional laboratory, where one must go to perform "real science," but they too are a small minority when compared with those who see the removal of the need for such a facility as immensely liberating.

Initiating A Pilot Project

It usually emerges during workshop discussions that some instructors are ready and eager to try the approach in their own classrooms. Occasionally, there is one educator, usually at a private institution, who can get enough money to do so using the institution's own resources. More often, the cost of a pilot project needs to be met by a donor agency. UNESCO has had considerable success in locating sources of such funding—the final crucial step in the proper assessment of the applicability of the approach in the local context.

It is our impression that in most instances the assessment has been comparatively limited. Given the realities in most of the countries we have visited, this is to be expected. In most cases, too, it must be remembered that it's not a question of weighing the relative merits of traditional-and small-scale equipment: it's a question of seeing what happens when students are allowed to do their own, hands-on, practical work for the first time. Can the teacher manage the situation? Did anyone get hurt? What is the attitude of the students? These are the basic kinds of questions most local educators and government officials want answers to. Until a pilot project has been done, it is all conjecture and/or unverified claims made by the promoters of the concept.

It is our experience that on completion of a pilot project, the demand is always for wider implementation. This, however, is a national matter in which the UNESCO/IUPAC program has no direct role to play.

Outcomes to Date

The cooperation between UNESCO (Basic Sciences Division) and IUPAC-CTC in this program has been very fruitful. Introductory workshops have been held in nearly 40 countries, which have led to pilot projects in nearly half of these. Many of these countries are poor, and their initiation of pilot projects represents a commendable effort to improve science education in very adverse circumstances. In three countries (South Africa, Cameroon, and Kenya), extensive implementation has taken place.

Donor agencies as well as ministries of education continue to support the spread of the concept in developing countries and countries in transition. As long ago as 1996, Beasley and Chant (in Australia), referring to beginning university courses, observed "the trend from macro is now established."[11] The outcomes of the UNESCO/IUPAC-CTC program since that time, reported here, give a global emphasis to this observation. Furthermore, chemistry education worldwide may be revolutionalized as the need for a traditional laboratory is removed and a majority of students are able to experience chemistry firsthand.

Conclusions

The experiences of the past few years lead to a number of conclusions.

- Active, focused collaboration between UNESCO and a scientific union (IUPAC) can be very effective in disseminating important ideas and information in science education outside the relatively small number of wealthier, developed countries. The political neutrality of these bodies is important for open communication. The model we have established might be extended to other scientific unions.
- The interventions "on the ground" are relatively costly, but essential for new ideas to be seriously considered. Electronic or printed documentation is cheaper, but is unlikely to achieve impact, although there is probably an important supportive role for this.
- The successes of the program have created new channels of communication. These should be nurtured for the benefit of all concerned. From the IUPAC point of view, the Committee on Teaching of Chemistry endeavors to keep informed of the developments and needs of chemistry education at all levels worldwide. Apart from practical work, in all but the richest countries there is a general dearth of good-quality (in the scientific, educational sense) teaching resources for the common, core chemistry content found in all curricula. Similarly, there is a lack of teaching resources for topics of growing general importance, such as chemical safety. CTC has identified further opportunities and needs in these areas and is cooperating with UNESCO and with IUPAC's Committee on Chemical Industry to disseminate the DIDAC teaching resources (including posters for classrooms without electricity).[12] CTC is also working with IUPAC's Commission on Toxicology to disseminate a new resource for teachers that deals with chemical safety.[13] We hope to continue this program over the next few years, in the belief that a significant impact on chemistry education will be made.

Acknowledgments

As Chairman, IUPAC-CTC, I thank Dr. A. N. Pokrovsky, UNESCO Basic Sciences Division, for the strong cooperation that has enabled this program to achieve success.

References

1 National Department of Education of S. Africa. *Curriculum 2005 Intermediate and Senior Phase Policy Document.* Pretoria, South Africa (1997).

2 IUPAC. *Report of the Education Strategy Development Committee*, p. 8 (2000).

3 A. Musar. *Equipment for Science Education: Constraints and Opportunities*, The World Bank, Washington, DC (1992).

4 UNESCO. *Low Cost Equipment for Science and Technology Education Vol. I* (1985); Vol. II (1986). UNESCO, Paris.

5 K. V. Sane and D. C. West. *Low Cost Chemical Instrumentation*, University of Delhi, Delhi (1991).

6 K. V. Sane. *In Science and Environment Education: Views from Developing Countries*, S. A. Ware (Ed.), pp. 129-140, The World Bank, Washington, DC (1999).

7 E. W. Thulstrup. *In Science and Environment Education: Views from Developing Countries*, S. A. Ware (Ed.), pp.113-127, The World Bank, Washington, DC (1999).

8 J. D. Bradley, S. Durbach, B. Bell, J. Mungarulire, H. Kimel. *J.Chem.Educ*. **75** , 1406-1409 (1998).

9 J. D. Bradley. *Pure Appl. Chem* **71**, 817-823 (1999).

10 Experiences de Microchimie: Manuel de l 'Enseignant. UNESCO/IUPAC-CTC. J.D. Bradley (Ed.), Magister Press, Moscow (1999).

11 W. Beasley and D. Chant. Aust. *J.Chem.Educ*.**41**, 11 -16 (1996).

12 *Chemistry International* **22** (4), 103 -105 (2000).

13 *Chemistry International* **22** (6), 180-181 (2000).

www.iupac.org/projects/2001/2001-046-1-050.html

The World Chemistry Congress 2001 and the Young Scientist Awards

The IUPAC World Chemistry Congress 2001 (the 38th IUPAC Congress) held in Brisbane, Australia, 1–6 July 2001, brought together well over 1000 delegates from around the world and a host of international and domestic scientists from a variety of disciplines. The traditional subdivisions were waived in favor of a new cross-disciplinary approach featuring the themes of materials chemistry for the future, chemistry by computer, challenges for drug discovery and development in the 21st century, environmental chemistry and the greening of industry, and modern synthetic chemistry.

The emphasis on the future interdisciplinary nature of chemistry, said Dr. Geoffrey Will, had a particular benefit to the numerous young chemists present at the Congress because it promoted the "big picture view" of the evolving discipline of chemistry. Dr. Will is the Congress editor for the series of lectures published in the July 2001 issue of IUPAC's Journal *Pure and Applied Chemistry*.

Due to the success of the Congress, the *Australian Journal of Chemistry—an International Journal for Chemical Science*, assembled a special double issue (Vol 54, issue 9 and 10, 2001) with highlights from the Materials Chemistry for the Future session. In her editorial reproduced below (by permission of CSIRO PUBLISHING), Dr. Alison Green reviews briefly the issues' contents:

Zeolites, molecular magnets, biomineralization, bone implants, synthetic opals, and molecular capsules are some of the areas where chemical science is giving rise to materials for the future. Diverse areas of cross-disciplinary research such as these are flourishing, and about a quarter of the papers presented at the recent IUPAC World Chemistry Congress in Brisbane (the largest chemistry conference ever held in Australia) made up the Materials Chemistry for the Future session. Highlights from this session make up this special issue of *Australian Journal of Chemistry—an International Journal for Chemical Science*. Matt Trau, who was a theme coordinator of the Materials Chemistry session, acted as guest editor for this issue, and has contributed the introductory Essay.

Nobel Laureate Yuan Tseh Lee discussed the photo-excitation of molecules in a molecular beam in the first plenary lecture, and he has subsequently presented the work in one of four reviews in this issue. Professor Lee also includes new results that shed light on the isomerization of xylenes. Sir John Meurig Thomas described some novel catalyst architecture where transition metal clusters are adsorbed within the mesopores of zeolites to achieve selective, heterogeneous, environmentally friendly processes. The biomineralization of chiton and limpet teeth was discussed by John Webb, who reports in his Current Chemistry article how vibrational spectroscopy can give insight into detailed mineral structure, which in turn provides important information on the complex processes of biomineralization. Matt Trau described his group's approach to combinatorial chemistry, in which colloidal silica beads are marked with up to six fluorescent dyes as labels, the markers thus functioning as "fluorescent bar codes," allowing the encoding of large libraries.

We enjoyed the privilege of awarding student prizes at the Congress. The awards, whose purpose is to encourage and reward young scientists, were co-sponsored by the RACI and the *Journal*. Judging was carried out by Professor Len Lindoy, Professor John White, Dr John Lambert and myself, with a great deal of very helpful input from other delegates.

While deciding second and third place was less straightforward, the clear winner was Teri Odom, who presented work carried out with Charles Lieber at Harvard, on the electronic properties of carbon nanotubes. Impressive images achieved using scanning tunnelling micro-scopy, and lucid explanations of the relationship between atomic structure, electronic properties, and structural defects, characterized her presentation. Teri Odom received AUD 750 and a 12-month subscription (print and electronic) to *Australian Journal of Chemistry—an International Journal for Chemical Science*. Teri was also the recipient of an IUPAC Prize for Young Chemists for her Ph.D. thesis. This award was presented at the Congress. She has contributed a Current Chemistry article on her work entitled "Electronic properties of single-walled carbon nanotubes" (*Aust. J. Chem.* 2001, 54, 601-604). Cameron Lutton and Jonathan Read were awarded joint second prize for their research on nanostructured biomaterials. They produced

IUPAC President Alan Hayes presents Teri Odom with the IUPAC Prize for Young Chemists Award.

Photo courtesy of Dr. Greg Cash of the University of Queensland.

a bone implant material in a scaffold-like architecture that incorporated hydroxyapatite nanoparticles. The pair shared AUD 250 and a 12-month subscription (print and electronic) to the *Journal*. Third prize was awarded to Yi-Anh Sha for research presented on the effects of substituent groups on ferroelectric liquid crystalline polymers. Sha received a 12-month subscription (print and electronic) to the *Journal*.

www.iupac.org/publications/pac/2001/7307
www.publish.csiro.au/journals/ajc/contents.cfm
www.iupac.org/news/prize.html

IUPAC News

Relocating to Cyberspace

by Fabienne Meyers

In May 1997, IUPAC officially celebrated the relocation of the Secretariat from Oxford, UK to the Research Triangle Park (RTP) in North Carolina, USA. The decision to relocate, which was considered in detail by the officers, was based on more than just the appeal of RTP. The move gave IUPAC an opportunity to underline its identity as a global organization and to modernize the administrative functions of the Secretariat, including further development and usage of electronic communication.

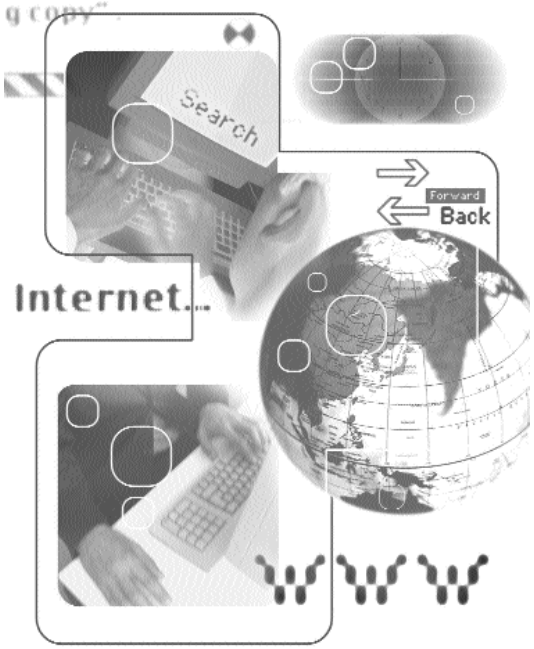
The Secretariat is now housed in a small one-story building in the midst of the Park, a 7000-acre wooded area centered between three major universities—Duke University in Durham, North Carolina State in Raleigh, and the University of North Carolina (UNC) at Chapel Hill. RTP is owned and developed by the private, not-for-profit Research Triangle Foundation. It is home to more than 140 organizations—including research laboratories for international chemical, pharmaceutical, and electronics firms—that employ more than 50 000 people, with a total payroll estimated at USD 2 700 million and a capital investment exceeding USD 2 000 million. So, even though IUPAC's office is quite small and discrete (there are four of us working at the office), the Secretariat has a number of interesting neighbors that might be worth visiting!

In my view, one of IUPAC's most fortuitous collaborations since relocating to the RTP has been with UNC Chapel Hill, and in particular with the computer center supported by the School of Information and Library Science, the School of Journalism and Mass Communication, and Information Technology Services. Known today as **ibiblio.org**, the center is the home of one of the largest "collections of collections" on the Internet. It was created and is maintained by the public for the public.

This unique online library project has developed under the leadership of Paul Jones, a computer scientist and associate professor of information and library science. It is in many ways the embodiment of the Internet as a clearinghouse of information. The project, named Sunsite when started 10 years ago at UNC Chapel Hill, was founded as an archives and information sharing environment designed to be contributor driven and content managed. The collections grew diverse, and covered subjects from music, literature, and history, to software. Continuing its outreach effort and expansion, Sunsite became Metalab. The project continued to stress excellence and active contributor involvement.

In fall 2000, the project made another significant step forward when it began a collaboration with the Center for Public Domain. The new arrangement resulted in an even more advanced collection of freely available information. This online library, which was renamed ibiblio, now stands above others because it maintains:

- a close relation to the open source models for development and management of collections
- a strong history of contributor participation and autonomy
- a flexibility of forms and management styles
- a diversity of collections that maintains depth and excellence and creates synergy
- a large community of contributors sharing their knowledge across disciplines



Ibiblio's goals of expanding and improving the distribution of open source software and documentation is fortuitous for IUPAC, whose main goal is also to provide greater access to information. Although IUPAC is still establishing itself in today's virtual world, it is without doubt benefiting from the fun and fearless spirit that our host, ibiblio, has developed over recent years. Paul Jones and his team, in particular Jonathan Magid and Donald Sizemore, have yet to say 'no' to our inquiries. I am grateful for their support.

Another individual to be thanked is Thomas Gould, who has continuously worked behind the scenes of iupac.org, helping us with the daily and continuous demand for site updates and maintenance. Tom, who started out at UNC Chapel Hill, now teaches at the School of Journalism and Mass Communication at Kansas State University, Manhattan, Kansas, USA.

Ibiblio.org averages 3 million information requests per day, while over the last four years the number of hits on the IUPAC site has increased 100 fold to recently hit about 300 000 a month. Such numbers are not trivial. Quantity however, should not be more important than quality; and for a scientific union such as IUPAC, managing a good balance between both should be a priority that benefits the scientific community. It is up to you and to us to make the best use of today's Internet and electronic technologies to further disseminate the products of IUPAC projects and to enhance communications.

Dr. Fabienne Meyers is the Web site manager for IUPAC.

More about . . .

RTP History, <www.rtp.org>

Public library of the internet, by F. Olsen, *The Chronicle of Higher Education*, 12 Sep. 2000, chronicle.com <www.chronicle.com/free/2000/09/2000091201t.htm>

ibiblio concept to a new level, by Roblimo, 17 Sep. 2000, slashdot.org <slashdot.org/features/00/09/17/155240.shtml>

www.ibiblio.org

Do and Don't—Tips of ICTNS

On the Use of *Italic* and Roman Fonts for Symbols

Scientific manuscripts frequently fail to follow the accepted conventions concerning the use of italic and roman fonts for symbols. An italic font is generally used for emphasis in running text, but it has a quite specific meaning when used for symbols in scientific text and equations. Here are a few tips.

The overall rule is that symbols representing physical quantities (or variables) are italic, but symbols representing units, or labels, are roman. Sometimes there may seem to be doubt as to whether a symbol represents a quantity or has some other meaning (such as a label): a good general rule is that quantities, or variables, can be given a value, but labels cannot. Vectors and matrices are usually denoted using a bold-face (heavy) font, but they should still be italic since they are still quantities.

Symbols representing

physical quantities or variables . . . . . italic fonts

units or labels . . . . . .roman fonts

Examples: The mass of my pen m = 24 g = 0.024 kg.

The electric field strength $\boldsymbol{E}$ has components E_x, E_y, and E_z.

The Planck constant h = 6.626 068 76 (52) x 10^{-34} J s.

The above rule applies equally to letter symbols from both the Greek and the Latin alphabet.

Example: When the symbol μ is used to denote a physical quantity (such as mass or reduced mass) it should be italic, but when it is used in a unit such as the microgram, μg, or when it is used as the symbol for the muon, μ, it should be roman.

The general rules concerning the use of an italic (sloping) font or a roman (upright) font are presented in detail in the *IUPAC Green Book.*

ICTNS is the Interdivisional Committee on Terminology, Nomenclature, and Symbols.

For more tips go to www.iupac.org/standing/idcns/italic_roman.html

Awards and Honors

Erick Carreira Receives the Thieme–IUPAC Prize

Erick Carreira is to be awarded the Thieme–IUPAC Prize 2002 in recognition of outstanding achievements in the field of synthetic organic chemistry. His research focuses on the asymmetric synthesis of biologically active, stereochemically complex, natural products. His work has resulted in the highly lauded syntheses of challenging target molecules and the development of catalytic and stoichiometric reagents for asymmetric stereocontrol using an approach that is both innovative and elegant. He will be presented the prize at ICOS14 in Christchurch, New Zealand on 16 July 2002.

The Thieme–IUPAC Prize is awarded every two years on the occasion of IUPAC's International Conference on Organic Synthesis (ICOS) to a scientist under 40 years of age, whose research has had a major impact on the field of synthetic organic chemistry. The Prize is sponsored jointly by Georg Thieme Verlag, IUPAC, and the editors of *Synthesis*, *Synlett*, *Science of Synthesis*, and *Houben-Weyl*.

Erick Carreira

Erick M. Carreira was born in Havana, Cuba in 1963. He obtained a B.S. degree in 1984 from the University of Illinois at Urbana-Champaign and a Ph.D. degree in 1990 from Harvard University. After carrying out postdoctoral work at the California Institute of Technology through late 1992, he joined the faculty at the same institution as an assistant professor of chemistry. He subsequently was promoted to associate professor of chemistry in the spring of 1996, and full professor in the spring of 1997. Since September 1998, he has been full professor of Organic Chemistry at ETH Zürich. He is the recipient of numerous awards.

His research program focuses on the asymmetric synthesis of biologically active, stereochemically complex, natural products. Target molecules are selected which pose unique challenges in asymmetric bond construction. A complex multistep synthesis endeavor provides a goal-oriented setting within which to engage in reaction innovation and design. Drawing from the areas of organometallic chemistry, coordination chemistry, and molecular recognition, Carreira's group is developing catalytic and stoichiometric reagents for asymmetric stereocontrol, including chiral Lewis acids and transition-metal based reductants.

www.chem.ethz.ch/D-CHEM-Prof/carreira/carreira.html
www.iupac.org/news/Thieme_prize.html

Roger Atkinson Receives the ACS Award for Creative Advances in Environmental Science and Technology

Roger Atkinson, a professor at the University of California, Riverside, has received the American Chemical Society's 2002 Award for Creative Advances in Environmental Science and Technology. The purpose of the award, which is sponsored by Air Products & Chemicals Inc., is to encourage creativity in research and technology or methods of analysis to provide a scientific basis for informed environmental control decision-making processes, or to provide *practical* technologies which will reduce health risk factors.

Atkinson, has conducted 30 years of research at the University of California, Riverside into the atmospheric chemistry of volatile organic compounds (VOCs). Through his research he has been able to piece together the kinetics, products, and mechanisms of the photooxidation of a number of VOCs by hydroxyl radicals, nitrate radicals, and ozone. Atkinson is particularly known for compiling the data generated by his group and other research groups into publications that are widely used by the atmospheric chemistry community, and involved in a related IUPAC project.

Atkinson is director of the university's Air Pollution Research Center (APRC) and he is distinguished professor of atmospheric chemistry in the department of environmental sciences. He is a faculty member in the department of chemistry and a member of the university's interdepartmental graduate program in environmental toxicology.

A native of Scarborough, England, Atkinson received B.A. (1966) and M.A. (1970) degrees in natural sciences from the University of Cambridge. He also received a Ph.D. degree in physical chemistry from Cambridge in 1969.

Atkinson is the author of some 400 papers, book chapters, and reports, and he has served on numerous state, national, and international air pollution committees and advisory panels. He was elected a fellow of the American Association for the Advancement of Science in 1997.

www.chem.ucr.edu/faculty/atkinson/atkinson.html
www.iupac.org/projects/1999/1999-037-2-100.html

IUPAC Projects

Standard Potentials of Radicals

Thermochemical properties of inorganic and organic radicals in solution will be the subject for review by a new IUPAC Task Group sponsored jointly by the Inorganic Chemistry Division and the Physical and Biophysical Chemistry Division. The objective will be to review and evaluate a variety of thermodynamic properties, including standard potentials of radicals, pK_a's of radicals, and other chemical equilibria of radicals, both in aqueous and non-aqueous media. Prior evaluations of these data were performed by individuals, in a rather non-systematic way, and are now quite out of date. Knowledge of these aqueous properties is essential in modeling the chemistry of atmospheric cloud water, terrestrial waters, radiation processes, and in understanding the fate and effects of radicals in living tissues. Analogous data for nonaqueous systems will be of value in understanding the chemistry occurring in industrial processes, in energy-transduction technology, and other fields. Moreover, there is a synergy attained by having reliable data in both types of media. The task group, lead by Professor David M. Stanbury of Auburn University, USA, will establish a Web site where evaluations for individual radicals will be posted dynamically as they are generated. Upon completion of the project, the evaluations will be published in the *Journal of Physical and Chemical Reference Data* and/or in *Pure and Applied Chemistry*. The task group will hold its first meeting near Zurich, Switzerland in early June 2002.


www.iupac.org/projects/2001/2001-015-1-100.html

Glossary for Toxicokinetics of Chemicals

At a Commission on Toxicology–VII.C.2 (COMTOX) meeting in Szeged, Hungary, in September 2000, the members present identified the lack of knowledge and confusion regarding terminology currently used in the field of toxicokinetics and chemistry as a problem for the development of the subject. Accordingly, a project called "Glossary for Toxicokinetics of Chemicals" was initiated within the Chemistry and Human Health Division. Further support was obtained for the project in July 2001 at the 41st IUPAC General Assembly in Brisbane, Australia.

IUPAC is the world authority on chemical nomenclature and terminology and thus the projected glossary fits within its remit. The objective of the project is to compile definitions of the current terminology used in toxicokinetics, including, where relevant, information on chemical speciation, analytical methods, analytical equipment, and the biological activity of chemicals.

An appendix will give practical examples of situations where toxicokinetic data may be applied. The glossary will thus facilitate interdisciplinary research in toxicokinetics and contribute to a better understanding among the disciplines.

The task group is chaired by Monica Nordberg and the current members are Douglas M. Templeton and John H. Duffus. They will consult with scientists active in the fields of chemistry, toxicology, medicinal chemistry, pharmacology, and biostatistics.

Comments and suggestions from the chemistry and toxicology community for toxicokinetic terms to be included are welcome and should be addressed to monica. nordberg@imm.ki.se.


www.iupac.org/projects/2000/2000-034-2-700.html

Recommendation on the Use of Countercurrent Chromotography in Analytical Chemistry

IUPAC has approved a two-year project to prepare a critical review of applications of countercurrent chromatography (CCC) in organic and inorganic analytical chemistry, pharmaceutical industry, and in radiochemistry. The project will place an emphasis on theory, methodology, and instrumentation. Recommendations will be made on the terminology and standardization, taking into account its relative position between other extraction and chromatography processes.

CCC is used as a method for the concentration, separation, and purification of chemical and pharmaceutical substances at both analytical and process (production) scales based on their partition between two immiscible solvent phases. One liquid phase is held stationary in the force field of a coil planet centrifuge while the other is eluted through it as the mobile phase. Among its various advantages is the ability to achieve high-resolution extractions/separations with minimal solvent use.

The application of CCC in analytical chemistry has been investigated for 16 years at a fundamental level at the Vernadsky Institute of Geochemistry and Analytical Chemistry at the Russian Academy of Sciences. Various applications of CCC to the concentration and separation of a number of elements in environmental and inorganic analysis (including the purification of chemical reagents) have been studied and a fundamental understanding of the hydrodynamics is developing. It is also clear that a basis for developing various methods of analysis has been established from the applications of CCC in the pharmaceutical industry, particularly in the production of drugs, and through the equipment made at

the Brunel Institute of Bioengineering, UK, and at other research and development institutions.

The aim of this proposal is to survey emerging technologies and applications based on CCC, including the progress made in the pharmaceutical industry, radiochemistry, and analytical and through preparative-scale inorganic separations.

Comments from the chemistry community are welcome and should be addressed to the project coordinator Prof. B.Spivakov, Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Kosygin Str. 19, Moscow, Russia 119991, Tel.: +7 095 137 82 63, Fax: +7 095 938 20 54, E-mail: spivakov@geokhi.ru.

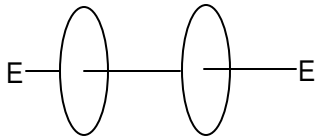
www.iupac.org/projects/2001/2001-041-2-500.html

Nomenclature for Rotaxanes, Catenanes, and Macromolecular Rotaxanes

There are currently no standards for nomenclature of rotaxanes, catenanes, and of macromolecular rotaxanes. During the last 15 years, the scientific community has shown increasing interest in these fields of small molecules and polymers, and Standardization of nomenclature in these fields is highly desirable and long overdue. This presents an opportunity for IUPAC to recommend nomenclature systems in order to establish world nomenclature standards.

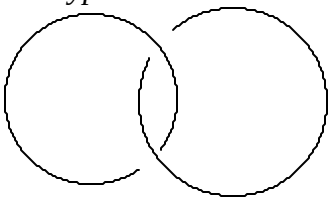
The title projects have been initiated in order to address the issues. Since the fields of rotaxanes and macromolecular rotaxanes are still rapidly expanding, the paths forward are necessarily undefined, so this may be an unusually challenging task.

Typical ***(Macromolecular) Rotaxane***



Pseudorotaxane: E-E is a linear (macro)molecule; E is an end-group small enough to permit dethreading. **Rotaxane:** E-E is a linear (macro)molecule; E is an end-group large enough to prevent dethreading. The number of rings threaded varies; 1 is commonest.

Typical ***Catenane***



Catenane: physically interlocked macrocycles with no chemical bonding between them. Each macrocycle size is generally specified and the macrocycles are usually non-polymeric. Catenanes contain at least two macrocycles, and may be linear or branched.

www.iupac.org/projects/2002/2002-007-1-800.html
www.iupac.org/projects/2000/2000-037-1-800.html

Provisional Recommendations

IUPAC Seeks Your Comments

In this section, we publish synopses of IUPAC's latest provisional recommendations on nomenclature and symbols. All comments on these recommendations are welcome and will be taken into consideration. The final revised versions are published in *Pure and Applied Chemistry*.

If you would like to comment on the provisional recommendations, please visit the IUPAC Web site at http://www.iupac.org/reports/provisional/index.html, where the full texts are available for downloading as draft pdf files. Alternatively, you can write to your nearest national/regional center to request a copy; the most recent list of national/regional centers is available on the Web site at the address above and last appeared in *CI*, Vol. 17, p. 141 (1997).

Thermochemistry of Chemical Reactions: Terminology, Symbols, and Experimental Methods for the Determination of Bond Energies

This work, which is presented in two parts, is concerned with the most currently experimental techniques used on the study of the thermochemistry of chemical reactions. The first part of this recommendation deals with the terminology and symbols, discusses the meaning, designation and symbols of the different parameters used in molecular thermodynamic studies. The second part is a brief description of the most important methods used to investigate the thermodynamic stability of molecules and chemical bonds, together with a detailed analysis of its basic assumptions and how thermodynamic quantities are derived.

www.iupac.org/reports/provisional/abstract02/ribeiro-da-silva_300902.html

Comments by 30 September 2002
Prof. Manuel A. V. Ribeiro da Silva
Universidade do Porto
Faculdade de Ciências, Departamento de Química
Rua do Campo Alegre, 687
P-4169-007 Porto, Portugal
Tel.: +351 22 608 2821
Fax: +351 22 608 2822
E-mail: risilva@fc.up.pt

Highlights from Pure and Applied Chemistry

Presenting recently published IUPAC technical reports and recommendations

Guidelines for the Representation of Pulse Sequences for Solution-State Nuclear Magnetic Resonance Spectrometry (IUPAC Recommendations 2001)

by A.N. Davies, J. Lambert, R. J. Lancashire, P. Lampen, W. Conover, M. Frey, M. Grzonka, E. Williams, and D. Meinhart
Pure and Applied Chemistry, Vol. 73, No. 11, pp. 1749–1764 (2001).

In drawing up the specifications for a standard for multidimensional nuclear magnetic resonance spectroscopy (NMR) it became clear that the spectroscopic data content needed to be qualified by experimental condition information especially pertaining to the pulse sequences used to obtain the free induced decays or spectra. Failure to include this information not only severely inhibits the ability of subsequent data handling packages to work with the experimental data, but also makes interpretation of the final results virtually impossible.

This paper has been produced in collaboration with the NMR spectrometer manufacturers in an attempt to reach agreement on a definitive list of the most frequently used pulse sequence programs. The list includes entries where common agreement has been reached as to the acronym to name the experiment and the key instrument independent parameters needed to report concisely. It is not intended to restrict in any way the freedom of manufacturers or users to develop new and novel experimental pulse sequences,

but should aid reporting of experimental data where the more common sequences are in use.


www.iupac.org/publications/pac/2001/7311/7311x1749.html

JCAMP-DX. A Standard Format for the Exchange of Ion Mobility Spectrometry Data (IUPAC Recommendations 2001)

by J. I. Baumbach, A. N. Davies, P. Lampen, and H. Schmidt
Pure and Applied Chemistry, Vol. 73, No. 11, pp. 1765–1782 (2001).

The relatively young field of ion mobility spectrometry has now advanced to the stage where the need to reliably exchange the spectroscopic data obtained worldwide by this technique has become extremely urgent. An internationally recognized electronic data exchange format is essential to assist in the validation of the various new spectrometer designs and to assist in intercomparisons between different laboratories' reference data collections.

To make the data exchange between users and system administration possible, it is important to define a file format specially suited to the requirements of ion mobility spectrometry. The format should be computer readable and flexible enough for extensive comments to be included. In this document, we define a data exchange format, agreed on by a working group of the International Society for Ion Mobility Spectrometry at Hilton Head Island, USA (1998), and Buxton, UK (1999).

This definition of the format is based on the IUPAC JCAMP-DX protocols, which were developed for the exchange of infrared spectra and extended to chemical structures, nuclear magnetic resonance data, and mass spectra. This standard of the Joint Committee on Atomic and Molecular Physical Data is of a flexible design. IUPAC has taken over the support and development of these standards and recently introduced an extension to cover year 2000 compatible date strings and good laboratory practice. The aim of this paper is to adapt JCAMP-DX to the special requirements of ion mobility spectra.


www.iupac.org/publications/pac/2001/7311/7311x1765.html

Molality-Based Primary Standards of Electrolytic Conductivity (IUPAC Technical Report)

by K. W. Pratt, W.F. Koch, Y. C. Wu, and P. A. Berezansky
Pure and Applied Chemistry, Vol. 73, No. 11, pp. 1783–1793 (2001).

New values of electrolytic conductivity were determined for aqueous KCl solutions with molalities of 0.01, 0.1, and 1.0 mol/kg in the temperature range 0 to 50 °C, at 5 K intervals. Expanded uncertainties, $2u_c$, were also calculated in accordance with the presently accepted protocol for the treatment of uncertainty. The new conductivity values are recommended as primary standards of electrolytic conductivity based on molality. They replace the previous values, based on the nonstandard demal scale, which were determined only at 0, 18, and 25 °C. The accuracy of the technique used was evaluated by repeating the determination of the previously recommended demal-based IUPAC standards of electrolytic conductivity and through comparison with other absolute measurements.


www.iupac.org/publications/pac/2001/7311/7311x1783.html

NMR Nomenclature. Nuclear Spin Properties and Conventions for Chemical Shifts (IUPAC Recommendations 2001)

by R. K. Harris, E. D. Becker, S. Cabral de Menezes, R. Goodfellow, and P. Granger
Pure and Applied Chemistry, Vol. 73, No. 11, pp. 1795–1818 (2001).

A unified scale is recommended for reporting the NMR chemical shifts of all nuclei relative to the ^{1}H resonance of tetramethylsilane (TMS). The unified scale is designed to provide a precise ratio, X, of the resonance frequency of a given nuclide to that of the primary reference, the ^{1}H resonance of TMS in dilute solution (volume fraction, $j < 1\%$) in chloroform. Referencing procedures are discussed, including matters of practical application of the unified scale. Special attention is paid to recommended reference samples, and values of X for secondary references on the unified scale are listed, many of which are the results of new measurements.

Some earlier recommendations relating to the reporting of chemical shifts are endorsed. The chemical shift, δ, is redefined to avoid previous ambiguities but to leave practical usage unchanged. Relations between the unified scale and recently published recommendations for referencing in aqueous solutions (for specific use in biochemical work) are discussed, as well as the special effects of working in the solid state with magic-angle spinning. In all, nine new recommendations relating to chemical shifts are made.

Standardized nuclear spin data are also presented in tabular form for the stable (and some unstable) isotopes of all elements with nonzero quantum numbers. The information given includes quantum numbers, isotopic abundances, magnetic moments, magnetogyric ratios and receptivities, together with quadrupole moments and line-width factors where appropriate.


www.iupac.org/publications/pac/2001/7311/7311x1795.html

New Books and Publications

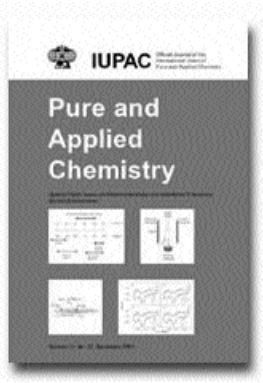
Electrochemistry and Interfacial Chemistry for the Environment

Pure and Applied Chemistry, Vol. 73, No. 12, 2001.

Modern chemistry has clearly played a key role in the improvement of quality of life around the world. However, these advances come with a price: increased contamination of the environment by substances that can disrupt endogenous biological systems—sometimes severely—and that ultimately impact on humans as well. Accordingly, it is appropriate for the chemical sciences community to actively address development of green chemical processes and environmental remediation. A number of efforts in this direction have been initiated in various IUPAC Divisions.

The Physical and Biophysical Chemistry Division has a long-standing commitment to environmental issues. A recent example was the division's workshop on Electrochemistry and Interfacial Chemistry in Environmental Clean-Up and Green Chemical Processes that was held from 6–7 April 2001 in Coimbra, Portugal. The project, which was organized by Professor Brett, was jointly funded by IUPAC and by the International Council for Science. The workshop brought together specialists in the area of electrochemistry and interfacial chemistry to address approaches to the removal of potential contaminants from industrial wastes in water, soil, and the atmosphere, the use of electrochemistry for the generation of reactants, removal of contaminants and electroanalysis, and the use of colloids, microemulsions, and nanoparticles for remediation. Photocatalysis also figured prominently in discussions. An additional key element in the workshop was a tutorial session, prior to the lectures and poster session, designed to acquaint everyone with basic concepts.

The objective of the project was to increase awareness within the worldwide industrial and academic chemical community of the importance of electrochemistry and surface chemistry in environmental clean-up and in environmentally friendly industrial chemical processes. The negative impact on the environment of industrial chemical processes and other fabrication procedures is well known, and significant efforts have been made to reduce this impact through less-polluting and more energy-efficient processes with appropriate recycling and effluent treatment. Treatment of stored solid or liquid waste and remediation of contaminated land resulting from pollution are other problematic areas which deserve attention. Electrochemistry and interfacial chemistry have an important role to play in all these areas involving solid and liquid pollutants. There is a need to demonstrate and clarify what can be achieved using presently available technology and to point out future tendencies in technological development.



The workshop was directed toward three types of participants who have particular interest in the combination of electro- or interfacial chemistry and the environment: specialists of international standing, scientists from developing countries describing the specific problems their countries face, and researchers and students concerned with environmental problems.

The organizing committee of C. M. A. Brett (Chairman), J. F. Rusling, L. Koopal, and J. Gregory arranged a program of invited lectures to reflect the contributions that can be made by electrochemistry and interfacial chemistry to solving and preventing some of the present environmental pollution problems. The workshop comprised 16 invited lectures and 40 poster contributions, with 77 participants from 18 countries. The workshop format allowed ample time for fruitful discussion of the advantages and limitations of the electrochemical and interfacial chemistry approaches at the small-scale level up to large-scale facilities.

This Special Topic Issue of *Pure and Applied Chemistry* on "Electrochemistry and Interfacial Chemistry for the Environment" was derived from the workshop. Workshop participants were asked to submit articles for the issue based on their presentations. The articles reflect well the panorama of subjects covered in the workshop, including fundamentals and the importance of current and new applications of electrochemistry and interfacial electrochemistry to environmental clean-up and green chemical processes. Topics covered include electrochemical reactors, electrosynthesis, electrochemical sensors, corrosion, photoelectrochemical degradation of pollutants, colloids for waste treatment, and industrial applications. The issue emphasizes the challenge of dealing with environmental pollution and clean-up, consistent with the needs and resources of various countries around the world, while suggesting some possible solutions.

With a foreword by G. W. Wilson, and a preface by C. Brett, this issue was coordinated by the IUPAC Special

Topics editor, Professor James R. Bull. For more information on the special topics project, go to <http://www.iupac.org/publications/ci/2000/july/special_topics_project.html>.

www.iupac.org/publications/pac/2001/7312/index.html

Handbook of Pharmaceutical Salts: Properties, Selection, and Use

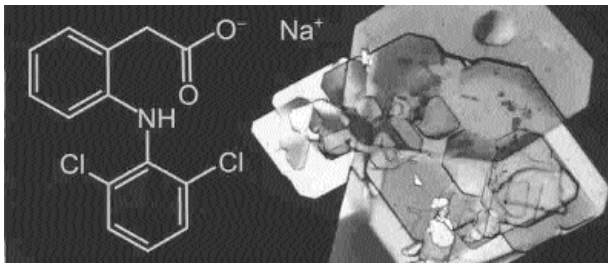
P. H. Stahl and G. Wermuth (editors)
Verlag Helvetica Chimica Acta, Zürich, 2002.
(ISBN 3-906390-26-8)

Because an estimated half of all drug molecules used in medicine are administered as salts, the selection of a suitable salt for a drug candidate is recognized as an essential step in the preclinical phase of drug development. Surprisingly, however, the scientific literature on this topic is rather limited and scattered throughout numerous journals and patents. The majority of medicinal chemists in the pharmaceutical industry whose primary focus is the design and synthesis of novel compounds as future drugs are organic chemists for whom salt formation is often a marginal activity restricted to the short-term objective of obtaining crystalline material. Because a comprehensive resource that addresses the preparation, selection, and use of pharmaceutically active salts has not been available, these scientists may forego the opportunities for increased efficacy and improved drug delivery provided by selection of an optimal salt.

To fill this gap in the pharmaceutical bibliography, an international team of 17 authors from academia and pharmaceutical industry contribute to this volume and present the necessary theoretical foundations as well as a wealth of detailed practical experience in the choice of pharmaceutically active salts. Altogether, the contributions in this book reflect the multidisciplinary nature of the science involved in selection of suitable salt forms for new drug products. The editors have taken care to address every conceivable aspect of the preparation of pharmaceutical salts.

This book is destined to be an essential reference for students of medicinal and pharmaceutical chemistry, and an indispensable handbook for research-and-development chemists, analytical chemists, biologists, development pharmacists, regulatory and patent specialists, and medicinal scientists engaged in preclinical development of drugs. This comprehensive up-to-date guide will be an instructive companion for all scientists involved in research and development of drugs and, in particular, of pharmaceutical dosage forms.

This reference is the result of an IUPAC project chaired by Prof. Camille G. Wermuth, the former president of IUPAC's Chemistry and Human Health Division.

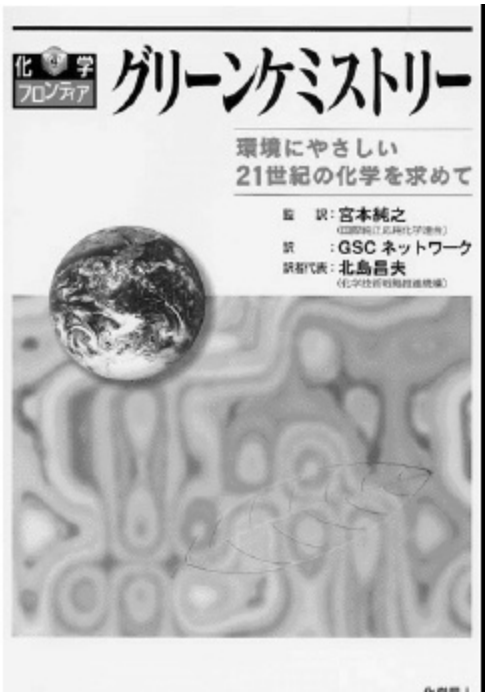


www.iupac.org/publications/books/author/wermuth02.html

Green Chemistry—the Japanese translation of the special topic issue of *Pure and Applied Chemistry* (Vol. 72, No. 7, 2000)

Translation coordinated by Junshi Miyamoto (2001).
(ISBN 4-7598-0734-9)

The original publication and its translation are to promote and disseminate awareness of environmentally compatible synthetic pathways (green chemistry) throughout the academic and industrial scientific research community. In 1999 an IUPAC project was initiated to publish a Symposium-in-Print on Green Chemistry, and to compile a collection of expert reviews on aspects of the topic, underpinned by an introductory account of the evolution



of the project, its rationale, and its interfaces with complementary initiatives and organisations.

This volume represents the culmination of that undertaking. The introductory overview gives a detailed account of the role and interest of IUPAC in promoting this initiative and provides an account of the historical emergence of the concept. This is followed by a synoptic preamble, in which the content and purpose of individual reviews in the issue are summarized. The Symposium-in-Print captures the current status of the discipline and projects the boundless opportunities and challenges confronting contemporary organic synthesis and its practice in a changing world, increasingly sensitized to the finite bounds of natural resources and the vulnerability of the biosphere. The issue offers evidence that current problems are being addressed and can be solved, and engenders expectations that future problems can be anticipated and prevented.


www.iupac.org/publications/pac/2000/7207/japanese_title.html
www.iupac.org/publications/pac/2000/7207/index.html

Polymer Characterization and Materials Science

R. D. Sanderson and H. Pasch
Macromolecular Symposia, Vol. 178.
Wiley-VCH, 2002, pp. 1–181.
(ISBN 3-527-30468-1)

This volume contains selected papers presented at the UNESCO School and IUPAC Conference on Macromolecules and Materials Science, held in Stellenbosh, South Africa, in April 2001. World authorities in various fields of macromolecular science were invited to give tutorials at the UNESCO School and informative plenaries at the conference. The exposure to new ideas and advanced concepts in macromolecular science is of great importance for South African students and senior staff alike. It is particularly valuable that with the support of UNESCO, generous concessions can be made for attendees from disadvantaged communities and from countries with emerging technologies.

The 4th UNESCO School and IUPAC Conference focused on polymer characterization, new polymer architectures and nanomaterials. Abridged versions of a number of papers are compiled to create the present volume of *Macromolecular Symposia.* The content of the papers is also available in the Virtual Teaching Encyclopaedia which contains papers from previous UNESCO conferences as well <www.sun.ac.za/unesco/unesco.htm>.


www.iupac.org/publications/macro/2002/178_preface.html

Non-Metals in Liquid Alkali Metals

Hans Ulrich Borgstedt and Cezary Guminski
IUPAC-NIST Solubility Data Series. 75.
Journal of Physical and Chemical Reference Data, Vol. 30, No. 4, pp. 835–1158, 2001.

All available solubility data of nonmetallic elements and some of their compounds in the five liquid alkali metal solvents (Li, Na, K, Rb, and Cs) are collected and compiled. Original publications with reliable data and information on the methods used to generate them are reported in individual compilations. When numerical data are not given in a publication, the data are often read out from figures and converted into numerical data by the compilers. The precision of this procedure is indicated in the compilations under estimated error. Evaluated solubility data are tabulated at the end of the critical evaluations: if there is agreement of at least two independent studies within the experimental error, the solubility values are assigned to the "recommended" category. Values are assigned as "tentative" if only one reliable result was reported, or if the mean value of two or more reliable studies was outside the error limits. In the tabulation, three, two, or one significant figures are assigned for respective precisions that are better than ±1% and ±10% and worse than ±10%. If necessary, the solubilities are recalculated into mol %.

The completeness of this investigation of the literature has been confirmed and extended by studying several reviews dealing with the solution chemistry of substances in the alkali metals. Solubility data are sometimes measured under parameters, which are not standard conditions of such measurements. Frequently measurements are performed under constrained pressure. The solubility of noble gases or other gases, which do not form compounds with the alkali metals, depends on the gas pressures. This dependency is documented in the data sheets.


www.iupac.org/publications/sds/2001/75_abstract.html
www.iupac.org/projects/2001/2001-034-1-500.html

Heat Capacity of Liquids: Critical Review and Recommended Values

Milan Zábranský, Vlastimil Ruzicka, Jr., and Eugene S. Domalski
Journal of Physical and Chemical Reference Data, 30, No. 5, pp. 1199–1689, 2001.

A study was carried out in which new experimental data on heat capacities of pure liquid organic and some inorganic compounds were compiled and critically evaluated. The study also provided recommended values. Compounds included in the compilation have a melting point below 573 K. The bulk of the compiled data cover

studies published in the primary literature between 1993 and 1999, with some data from 2000. However, some data from older sources were also included. The data were taken from almost 1030 literature references. Parameters of correlating equations for temperature dependence of heat capacities of liquids were developed. This paper is an update of a two-volume monograph entitled *Heat Capacity of Liquids: Critical Review and Recommended Values* (96ZAB/RUZ) that was published in 1996 in the *Journal of Physical and Chemical Reference Data* as Monograph No. 6 and was the product of IUPAC Project No. 121/11/87.

www.iupac.org/projects/2000/2000-031-1-100.html

Pesticide Formulation and Application Systems: A New Century For Agricultural Formulations

Jane C. Mueninghoff, Alan K. Viets, and Roger A. Downer (editors)
American Society for Testing and Materials, 2001.
(ISBN 0-8031-2891-6)

Pesticide Formulation and Application Systems, Twenty-First Volume contains 21 selected papers presented at the Pesticide and Application Systems Symposium, which was held 24–26 October 2000 in Orlando, Florida, USA. The symposium, sponsored by the ASTM E 35.22 subcommittee, had the theme "A New Century for Agricultural Formulations."

The papers published in this volume cover recent work on the main aspects of formulation science and technology, including product development, formulation ingredients, regulatory issues, application technology, and biological efficacy. The papers and the extensive reference citations are evidence of how successful efforts have been in recent years to provide formulators with up-to-date information necessary for them to perform their jobs.

As one turns the pages from topic to topic one is again made aware of the important role that surface-active agents play in all phases of agricultural formulations. Study after study provides data showing that the development of new formulations, the ease of processing, the final product quality and stability, the application characteristics, and the efficacy of the product are critically impacted by the choice of surfactant.

Formulation work is often focused on optimizing specific commercial goals, and thus such work often must be narrowly focused. However, this volume provides broad and valuable guidance for workers in this field, who must know how to fit together the active ingredient, the adjuvants such as surfactants, and the product quality criteria in order to arrive at a successful agricultural formulation.

Reviewed by Claude Corty, former manager of Formulation and Application Technology Research and Development in the Agricultural Products Department at DuPont.

www.astm.org

Reports from Conferences

Advanced Materials

by Joshua Jortner

The IUPAC Conference on New Directions in Chemistry, Workshop on Nanostructured Advanced Materials (IUPAC–WAM II), which was held in Jakkur, Bangalore, India, from February 13–16, 2002, constituted a remarkable scientific accomplishment. The conference's high-quality lectures—on recent developments in the broad, interdisciplinary research field of nanostructured materials—merged the latest scientific results and potential technological applications.

WAM II fulfilled one of the core objectives of IUPAC: to identify significant, emerging research fields involving cutting-edge technologies. The conference focused on quantum structures (i.e., nanoparticles and nanocrystals of metals and of semiconductors, nanostructures, nanowires, and nanobiological systems), assemblies of nanostructures (e.g., nanoparticles and nanowires), and the use of biological systems (e.g., DNA) as templates for metallic or semiconducting nanostructures. The conceptual framework for dynamics, response, and transport in nanostructures was provided by the theoretical and computational studies that were presented.

The program's 20 plenary lectures were delivered by international scientific leaders in the fields of chemistry, material science, biophysics, and physics. Most of the 10 invited lectures were delivered by young Indian scientists, thereby providing them the opportunity to present their impressive scientific work before an international audience. In addition to the plenary and invited lecturers, about 50 additional scientists, mostly from India, but also from the USA, UK, and Slovenia, participated in WAM II.

The impressive visibility of IUPAC during WAM II provided a clear message that the Union is broadening the scope of its international activities beyond nomenclature. As an important core activity of IUPAC, the conference:

- Promotes high-quality, international scientific-technological activities and communication.
- Contributes recommendation for future technologies based on the chemical sciences.

Attendees of the IUPAC-WAM II Conference. First Row (from left): Uzi Landman, M. A. El-Sayed. J. Jortner, C. N. R. Rao, M. P. Pileni, S. T. Lee, I. Willner. Second Row (from left): P. Gai, A. K. Raychaudhuri, S. Komerneni, A. K. Sood, M. Sanya, G. U. Kulkarni (Convener).

- Encourages young scientists to pursue frontline chemical science research.
- Provides excellent visibility for IUPAC.

Aside from providing high-quality scientific and technological information exchange, WAM II enabled a successful and significant pedagogical activity for young scientists. It was very important for the young generation of Indian scientists (in this case) to be able to interact extensively with the leadership in the field.

The Organizing Committee recommends the continuation of the IUPAC Conference on New Directions in Chemistry and the continuation of WAM programs on a biannual basis. The area of Advanced Materials is perfect for this activity.

Deep gratitude is due to Professor C. N. R. Rao for his outstanding scientific leadership, while serving as the president of WAM II. Thanks and appreciation also are due to the local Organizing Committee, and in particular the chairman Prof. G.U Kulkarni, for coordinating the local arrangements. The International Organizing Committee consisted of John Corish, Mostafa El-Sayed, C. N. R. Rao, and myself.

Selected presentations of WAM II will be published as a special issue of *Pure and Applied Chemistry*. This volume will be significant for the scientific world and for technology.

Joshua Jortner, IUPAC past president, is a professor at Tel Aviv University.

www.jncasr.ac.in/wam

Solution Chemistry

by J. Barthel

The 27th International Conference on Solution Chemistry (ICSC), held under the auspices of IUPAC, took place from 26–31 August 2001 in Vaals, Netherlands, near the city of Aachen, Germany. Fifteen invited speakers (six plenary lectures and nine section lectures) reported on advances in solution chemistry, covering the following topics:

- Molecular liquids
- Non-electrolyte solutions
- Electrolyte solutions
- Ionic liquids and molten salts
- Colloids in liquids

There were an additional 55 oral presentations and 44 poster presentations. The meeting was attended by 110 participants and 40 accompanying persons from 24 countries. The lectures and posters were of high scientific quality, representing both progress of theory and reliable experimental work.

Accommodation of all participants in and nearby the conference hotel, which was surrounded by a beautiful landscape, allowed for individual and group discussions and a late-evening visit of the poster exhibition. The conference's social program included a welcome party, a common excursion to Maastricht, and an evening performance by a magician.

The chairman and convenor of the ICSC meetings Bernard Gill of Leeds, resigned from his duties after 20 years of service in this position. The participants sincerely thanked him for his efficient work. I. Persson of Uppsala, Sweden, was elected as his successor. The ICSC community is very thankful to the organizers of the 27th ICSC for the efficient and successful meeting. The meeting was organized by M. Zeidler, J. Richter, W. Stahl, and A. Doelle.

The conference series will continue in 2003 at Debrecen, Hungary and in 2005 at Ljubljana, Slovenia.

Plenary lectures are published in the November 2001 issue of *Pure and Apllied Chemistry*, and for which B. Gill acted as conference editor.

J. Barthel is a professor at Universität Regensburg, Germany.

www.iupac.org/publications/pac/2001/7311

Organometallic Chemistry Directed Towards Organic Synthesis

by Irina Beletskaya

The idea to organize the IUPAC Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS) was expressed by the organic division of IUPAC 20 years ago, and ever since, the biennial conference has attracted an enormous number of chemists in the field of organic synthesis and organometallic compounds. The 11th OMCOS was held in Taipei, Taiwan in June 2001. Fears that the remoteness of Taiwan from many scientific centers would result in lowering of the number of participants fortunately did not come true as more than 800 participants from 32 countries attended. The conference attracted not only eminent scientists from all over the world, but also their young colleagues. Much credit is due to the organizing committee and its chairman Professor T. Y. Luh for managing to engage a large number of sponsors, making the registration fee for the young scientists merely nominal.

Five plenary lectures, 19 invited lectures, and a large number of short reports were delivered at the conference. Over 300 posters were exhibited as well. The lectures, short oral presentations, and posters reflected enormous progress in this field and demonstrated the extraordinary potential of transition metal catalysis in organic synthesis to lead to the creation of new drugs and new materials, the synthesis of complex molecules, and the discovery of new chemical reactions.

The conference was opened with a lecture by Professor F. A. Cotton, which was dedicated to the 50th anniversary of the discovery of ferrocene. The story of this discovery, which has changed the face of organometallic chemistry, as told by one of its authors was certainly an unforgettable episode. Another eminent organometallic chemist, Professor A. Yamamoto, talked about the discovery of the oxidative addition reactions before discussing the most important task of modern chemistry—transforming it into "green chemistry."

The Springer award for young scientists (under age 40) was presented at the conference to Professor G. Fu of the Massachusetts Institute of Technology, USA, for his outstanding contribution to this field of chemistry. In accepting the honor, Fu gave a brilliant "award lecture."

The conference was held at the Grand Hotel, a unique construction in an oriental style that dominates the Taipei cityscape and provides excellent conference facilities. The conference was very well organized so that everything progressed in a highly efficient and orderly manner, and the atmosphere, as usual at OMCOS, was exceptionally friendly.

A selection from the plenary and invited lectures is published in the Janaury 2002 issue of *Pure and Applied Chemistry*, for which the Conference Chairman, Tien-Yau Luh, acted as editor.

Irina Beletskaya is a professor at Moscow State University, Moscow, Russia. She is also a representative of IUPAC and was president, Organic Chemistry Division from 1989–1991.

www.iupac.org/publications/pac/2002/7401

Conference Announcements

designates IUPAC sponsorship

35th International Conference on Coordination Chemistry (35-ICCC) 21–26 July 2002, Heidelberg, Germany

The aim of this conference will be to provide an international forum for high-level discussions of all aspects of coordination chemistry and to give a representative overview of the state of the art in this field. Young chemists are particularly encouraged to participate and they will find answers to questions that stimulate their continued research. Six subsections will focus on frontier topics of coordination chemistry, including recent results of outstanding significance that impact our daily life, such as development of new drugs, catalysts for modern plastics, functional nanomaterials, and structure of the photosystems of plants. The meeting will help scientists to identify important applications of coordination compounds and may promote technology transfer. It will bring together not only coordination chemists but also scientists with academic (biology, medicine, physics) or industrial background to share scientific knowledge in an interdisciplinary atmosphere. This will generate significant impact regarding international future research in coordination chemistry on an international level.

Contact: Birgit Bauer, Anorganisch-Chemisches Institut, Universität Heidelberg, Im Neuenheimer Feld 270, Universität Heidelberg, D-69120 Heidelberg, Germany.
Tel.: +49 (0) 6221 548388
Fax: +49 (0) 6221 548389
E-mail: iccc35@urz.uni-hd.de

http://www.iccc35.de

The Second Pan-European Younger Chemists' Conference 30 September–2 October 2002, Heidelberg, Germany

A meeting of Younger European Chemists (up to age 35) will be held 30 September-2 October 2002 in Heidelberg,

Germany. This is an event of the High-Level Scientific Conference Programme of the European Commission. It is the second in what will hopefully become an annual series. The first meeting took place in London in July 2001.

Chemistry will be interpreted broadly for the meeting—not only chemical science of all sorts but also some chemical engineering and technology. A principal aim is to bring European younger chemists working in research and R&D of all types together not only from EC countries but also from other European countries, thus encouraging greater interaction, networking, novel collaborations, and increased European harmony.

The core aspects of the conference are posters and talks by Europe's younger chemists. Keynote speakers include Harry Kroto, Jean-Marie Lehn, and the top research director of BASF. The Europa Medal and £500 Prize for Chemistry will be awarded at the conference. There will be an afternoon visit to BASF in Ludwigshafen as well.

The conference is being sponsored by Younger Chemists' Committee of the Heidelberg Branch of the German Chemical Society; BASF Ludwigshafen, Germany; and the Royal Society of Chemistry, United Kingdom.

Contact: Dr. Eric Wharton, SET for Europe, Place Cottage, 1 The Green, Chilton, Didcot, OXON OX11OSD, United Kingdom
Tel.: +44 (0) 1235 832335
Fax: +44 (0) 1235 820686
E-mail: info@heidelberg-2002.de or ericw@set-foreurope.org

www.heidelberg-2002.de

10th International Symposium on Macromolecule Metal Complexes (MMC-X) 20–24 May 2003, Moscow, Russia

This symposium, held every two years, provides an international forum for presentation and discussion about the most recent progress and future trends in the rapidly expending interdisciplinary field of macromolecular metal complexes. The main goal of the meeting is to bring together scientists and technologists (polymer chemists, coordination chemists, biochemists, catalytic chemists etc.), covering the various research topics of the symposium, to intensity the dialogue between young scientists, academia and industries, to encourage the newcomers to the field and to give new motivations for future developments.

New insight have been developed in the role of the macromolecule on material properties such as catalysis, electron transfer, non-linear optic, and in the other wide ranging technologies including secondary battery, photoenergy conversion, fuel cells, sensors, toxic material recovery, medical devices.

The scientific program will cover the following areas:

- Fundamental Aspects of Macromolecular Metal Complexes (Synthesis, Structure, Properties)
- Electron and Photonic Transfer
- Catalysis and Separation Processes
- Supramolecules, Dendrimers, Molecular Recognition
- Metal Ion Conductive Polymers
- Environmental Application of MMC

Approximately 200 scientists from all over the world are expected to attend the Symposium.

Contact: Prof. Valerii V. Lunin, Department of Chemistry, Moscow State University, Leninskie Gory, Moscow, 119899, Russia.
Tel.: +7 095-939-53-77
Fax: +7-095-932 8846
E-mail: kar@petrol.chem.msu.ru

www to be announced

Plutonium Futures—The Science 2003 6–10 July 2003, Albuquerque, New Mexico, USA

This conference, third in a series organized by the Los Alamos National Laboratory, will provide an international forum for presentation and discussion of current research on plutonium and other actinide elements. A number of issues surrounding plutonium and the actinides deserve and receive significant international attention, including the safe storage and long-term management of weapons materials and the management of large inventories of actinides from nuclear power generation. The conference will provide opportunities to examine present knowledge of the chemical and physical properties of plutonium and other actinides in complex media and materials and to discuss the current and emerging science (chemistry, physics, materials science, nuclear science, and environmental effects) of plutonium and actinides relevant to enhancing global nuclear security.

The scientific program will consist of invited plenary and keynote lectures followed by presentations of invited and contributed papers. The plenary sessions will include participation by policy makers as well as scientific leaders. Scientists, engineers, and students from throughout the world are encouraged to participate and make technical contributions. Anticipated conference technical sessions will cover: materials science; nuclear fuels; condensed matter physics; actinides in the environment; separations, detection, and analysis; processing; storage, disposal, and waste; and novel plutonium/actinide compounds and complexes.

Participation by young scientists is encouraged. The registration fee will be waived for all students and postdoctoral fellows. In addition, financial assistance for travel expenses is available for students and postdoctoral fellows who present papers. See the conference web site. There will be a half-day introductory tutorial session on actinide science for students and non-specialists on Sunday afternoon before the start of the conference.

Contact: Plutonium Futures—The Science, Los Alamos National Laboratory, Nuclear Materials Technology Division, P.O. Box 1663, MS E500, Los Alamos, NM, USA 87545
Tel.: +1 505 667-7753
Fax: +1 505 667 6569
E-mail: puconf2003@lanl.gov

Conference Announcements in Brief

Pharmacognosy
27–31 July 2002
43rd Annual Meeting of the American Society of Pharmacognosy and 3rd Monroe Wall Symposium, New Brunswick, New Jersey, USA.
Dr. Ramesh C. Pandey, General-Chair, Xechem International, Inc., 100 Jersey Avenue, B-310, New Brunswick, NJ, 08901 USA
Tel.: +1 732 247 3300
Fax: +1 732 247 4090
E-mail: rcp2002asp@hotmail.com
<www.phcog.org>

Electroseparation
1–4 September 2002
13th International Symposium on Capillary Electroseparation Techniques (ITP 2002), Helsinki, Finland.
Prof. Marja-Liisa Riekkola
Tel.: + 358 9 191 50252
Fax: + 358 9 191 50253
E-mail: ITP-2002@helsinki.fi
<itp2002.chem.tue.nl>

Solar Energy and Photochemistry
23–28 February 2003
The 7th International Conference on Solar Energy and Applied Photochemistry [SOLAR '03] and the 4th International Training Workshop on Environmental Photochemistry, [ENPHO '03], Luxor, Egypt.
Professor M.S.A. Abdel-Mottaleb
Tel.: 002012 216 9584 (cellular)
Fax: 00201 634 7683 or 00202 484 5941
E-mail: solar@photoenergy.org, solar@link.net
<www.photoenergy.org>

Calendar of IUPAC Sponsored Conferences

Visit www.iupac.org for complete information and further links

NEW *designates a new conference since the last issue*

2002

p-Electron Systems
30 May–4 June 2002
5th International Symposium on Functional **p**–Electron Systems (Fπ5), Ulm/Neu-Ulm, Germany.
Prof. Dr. Peter Bäuerle, Abteilung Organische Chemie II, Universität Ulm, Albert-Einstein-Allee 11, 89081 Ulm, Germany
Tel.: +49 731 502 2850
Fax: +49 731 502 2840
E-mail: peter.baeuerle@chemie.uni-ulm.de

Polymer Systems
3–7 June 2002
4th International Symposium on Molecular Order and Mobility in Polymer Systems, St. Petersburg, Russia.
Prof. T. M. Birshtein, Institute of Macromolecular Compounds, Russian Academy of Sciences, Bolshoi pr. 31, St. Petersburg 199004, Russia
Tel.: +7 812 328 85 42
Fax: +7 812 328 68 69
E-mail: birshtein@imc.macro.ru

Biodegradable Polymers and Plastics NEW
4–8 June 2002
7th World Conference on Biodegradable Polymers and Plastics,
Tirrenia (Pisa), Italy.
Prof. Emo Chiellini (Chairman)
Department of Chemistry and Industrial Chemistry
University of Pisa
Via Risorgimento 35
I-56126 Pisa, Italy
Tel.: +39 050 918299
Fax: +39 050 28438
E-mail: chlmeo@dcci.unipi.it

Nuclear Analytical Methods
16–21 June 2002
7th International Conference on Nuclear Analytical Methods in the Life Sciences, Antalya, Turkey.
Prof. Namik K. Aras, Bahcesehir University, 34900 Istanbul, Turkey
Tel.: +90 212 669 6523
Fax: +90 212 669 4398

Macromolecules
7–12 July 2002
39th International Symposium on Macromolecules—IUPAC World Polymer Congress 2002, Beijing, China.
Prof. Fosong Wang, The Chinese Academy of Sciences, Beijing 100864, China

Tel: +86 10 62563060
Fax: +86 10 62573911
E-mail: fswang@mimi.cnc.ac.cn

Solid-State Chemistry
7–12 July 2002
5th Conference on Solid-State Chemistry, Bratislava, Slovakia.
Prof. P. Sajgalik, Slovak Academy of Sciences, Dubravska c. Bratislava, SK-842 36 Slovakia
Tel.: +421 7 59410400
Fax: +421 7 59410444
E-mail: ssc2002@savba.sk

Organometallic Chemistry
7–12 July 2002
20th International Conference on Organometallic Chemistry, Corfu, Greece.
Dr. Constantinos G. Screttas, National Hellenic Research Foundation, Institute of Organic and Pharmaceutical Chemistry, 48 Vas. Constantinou Avenue, 11635 Athens, Greece
Tel.: +30 1 7273876
Fax: +30 1 7273877
E-mail: kskretas@eie.gr

Carbohydrates
7–12 July 2002
XXIst International Carbohydrate Symposium, Cairns, Queensland, Australia.
Prof. R. V. Stick, University of Western Australia, Department of Chemistry, Nedlands, 6007, Western Australia
Tel.: +61 8 9380 3200
Fax: +61 8 9380 1005
E-mail: rvs@chem.uwa.edu.au

Polymers and Organic Chemistry
14–18 July 2002
Polymers and Organic Chemistry 2002, San Diego, California, USA.
Prof. Spiro Alexandratos, Office of Academic Affairs, City University of New York, 535 East 80th St., New York, New York 10021, USA
Tel.: +1 212 794 5470
Fax: +1 212 794 5706
E-mail: sdabh@cunyvm.cuny.edu

Organic Synthesis
14–19 July 2002
14th International Conference on Organic Synthesis, Christchurch, New Zealand.
Prof. Margaret A. Brimble, Department of Chemistry, University of Auckland, 23 Symonds St., Auckland, New Zealand
Tel.: +64 9 373 7599, Ext. 8259
Fax: +64 9 373 7422
E-mail: m.brimble@auckland.ac.nz

Photochemistry
14–19 July 2002
XIXth IUPAC Symposium on Photochemistry, Budapest, Hungary.
Prof. H. D. Roth, Rutgers University, Department of Chemistry and Chemical Biology, 610 Taylor Road, New Brunswick, NJ 08854-8087 USA
Tel.: +1 732 445 5664
Fax: +1 732 445 5312
E-mail: roth@rutchem.rutgers.edu

Electrical Properties of Polymers
15–18 July 2002
21st Discussion Conference and 9th International ERPOS Conference on Electrical and Related Properties of Polymers and Other Organic Solids, Prague, Czech Republic.
Prof. Dr. Drahomir Vyprachticky, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovského nám. 2, 162 06 Praha 6, Czech Republic
Tel.: +420 2 20403251 or +420 2 20403332
Fax: +420 2 35357981
E-mail: vyprach@imc.cas.cz or sympo@imc.cas.cz

Solubility Phenomena
21–26 July 2002
10th International Symposium on Solubility Phenomena, Varna, Bulgaria.
Prof. Christo Balarew, Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences, BG-Sofia 1040, Bulgaria
Tel.: +359 (2) 9793925
Fax: +359 (2) 705 024
E-mail: balarew@svr.igic.bas.bg

Coordination Chemistry NEW
21–26 July 2002
35th International Conference on Coordination Chemistry (35-ICCC), Heidelberg, Germany.
Prof. Roland Krämer, Chairman Anorganisch-Chemisches Institut Universität Heidelberg Im Neuenheimer Feld 270 D-69120 Heidelberg, Germany
Tel.: +49 (0) 6221 548438
Fax +49 (0) 6221 548599
E-mail: roland.kraemer@urz.uni-hd.de

Chemical Thermodynamics
28 July–2 August 2002
17th IUPAC Conference on Chemical Thermodynamics, Rostock, Germany.
Prof. A. Heintz, FB Chemie, Universitat Rostock, Hermannstr. 14, D-18051 Rostock, Germany
Tel.:+49 381 498 1852
Fax: +49 381 498 1854
E-mail: andreas.heintz@chemie.uni-rostock.de

Natural Products
28 July–2 August 2002
23rd International Symposium on the Chemistry of Natural Products, Florence, Italy.
Prof. B. Botta, Dip. Studi Chimica e Tecnologia Sostanze, Biologicamenta Attive, University "La Sapienza", P.le A. Moro 5, 00185 Roma, Italy
Tel.: +39 06 49912781 or +39 06 49912783
Fax: +39 06 49912780
E-mail: bruno.botta@uniroma1.it

Boron Chemistry
28 July–2 August 2002
XIth International Meeting on Boron Chemistry (IMEBORON XI), Moscow, Russia.
Prof. Yu. N. Bubnov, A. N. Nesmeyanov Institute of Organoelement Compounds of the Russian Academy of Sciences, Vavilov str. 28, Moscow V-334, GSP1, 119991 Russian Federation
Tel.: +7 095 135 6166 or +7 095 135 7405
Fax: +7 095 135 5085
E-mail: imeboron@ineos.ac.ru

Crop Protection
4–9 August 2002
10th IUPAC International Congress on the Chemistry of Crop Protection (formerly International Congress of Pesticide Chemistry), Basel, Switzerland.
Dr. Bernard Donzel, c/o Novartis CP AG, WRO-1060.3.06, CH-4002 Basel, Switzerland
Tel.: +41 61 697 22 67
Fax : +41 61 697 74 72

How to Apply for IUPAC Sponsorship
To apply for IUPAC sponsorship, conference organizers should complete an Advance Information Questionnaire (AIQ). The AIQ form is available at 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.

E-mail: bernard.donzel@cp.novartis.com

Physical Organic Chemistry
4–9 August 2002
16th International Conference on Physical Organic Chemistry: Structure and Mechanism in Organic Chemistry, San Diego, California, USA.
Prof. Charles L. Perrin, Department of Chemistry, University of California at San Diego, La Jolla, California 92093-0358, USA
Tel.: +1 858 534 2164
Fax: +1 858 822 0386
E-mail: icpoc@ucsd.edu

Chemical Education
6–10 August 2002
17th International Conference on Chemical Education—New Strategies for Chemical Education in the New Century, Beijing, China.
Prof. Xibai QIU, 17th ICCE c/o Chinese Chemical Society, P.O. Box 2709 Beijing 100080, China
Tel.: +86 10 62568157, 86 10 62564020
Fax: +86 10 62568157
E-mail: qiuxb@infoc3.icas.ac.cn

Bioorganic Chemistry
11–14 August 2002
6th International Symposium on Bioorganic Chemistry (ISBOC-6), Toronto, Ontario, Canada.
Dr. Ronald Kluger, Department of Chemistry, University of Toronto, Toronto, Ontario, Canada M5S 3H6
Tel.: +1 416 978 3582
Fax.: +1 416 978 3482
E-mail: rkluger@chem.utoronto.ca

Polymer Networks 2002
2–6 September 2002
Polymer Networks 2002, Autrans, France.
Prof. E. Geissler, Université J. Fourier de Grenoble, Laboratoire de Spectrométrie Physique, B.P. 87, F-38402 St Martin d'Heres cedex, France
Tel: +33 476 635823
Fax: +33 476 514544
E-mail: erik.geissler@ujfgrenoble.fr

Physical Chemistry of Liquids
6–15 September 2002
European Molecular Liquids Group (EMLG) Annual Meeting on the Physical Chemistry of Liquids. Novel Approaches to the Structure and Dynamics of Liquids: Experiments, Theories, and Simulations, Rhodes, Greece.
Prof. Dr. Jannis Samios
Tel.: +30 1 7274534 or +30 1 7274751
Fax: +30 1 7274752
E-mail: isamios@cc.uoa.gr

Polymer Science and Technology
2–5 December 2002
IUPAC Polymer Conference on the Mission and Challenges of Polymer Science and Technology, Kyoto, Japan.
Prof. Seiichi Nakahama, Faculty of Engineering, Tokyo Institute of Technology, 2-12-1 Ohokayama, Meguro-ku, Tokyo 152-8552, Japan
Tel.: +81 3 5734 2138
Fax.: +81 3 5734 2887
E-mail: snakaham@polymer.titech.ac.jp

2003

Clinical Laboratory NEW
6–7 February 2003
2nd European Symposium on Clinical Laboratory and In Vitro Diagnostic Industry, Barcelona, Spain
Prof. Xavier Fuentes Arderiu Ciutat Sanitària i Universitària de Bellvitge Servei de Bioquímica Clínica L'Hospitalet de Llobregat, Catalonia, E-08907 Barcelona, Spain
Tel.: +34 93 260 7644
Fax: +34 93 260 7564
E-mail: xfa@csub.scs.es

Flow Analysis
10–14 February 2003
The 9th International Conference on Flow Analysis, Geelong, Victoria, Australia.
Dr. Daryl J. Tucker, School of Biological and Chemical Sciences, Deakin University, Geelong, Victoria 3127 Australia.
Tel.: +61 3 5227 2325
Fax: +61 3 5227 1040
E-mail: tucker@deakin.edu.au

100 Years of Chromatography NEW
13–18 May 2003
3rd International Symposium on Separations in BioSciences (SBS '03), follow up to the International Symposia Series "Biomedical Applications of Chromatography and Electrophoresis," Moscow, Russia.
Prof. Vadim A. Davankov, Nesmeyanov Institute of Organo-Element Compounds, Vavilov str., 28, 119991, Moscow, Russia.
Tel.:/Fax: +7 095 135 6471
E-mail: davank@ineos.ac.ru

High Temperature Materials
19–23 May 2003
11th International Conference on High Temperature Materials Chemistry (HTMC XI), Tokyo Japan.
Prof. Michio Yamawaki, University of Tokyo, Department of Quantum Engineering and Systems Science, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

Macromolecule Metal Complexes
20–24 May 2003
Xth International Symposium on Macromolecule Metal Complexes (MMC-X), Moscow, Russia.
Prof. Valerii V. Lunin, Department of Chemistry, Moscow State University, Leninskie Gory, Moscow, 119899, Russia.
Tel.: +7 095 939 5377
Fax: +7 095 932 8846
E-mail: kar@petrol.chem.msu.ru

IUPAC 42nd General Assembly
8–17 August 2003
Ottawa, Ontario, Canada.
IUPAC Secretariat
Tel.: +1 919 485 8700
Fax: +1 919 485 8706
E-mail: secretariat@iupac.org

IUPAC 39th Congress
10–15 August 2003
39th IUPAC Congress and 86th Chemistry at the Interfaces, Ottawa, Ontario, Canada.
Conference Services Office, Building M-19, Montreal Road, Ottawa, Ontario, Canada K1A 0R6
Tel.: +1 613 993 0414
Fax: +1 613 993 7250
E-mail: iupac2003@nrc.ca

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 applica-tion 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.