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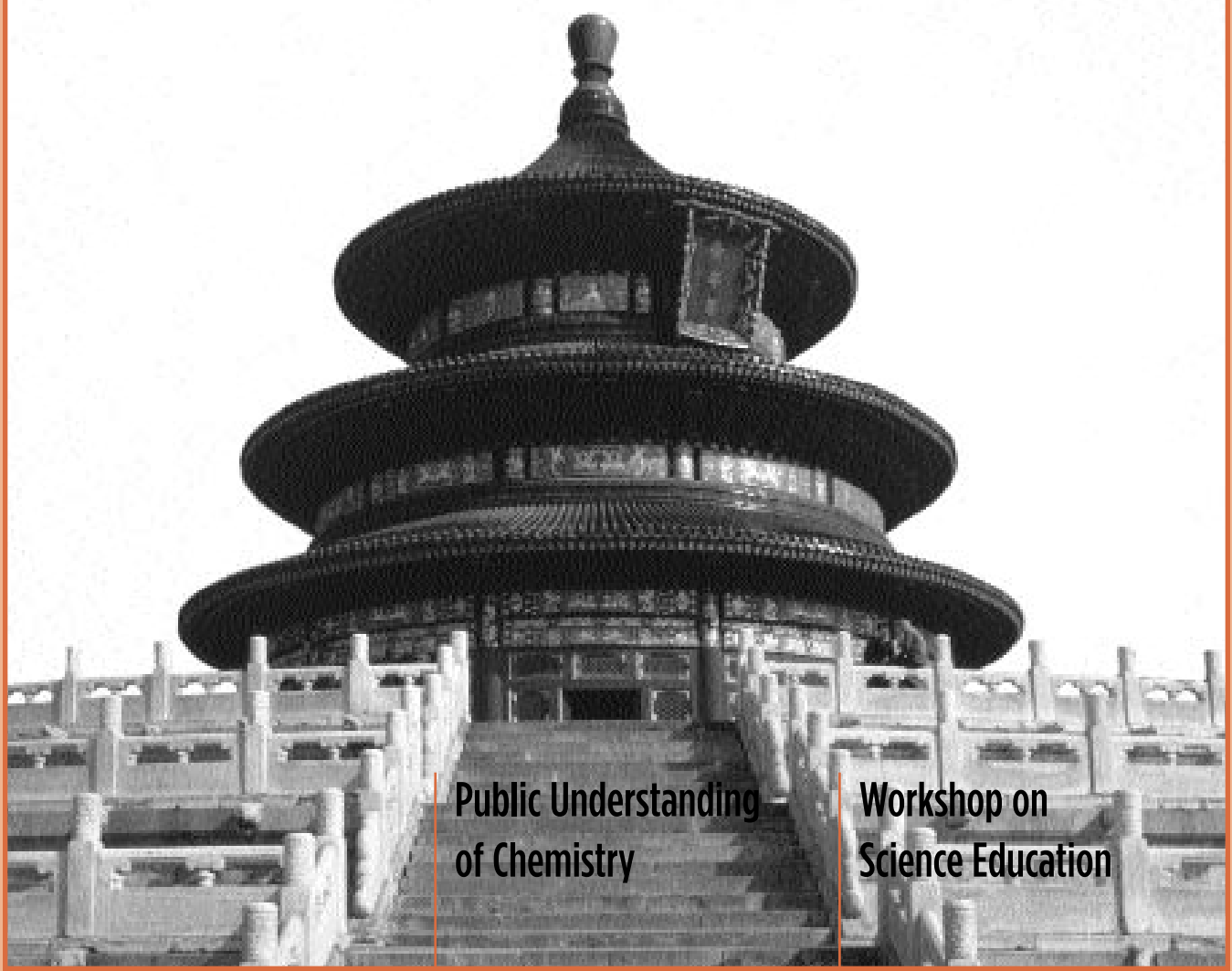
Chemistry Education:

New Strategies for the New IUPAC Committee



Public Understanding of Chemistry

Workshop on Science Education

CHEMISTRY International

The News Magazine of the International Union of Pure and Applied Chemistry (IUPAC)

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From the Editor

Hollis and I in the publication attic at the IUPAC Secretariat, RTP, North Carolina.

Photograph by O'Neil Arnold

This year, *Chemistry International* celebrates its 25th anniversary by getting a "face lift." This might not come as a big surprise, as the idea has been floating around for a while. So, here it is!

The permanent green cover has been put to rest, and one color tone added throughout the text. The idea of redesigning your newsmagazine is not only justified by the fact that we need changes to keep it interesting, but also because a more appealing and contemporary look should allow for a better presentation of the contents. While embarking on this project, with designer Hollis Oberlies and copy editor Chris Brouwer, we looked at other newsmagazines, reviewed *CI* contents, and evaluated our own resources. Chris and I tweaked the editorial style, while Hollis shook it all up and made a new layout.

What does remain is the most important aspect of this newsmagazine: that it entirely depends on voluntary contributions from individual volunteers like YOU. That is why I like to think of *CI* as YOUR newsmagazine—not only because at one point it lands in your mailbox, but more importantly because sooner or later you will report in it. If what you expect to find in *CI* is news about IUPAC, its activities, its chemists, its projects, its publications, its recommendations, its conferences, etc., then you—who are closely or remotely part of IUPAC—should do your part and submit your contribution for publication.

See YOU in *CI*, and have a pure and happy chemistryear!

Fabienne Meyers
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CHEMISTRY International January-February 2003 Volume 25 No. 1

A complementary map/ 2003 calendar is enclosed with this issue

President's Column

Pieter S. Steyn
IUPAC President 2002-2003

It's my privilege to wish members of IUPAC bodies, fellows, affiliates, and our highly esteemed company associates an enjoyable and satisfying 2003. We always have great expectations at the beginning of a new year, and 2003 will be no different, with its unique challenges and opportunities. I am highly indebted to you, the members of the IUPAC family, for your outstanding contributions and voluntary work on behalf of the goals and ideals of the Union. From its contribution to a sound understanding of the molecular processes involved in post-genomic chemistry to an explanation of the physical phenomena influencing the design and properties of nanomaterials, chemistry is truly the core science. The fact that we are equipped with the physical tools enabling us to study these conundrums makes these very interesting times.

A year ago I referred to the task group headed by Dr. Ed Przybylowicz to revisit the Strategic Plan of IUPAC. With the benefit of input from the IUPAC family and the National Adhering Organizations, the task group compiled a succinct Vision Statement and a new Mission Statement. It also reduced the previous 10 Long-Range Goals to 6. The IUPAC Bureau is unanimous in its support of the new strategy, made public for the first time in this issue of *Chemistry International*. It is, in fact, very much in line with the plan adopted in 1997. In the future all of our actions will be aligned with and in support of this new strategy.

IUPAC must continue to serve the needs of chemists at both the fundamental and applied level . . .

Take a look at the first goal: *IUPAC will provide leadership as a worldwide scientific organization that objectively addresses global issues involving the chemical sciences*. It is a direct reflection of the strategic change at IUPAC that led to the transition from a commission-driven organization to one focused on the effective execution of projects of broad international interest. I am delighted by the progress already reported and in the adoption of modern electronic communication technology, especially the Internet, in the execution of IUPAC business. The Project Committee (Professor Jack Lorimer, chairman) and the Evaluation Committee (Professor Gerhard Schneider, chairman) now ensure the effectiveness and quality of IUPAC operations. In addition, sound management procedures are in place to ensure that IUPAC funding is effectively utilized. Never content with the status quo, however, IUPAC has established a new task group, led by Vice President Leiv Sydnes, to focus on governance at the Bureau, Executive Committee, and Council level. I expect that some proposals may be put forth at the August Council meeting in Ottawa.

IUPAC's new strategy was put to work this past year providing scientific advice to the Organization for the Prohibition of Chemical Weapons (OPCW) in its advisory role to the Chemical Weapons Convention (CWC) of the United Nations. A workshop held in Bergen, Norway, was a resounding success and culminated in a report that was presented to the director general of the OPCW and to all national authorities. IUPAC's report should help the OPCW and its States Parties to prepare for the First Review Conference in 2003. The full proceedings of the CWC Workshop, including the report to the OPCW, will appear in the December 2002 issue of *Pure and Applied Chemistry*.

The partnership between SCOPE (Scientific Committee on Problems of the Environment) of ICSU (the International Council for Science) and IUPAC led to the undertaking of a major project on Environmental Implications of Endocrine Active Substances: Present State of the Art and Future Research Needs. At the International Symposium on Endocrine Active Substances held in Yokohama, Japan, early in November 2002, topics ranged from the Molecular Mode of Action of Nuclear Receptors to the Effects of Endocrine Active Substances in Wildlife Species. The meeting, which was chaired by Dr. Junshi Miyamoto, past president of IUPAC Division VI, Chemistry and the Environment, gathered world experts in this crucial area of environmental risk.

I am delighted by the focus of the Committee on Chemistry Education on the teaching of chemistry at school and tertiary levels as well as on the public understanding of chemistry. The newly created Division of Chemical Nomenclature and Structural Representation is now fully functional and supports

our leadership role in the language of chemistry. IUPAC must continue to serve the needs of chemists at *both* the fundamental and applied level, and in that regard it is particularly satisfying to note the efforts of Dr. Alan Hayes (IUPAC past president) and the officers of the Committee on Chemistry and Industry. These efforts have led to new terms of reference for COCI, and IUPAC is now much better positioned to serve the needs of the chemical industry.

I invite all chemists to participate in the 39th IUPAC Congress and the 86th Conference of the Canadian Society for Chemistry <www.iupac2003.org>. This important event, dedicated to Chemistry at the Interfaces, will take place during August 2003 in Ottawa, and is concurrent with the IUPAC General Assembly. At the meeting, nine future leaders of chemistry will be awarded the IUPAC Prize for Young Chemists. The deadline for the 2003 Prize is 1 February 2003; details can be found at <www.iupac.org/news/prize.html>. I again appeal to young chemists to get involved in the new IUPAC; we place great value upon your ideas, energy, and commitment.

Pieter S. Steyn <psst@sun.ac.za> is the current IUPAC president and has been involved with the Union since 1973. He is director of the Division of Research Development of the University of Stellenbosch in South Africa.

IUPAC Strategic Plan – 2002-2003

Vision Statement

IUPAC advances the worldwide role of chemistry for the benefit of Mankind.

Mission Statement

IUPAC is a non-governmental organization of member countries that encompass more than 85% of the world's chemical sciences and industries. IUPAC addresses international issues in the chemical sciences utilizing expert volunteers from its member countries. IUPAC provides leadership, facilitation, and encouragement of chemistry and promotes the norms, values, standards, and ethics of science and the free exchange of scientific information. Scientists have unimpeded access to IUPAC activities and reports. In fulfilling this mission, IUPAC effectively contributes to the worldwide understanding and application of the chemical sciences, to the betterment of the human condition.

Long-Range Goals

To fulfill its mission, IUPAC has established a set of Long-Range Goals. In the pursuit of these goals, IUPAC will assure sound management of its resources to provide maximum value for the funds invested in the Union.

a) *IUPAC will provide leadership as a worldwide scientific organization that objectively addresses global issues involving the chemical sciences.*

b) *IUPAC will facilitate the advancement of research in the chemical sciences through the tools that it provides for international standardization and scientific discussion.*

c) *IUPAC will assist chemistry-related industry in its contribution to sustainable development, wealth creation, and improvement in the quality of life.*

d) *IUPAC will foster communication among individual chemists and scientific organizations, with special emphasis on the needs of chemists in developing countries.*

e) *IUPAC will utilize its global perspective and network to contribute to the enhancement of chemistry education, the career development of young chemical scientists, and the public appreciation of chemistry.*

f) *IUPAC will broaden its national membership base and will seek the maximum feasible diversity in membership of IUPAC bodies in terms of geography, gender, and age.*

Chemistry Education

Over the course of the past year, there has been substantial interest and activity within IUPAC surrounding the issue of chemistry education. The year 2002 began with the creation of the Committee on Chemistry Education (CCE) and in August the IUPAC-sponsored 17th International Conference on Chemical Education was held in Beijing. This main article describes how the revamped and reinvigorated CCE will be structured, its goals, and guidelines for projects. One accompanying article describes the role of the new CCE Subcommittee on the Public Understanding of Chemistry, a second gives an account of the recent inter-union workshop on science education—a project recently undertaken by CCE—while a third article reports on the successful Beijing conference.

In 1999, at the IUPAC General Assembly in Berlin, then–IUPAC president Joshua Jortner took it upon himself to stir up IUPAC's educational activities. He organized an ad hoc committee to take a fresh look at IUPAC's position on chemical education issues. As a result, the Committee on Chemistry Education (CCE) was established in January 2002, with Peter Atkins as chairman. The CCE superseded the former Committee on Teaching of Chemistry (CTC). Having been in place for a year now, *CI* asked the chairman to tell us where this new committee is heading and how it functions.

CCE will contribute to the worldwide propagation and appreciation of chemistry.

by Peter Atkins

The Committee on Chemistry Education (CCE) had a first strategic meeting in March 2002, at which a small group of us had set out to establish the newly formed committee's general objectives. Later in August, our proposals were ratified by the full committee at its meeting held during the 17th International Conference on Chemical Education in Beijing.*

* See Conference report on page 9.

The Structure and Aims of the Committee

First, the committee is huge: There are currently nearly three dozen members. It is composed of eight Titular Members, eight Associate Members (all of whom are representatives of the Divisions), and around two dozen National Representatives from all over (well, nearly all over) the world. The number is so large (and growing . . . hence the slightly vague statistics) because there is no restriction on membership and our responsibility is so widely embracing. We are, of course, very pleased that there is such substantial interest.

To make the committee manageable, and to take some pressure off the chairman, we have created two primary subcommittees and a project advisory group.

The *Subcommittee for Chemistry Education Development (CED)*, under the secure chairmanship of John Bradley, is concerned with chemical education in the developing world. John is widely experienced in this area, particularly through his work on the dissemination of microscale techniques. In addition, he provides invaluable continuity for the CCE, having served as chairman of the CTC, the CCE's predecessor.

The *Subcommittee on the Public Understanding of Chemistry (PUC)* is chaired by Peter Mahaffy. Its duty is clear from its name, and Peter is currently coming to grips with the panoply of national approaches to this important area; *see Peter's report hereafter*. A vital source of information for the subcommittee is the Committee on Chemical Industry (COCI), with which—I am pleased to say—we are strengthening our links. A representative of COCI is on CCE and a small liaison committee of COCI members has been charged with determining issues for CCE to pursue.

Our *Project Advisory Group* is built around Elisa Pestana, our secretary, who is also our project coordinator. The project program (see below) absorbs a great deal of effort and time, and to help Elisa we have set up a small group (Bob Bucat, Ram Lamba, and Tony Ashmore) to facilitate the flow of projects through the system and to ensure that referees' reports are collected and interpreted fairly.

Finally, we feel that good communications with COCI and CHEMRAWN are absolutely essential to the furthering of our goals; the former largely because the

chemical industry desperately needs well-educated chemists and a supportive public, and the latter largely because of the crucial contribution to sustainable development that chemistry can make. I am in the process of establishing helpful relations with CHEMRAWN and will report on that later.

The Projects

Our concentrating on relations with the other operational committees does not mean that we are unaware of the wonderful intellectual resource represented by the Divisions. They already have representatives on CCE (in the form of our eight Associate Members), so the problem of communication is less acute. Nevertheless, we need to ensure that there is a good flow of information and ideas, perhaps in the form of joint projects, into CCE. That process should be continuous, but I shall try to visit all the Division Committees at the General Assembly in Ottawa, provided the timetable and the respective president allows it, and look for ways of extending our fruitful collaboration. The Divisions are tremendous scientific and human resources, and I hope that they will see the CCE as an attractive conduit for their pedagogical ideas.

The CCE must also be the generator and encourager of its own ideas, and I hope that we will soon have a vigorous program of activity emerging from our own members, as well as projects entering the system from outside. At the Beijing meeting we laid down guidelines—they are no more than that—for the types of projects that we would like to encourage. All of them fall broadly under the heading "the flow of ideas," including the flow of ideas within the subject, from instructor to student (at all levels of education), and from the chemical community into the public arena.

We need to ensure that there is a good flow of information and ideas.

We are also paying special attention to the encouragement of ideas that relate to the different regions and subregions of the world. Whereas in general the guidelines for projects within IUPAC specifically discourage regionalization for scientific projects, that constraint has less force for educational projects, for they must acknowledge the resources and aspirations of regions. However, although projects may emphasize regionality, hopefully those that have emerged in one region will be exportable in some respects into others, perhaps to the extent of providing a template for future activity. Examples for such projects include establishing a course curriculum in Latin America, or setting up a clearinghouse for the flow of pedagogical ideas into and out of Russia and the Commonwealth of Independent States. The feasibility of the first project is being explored. The latter project still needs more detailed formulation, but the CCE thinks the idea is excellent and is looking for a way to carry it forward with a view to emulate it in other regions.

The specific guidelines we have enunciated for projects are as follows:

- projects that contribute to the flow of ideas
- projects based on ideas that emerge within a country and are perceived to have subregional, regional, or global significance
- projects that encourage curriculum development within a region or subregion, where local requirements have indicated a demand
- projects that contribute to the distribution of good practice and information within a region or subregion, using the appropriate language
- projects strongly urged by Divisions and Standing Committees that have an educational dimension or are perceived as relevant to the public understanding of chemistry
- projects that reach into regions and subregions that are currently under-represented in IUPAC activity
- projects based on innovations within a country that are perceived by those outside the country as having potential regional or global significance
- projects encouraging inter-Union collaboration [See Bob Bucat's report on page 7]
- projects that are innovative in the realm of the public understanding of chemistry
- projects that are a response to an explicitly demonstrable demand within a region or subregion
- projects that encourage collaboration between countries in a region or between regions and subregions
- projects for which IUPAC seed money is helpful to gain access to other sources of funding

The CCE is well aware that hugely important regional enterprises are taking place in other parts of the world, and that developments there should also be encouraged. So, if you have ideas along these lines, then we would be more than happy to develop them. Of course, you might have bright ideas that do not conform fully to these guidelines: we would not wish to dissuade you from putting them forward.

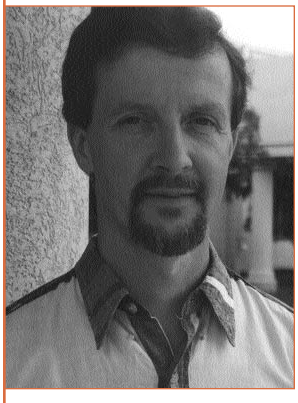
Both subcommittees are currently hard at work formulating projects in their particular domains of activity, and I will write about them in a later article. Meanwhile, I hope you see that we have gotten off to a vigorous start and that the CCE will contribute to the worldwide propagation and appreciation of chemistry.

Peter Atkins <peter.atkins@lincoln.ox.ac.uk> is CCE chairman and professor at the Lincoln College, in Oxford, UK.

www.iupac.org/standing/cce.html

On the Public Understanding of Chemistry

Encouraging the Flow of Ideas



by Peter Mahaffy

An important objective of IUPAC's revised chemical education efforts was to give increased attention to the critical interfaces between chemistry and society. Chemistry as a science cannot flourish in isolation, but must develop within a context of public understanding and mutual trust. Thus, one of the Union's long-range goals is to "advance the public understanding of chemistry."

I'm pleased to report that IUPAC's efforts to focus on the two-way flow of ideas between chemistry and society have had a fruitful beginning with the formation of the CCE Subcommittee on the Public Understanding of Chemistry (PUC). The subcommittee held its first informal meeting at the 17th International Conference on Chemical Education in Beijing in August 2002. The five out of eight members who were able to attend set the directions for the committee's work.

The contexts for chemistry and for its interactions with society are fundamentally different in the various parts of our global village. It is therefore a daunting task to map what projects in this area are being undertaken by chemical societies, industry, educational institutions, and nongovernmental organizations. The subcommittee is aware of the impressive existing initiatives in this area and the limited resources within PUC. The biggest challenge will be to avoid duplicating existing efforts and to explore what activities will best fit with IUPAC's mission and focus.

The PUC subcommittee agreed to prepare a proposal for an IUPAC project to initiate this mapping and evaluation of existing public understanding of science efforts and to propose a focus for PUC activities. Consistent with IUPAC's focus, activities will likely be centered on facilitating communication among those responsible for on-going public understanding initiatives, and encouraging others to fill in the gaps that are identified. It is clear that much of our work will be done electronically, and the Internet will be an important tool in communicating what is being done. Bob Bucat <bucat@chem.uwa.edu.au> has agreed to coordinate the preparation of a project proposal. He welcomes your comments.

A public launch of the IUPAC CCE Public Understanding initiative will take place on 14 August 2003 at the 39th IUPAC Congress, held jointly this year with the 86th Conference of the Canadian Society for Chemistry (session CE03 of the Congress). On that date a series of three symposia featuring invited speakers will be held, focusing on various aspects of the public understanding of chemistry. Symposia titles and the committed invited speakers are as follows:

- *The Flow of Ideas Between Chemists and the Public Through the Media,* sponsored by DOW Canada, and featuring Madeleine Jacobs, editor in chief of *Chemical & Engineering News*, as one of the confirmed speakers. Other representatives from the media and chemists dedicated to promoting the public understanding of chemistry will also be featured.
- *The Flow of Ideas from the Research Lab to Industrial or Public Use,* sponsored by Imperial Oil, featuring Howard Alper, president of the Royal Society of Canada as one of the confirmed speakers. Other representatives from government and industry will also address this interface.
- *The Flow of Ideas Through Society,* sponsored by Shell Canada Chemicals, featuring Tim Faithfull, president of Shell Canada, and Stuart Smith, past chair of the National Round Table on the Economy and Environment, as confirmed speakers. Other speakers will also address the interactions among chemistry and other key disciplines concerned with the health of people and the environment, social justice, economic growth, and general public aspirations.

Finally, an international poster contest for 10–16 year old students on the importance of chemistry in daily life is being launched this spring. Selected entries will be displayed at the Congress and published in *Chemistry International*. PUC member Lida Schoen <amschoen@xs4all.nl> is the contest coordinator through the Science Across the World network.

Members of PUC include Dr. Anthony D. Ashmore (UK), Dr. D. Balasubramanian (India), Professor Robert B. Bucat (Australia), Professor Choon H. Do (Korea), Dr. Lida Schoen (Netherlands), Professor Joseph Schwarcz (Canada), and Professor Yoshito Takeuchi (Japan), and myself (Canada) as chairman.

The subcommittee welcomes your suggestions for priorities and would like to be made aware of activities and efforts in your country or region. Please contact me with your comments.

Peter Mahaffy <peter.mahaffy@kingsu.ca> is professor at the King's University College, in Edmonton, Alberta, Canada.

First Inter-Union Workshop on Science Education

by Bob Bucat

The First Inter-Union Workshop on Science Education, entitled "New Directions in the Teaching and Learning of Science," took place during the 17th International Conference on Chemical Education held in Beijing, China, in August 2002. The workshop, which was funded by generous grants from UNESCO and the International Council for Science (ICSU), arose out of an inter-Union collaboration exploration meeting held at the IUPAC Secretariat in February 2002, involving representatives of IUPAC, the International Union of Biochemistry and Molecular Biology (IUBMB), the International Union of Biological Sciences (IUBS), the International Mathematical Union (IMU), and the International Union of Pure and Applied Physics (IUPAP). <www.iupac.org/projects/2001/2001-054-1-025.html>

At the workshop, various aspects of science education were discussed. Professor Ellis Bell (University of Richmond, Virginia) represented the IUBMB, and Professor Rodolphe Toussaint (University of Quebec) represented IUBS (co-author with Professor A. Giordan). Unfortunately, representatives of the other scientific unions were unable to attend.

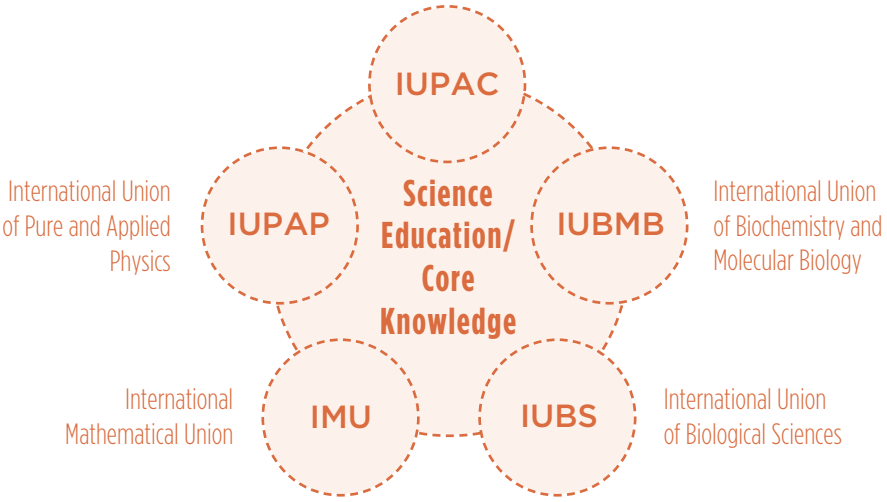
Professor Ellis Bell (IUBMB) (left) and Professor Rodolphe Toussaint (IUBS)

Professor Peter Atkins (IUPAC) opened the Workshop by describing its motivation: to find a forum at which representatives of different Unions could share their approaches to the problems of science education. According to Atkins, the meeting was intended to allow members of IUPAC to become aware of problems, practices, and solutions in other sciences—perhaps to recognize common ground and perhaps to appreciate new ideas.

Professor Bell addressed the role of education committees in academic societies, pointing out that IUBMB had been increasingly successful at having sessions integrated into its full meetings. As a consequence, the status of the education committee had been raised. In his view, the major problem facing education in biochemistry and molecular biology is how to prepare for a multitude of different interests in the light of the recent explosion of knowledge such as that emanating from the genome project.

According to Bell, the education committee of IUBMB has decided to focus on skills and information. Most of the important skills are not discipline specific. There is of course a core of knowledge, but the focus should be on a toolkit of key principles. As Bell explained, a common problem with too much information has been the tendency to compartmentalize, which is the opposite of multidisciplinarity. Examination systems commonly encourage this compartmentalization.

Professor Bell remarked that a "research paradigm of teaching," with programs built around research projects, is IUBMB's current focus. The aim of this mode of education is to encourage thinking like a working scientist.



Concurrent with this focus are a range of emphases:

- use many different styles of teaching
- employ different ways of evaluating student learning
- evaluate a range of outcomes and escape from the crudeness of one-dimensional grades
- use student portfolios
- explore service learning, such as production of outreach information pamphlets
- participate in outreach activities
- research internships
- offer career mentoring

Pedagogical practices being encouraged in the classroom include the following:

- developing Web sites
- providing realistic laboratory experiments
- creating research projects using pre-defined skills
- integrating laboratory components from different courses so that students experience the same concepts in different settings

Professor Toussaint argued that it is possible to develop a scientific culture within the realm of the school curriculum. Courses should inculcate the cultural characteristics of biological sciences and thereby allow the student to interact intelligently with the scientific community. Courses should offer enough data and rationalization for students to become good critics of science and technology and hence to be able to judge the effects of science on society. Moreover, they should be encouraged to become participants rather than spectators in scientific activities and should learn to view the biological sciences as a common human enterprise.

Toussaint went on to argue that the obligations of a biological education included the following:

- Scientific conceptualization should be expressed in and related to particular social contexts.
- The problems studied must integrate ecological, biological, economical, ethical, and legal components. Genetically modified foods are a particular case.
- Problems must be studied in the context of their technological ramifications.
- Material in the public domain of debate should be taught and, conversely, should be part of the public debate.
- History of the technological basis of knowledge and its applications should be included.

Professor Toussaint expressed a belief that courses should build self-confidence in making judgments, a desire to explore and discover, an ability to criticize, an ability to exercise creativity, and an urge to communicate.

The ensuing lively discussion showed that there were numerous common problems and attitudes, and all the participants considered that a similar discussion should be planned in other venues. The point was made that the circumstances seem ripe for the various Unions to cooperate in IUPAC projects that address common challenges.

Bob Bucat <bucat@chem.uwa.edu.au> is professor at the University of Western Australia, in Perth.

Conference Chairman Professor Chunli Bai gives the welcome address at the Opening Ceremony

New Strategies for Chemical Education in the New Century

A Report on the 17th International Conference on Chemical Education Held in Beijing

by Xibai Qiu

From 6–10 August 2002, more than 400 university, college, and secondary school chemistry teachers; education researchers; chemistry researchers; chemical engineers; and publishers from 40 countries and regions gathered in Beijing for the 17th International Conference on Chemical Education (ICCE) to discuss new ideas, thoughts, approaches, and techniques for chemical education in the new century. The theme of the conference, which was sponsored by IUPAC and organized by the Chinese Chemical Society, was "New Strategies for Chemical Education in the New Century." This conference, the first ICCE in the new century, was held at the Fragrant Hill Hotel, located in a famous scenic spot.

At the opening ceremony on 7 August, Professor Chunli Bai—academician and vice president of the Chinese Academy of Sciences, executive president of the Chinese Chemical Society, and IUPAC Bureau Member—delivered the welcoming address. Professor Peter Atkins, chairman of the IUPAC Committee on Chemistry Education (CCE) and IUPAC conference representative, Professor Changgen Feng, representative of the China Association of Sciences and Technology, and Professor Eli M. Pearce, president of the American Chemical Society, also made addresses. In addition, the vice minister of education, Professor Guiren Yuan, and the representative of UNESCO, Dr. A. Pokrovsky, also attended the opening ceremony.

Three hundred sixty-three papers covering a wide range of chemical education issues were accepted. Ten eminent professors were invited to give the plenary lectures at the conference. Topics of their lectures were as follows:

- "Chemistry: Teaching It, Enjoying It, and Spreading It," by Peter Atkins
- "Nanoscience and Nanotechnology," by Chunli Bai
- "Chemical Education: Higher Level and Wider Scope," by Kui Wang
- "The Graduate Education System in the United States," by Eli Pearce
- "Could or Should Chemical Education be Globalized by Internet," by Yoshito Takeuchi
- "Electrochemistry Remediation of the Environment: Fundamentals and Micro-Scale Laboratory Experiments," by Jorge G. Ibanez
- "Using Dance, Drama, and Animation in Chemical Education for the Global Population," by Z. M. Lerman
- "The Art of Doing Research in Chemistry Education," by Hans-Jurgen Schmidt
- "Chemistry for Sustainable Developing: Greening the Curriculum," by Sylvia A. Ware
- "Multimedia Computer Coursewares for Chemistry Teaching in Universities," by Panwen Shen.

Twenty-one more invited lectures and 162 oral lectures were arranged into six sessions, each of which highlighted a different special topic: 1) public education and chemical literacy education, chemistry and society, and environment-oriented chemical education; 2) chemistry experiments, green chemistry, and environment-friendly chemistry experiments; 3) Internet, computer, and chemistry; modern technologies used for chemistry education; 4) teaching university chemistry; 5) teaching chemistry in secondary schools; 6) theoretical basis of chemical education, chemistry Olympiad, chemical education, and frontiers of chemistry research.

One hundred seventy more papers were presented as posters and displayed the recent chemical teaching research of chemistry teachers from different types of schools from all over the world.

At the four workshops, the organizers highlighted their recent research results, which mainly concerned micro-scale chemistry, low-cost chemical instruments, and greening chemistry experiments. The speakers' vivid explanations and interesting experiments made the workshops exciting.

After the conference, a number of participants attended a Seminar on Chemical Education held in Xi'an, including Professor John Bradley, chairman of the CCE Subcommittee for Chemistry Education Development; Professor Xinqi Song, president of Chinese Chemical Society; as well as three other chemists from abroad and China. More than 40 chemical teachers from the western part of China attended the seminar. The topics included chemical education, advances in chemistry, and micro-experiments. Participants expressed hope that more seminars like this would be organized.

Prof. Xibai Qiu <qiuxb@infoc3.icas.ac.cn> is vice chairman of the Committee on International Activities of the Chinese Chemical Society, and was secretary of the 17th ICCE.

Russia and IUPAC

Long-before the Cold War thawed, the Soviet Union was an integral part of IUPAC. Today, the Russian Academy of Sciences helps to advance IUPAC ideas and principles throughout Russia's chemistry community. *CI* asked a Russian member, Petr Fedotov, to briefly review the history of the Academy, its National Committee of Russian Chemists, and examples of recent IUPAC–Russia projects.

by Petr Fedotov

For over 70 years Russia and the Soviet Union have participated in IUPAC activities. The relationship formally began in 1931 when the Academy of Sciences of the Soviet Union became a National Adhering Organization in IUPAC. Since that time, three Russian academicians have served as president of IUPAC: V. N. Kondratiev, 1967–1969; V. A. Koptyug, 1987–1989; and K. I. Zamaraev, 1993–1995. In addition, Russian titular and associate members have actively worked in all IUPAC divisions. For example, V. A. Kabanov was president of the Macromolecular Division from 1979–1981, K. I. Zamaraev was president of the Physical Chemistry Division from 1987–1989, and I. P. Beletskaya was president of the Organic Chemistry Division from 1991–1993. For many years F. A. Kuznetsov has been actively participating in the activities of CHEMRAWN (Chemical Research Applied to World Needs) Committee and at present O. M. Nefedov is an elected member of the IUPAC Bureau, Executive Committee of IUPAC Bureau, and Evaluation Committee.

K. I. Zamaraev, President of IUPAC from 1993–1995

It would be useful to describe the history of the Russian Academy of Sciences itself. It was founded in 1724 in St. Petersburg according to Peter the Great's order and by the decree of the Governing Senate. In 1889, the Academy was one of the constitutors of the International Union of Academies, the prototype of the International Research Council (1919–1931), which later became ICSU, the International Council of Scientific Unions (1931–1998) and is now the International Council for Science. The Academy was continuously developed in the Russian Federation after 1917 and in the Soviet Union after 1924. The Soviet government in its decree of 1925 recognized the Academy as "highest all-Union scientific institution," gave it a new name (the USSR Academy of Sciences), and integrated it into the Academies of Soviet Republics. In 1991, in connection with the disintegration of the Soviet Union, the Academy changed its status and received the initial name of the Russian Academy of Sciences. At present the Academy incorporates 366 research institutions all over Russia engaged in the study of basic fields of modern science. These research institutions and laboratories accumulate the best scientific potential, world-famous scholars, and gifted youth. Nine Professional Divisions of the Academy (including the Division of Chemistry and Material Sciences) feature the scientific and organizational centers that unify the Academy members occupied in one and the same of adjacent fields of science, as well as the associates of Institutes and other scientific and auxiliary bodies of the Academy. Three Regional Branches (Siberian, Ural, and Far East Branches), embracing a number of Regional Scientific Centers, are also incorporated in the Russian Academy of Sciences.

The National Committee of Russian Chemists (O. M. Nefedov, chairman; B. F. Myasoedov, vice chairman) is responsible for relations between IUPAC and the Russian Academy of Sciences. However, the National Committee incorporates leading chemists not only from the Academy, but from industry and universities as well, which helps to advance IUPAC ideas in all of Russia's chemistry communities. The National Committee is working on the IUPAC Affiliate Program in Russia, which favors a national infrastructure for IUPAC and assists in sounding out national opinion on IUPAC matters. Such an infrastructure also may be useful for setting up IUPAC congresses or sponsored symposia.

The National Committee has helped organize a series of IUPAC-sponsored conferences in Russian scientific centers, including the "International Memorial K. I. Zamaraev Conference on Physical Methods for Catalytic Research at the Molecular Level," 1999, Novosibirsk, and "Horizons for Organic and Metalloorganic Chemistry", 1999, Moscow. The committee, with financial support from the German Chemical Society, also promoted the participation of young Russian scientists in the 37th IUPAC Congress in Berlin in 1999. Of special note is an international conference on Chemical Research Applied to World Needs, entitled "Chemistry and Sustainable Development Toward Clean Environment, Zero Waste,

and Highest Energy Efficiency" (CHEMRAWN VIII), which was organized by V. A. Koptyug and O. M. Nefedov and held in September 1992 in Moscow. V. A. Koptyug also contributed to a broadened participation of Soviet and Russian scientists (e.g., from the Siberian Branch of the Academy) in the activities of IUPAC divisions and commissions.

Also in the 90s, the Academy participated in the preparation of the IUPAC book series "Chemistry for the 21st Century." K. I. Zamaraev was the first chairman of the Editorial Advisory Board, whereas I. P. Beletskaya was a Board member. Members of the National Committee also encourage the submission of scientific and educational projects to IUPAC. Furthermore, B. F. Myasoedov, I. P. Beletskaya, and S. D. Varfolomeev were representatives of the Russian NAO at the recent "Chemical Weapons Workshop" (Norway, July 2002—see p. 17 for a report on this IUPAC project).

Great national forums on chemistry (Mendeleev Congresses) are organized in Russia every four to five years. The first congress after the disintegration on the Soviet Union (XV Mendeleev Congress on General and Applied Chemistry) was held in Byelorussia (Minsk, May 1993) under the active support of the Academy of Sciences of Byelorussia. Mendeleev Federation of Chemical Societies of Commonwealth of Independent States (CIS) was founded at that congress. Professor J. Jortner (IUPAC president from 1998–1999) and Dr. A. Hayes (IUPAC president from 2000–2001) were participants in the XVI Mendeleev Congress in 1998. The next Mendeleev Congress, which is IUPAC sponsored, will be held in Kazan in September 2003 (see announcement p. 28). Professor P. Steyn (IUPAC president), Professor L. Sydnes (IUPAC vice president), and Professor H. Ohtaki (member of the IUPAC Bureau and its Executive Committee), as well as a number of Nobel Prize winners have already decided to participate. A round-table discussion on the "State and Development of Chemical Science in the Former Soviet Union Countries" is being planned with the participation of presidents of chemical societies from CIS, Baltia, and leading countries of Europe, Asia, and America.

It should be noted that the Russian Academy is now placing particular emphasis on cooperation with scientific institutions of the CIS and Baltia. The Academy is also pursuing participation in the activities of the International Association of Academies of Sciences (IAAS), thereby combining efforts of the National Academies of the Republics of Azerbaijan, Armenia, Byelorussia, Vietnam, Georgia, Kirghizia, Moldavia, Russia, Tajikistan, Turkmenistan, Uzbekistan, and Ukraine. B.E Paton, president of the Ukrainian Academy of Sciences, is the president of IAAS, and also a full member of the Russian Academy of Sciences. IAAS organizes annual meetings for presidents of National Academies. As the result of an initiative of IAAS, the heads of government of CIS member states signed an agreement to cooperate on scientific and technological projects.

Traditionally, the USSR Academy of Sciences was the publisher of All-Union scientific chemical journals. All these journals are now published in Russia. Nevertheless, research papers of scientists from the CIS and Baltia are widely printed in Russia. Furthermore, new journals that encourage international scientific cooperation are appearing. A journal named *Mendeleev Communications* was founded in 1991 by the Russian Academy of Sciences and the Royal Society of Chemistry. Preliminary accounts of new work in chemistry from Russia and elsewhere are printed in this journal.

Before 1991 (disintegration of the Soviet Union), the practical realization of most important scientific ideas occurred within programs receiving All-Union financial support. At present, science in republics of the former Soviet Union experience financial, personnel, material, and technical difficulties. Nevertheless, Russia continues to exhibit the most activity in the scientific-technical sphere. Hence, Russia should direct more effort to integrating and coordinating the scientific communities and organizations of "Post-Soviet" areas in order to support common objectives.

All of what is mentioned above is very important, considering that among republics of the former Soviet Union, only Russia has full membership in IUPAC. In such a way, the National Committee of Russian Chemists has a unique opportunity to promote the dissemination of IUPAC ideas and principles within all "Post-Soviet" areas. Additionally, the National Committee may involve leading chemists from these republics in IUPAC activities.

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The Double Helix Is 50 Years Old

by Balazs Hargittai and István Hargittai

In 2003, the double helix is half a century old! On 25 April 1953, a one-page article appeared in *Nature* (London), entitled "Molecular Structure of Nucleic Acids: A Structure of Deoxyribonucleic Acid."[1] In it, James Watson (b. 1928) and Francis Crick (b. 1916) suggested a double-helix structure for the substance of heredity, known also as DNA. The brief note was the culmination of a decades-long quest to uncover the chemical identity of the substance responsible for heredity and it was also the beginning of unprecedented growth in molecular biology and the development of biotechnology.

A purely diagrammatic figure of elegant simplicity illustrated Watson and Crick's note. It showed the two helices of the molecule that were related by a twofold axis of rotation perpendicular to the common axis of the helices. This symmetry implied that the two helices ran in opposite directions, complementing each other. The paper described how the two helices were held together by purine and pyrimidine bases, joined in pairs, as a single base from one being hydrogen-bonded to a single base from the other. A by-now-famous sentence concluded the note, "It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material."

A few weeks later Watson and Crick published a second note, "Genetical Implications of the Structure of Deoxyribonucleic Acid,"[2] in which they further elaborated the double helix structure. They described the recipe for self-duplication and stressed the role of hydrogen bonding in the base pairs. Their beautiful diagrammatic figure of the double helix was repeated in the second paper.

Heredity has been an intriguing question long before science could have given an answer to its puzzle. In our era of gene technology, it is almost unbelievable that the question regarding the chemical identity of the substance of heredity was first posed in 1928.[3] The British pathologist, Frederick Griffith made an important observation: when virulent, encapsulated type III pneumococci were killed and injected—together with living, nonencapsulated, thus harmless, type II pneumococci—into laboratory mice, the mice died. Griffith found virulent type III pneumococci in their bodies. One type of bacteria was transformed into another due to the presence of a certain yet unknown chemical substance.

Oswald Avery (1877–1955) at the Rockefeller Institute set out to identify the chemical substance, called by him "the transforming principle." Avery and his co-workers, Colin MacLeod and Maclyn McCarty (b. 1911),[4] concluded their long and meticulously documented article with the following statement: "The evidence presented supports the belief that a nucleic acid of the deoxyribose type is the fundamental unit of the transforming principle of Pneumococcus Type III." It was a seminal paper, but it was a long way from this historic discovery to the general recognition of deoxyribonucleic acid as the substance of heredity. The double helix structure of DNA then removed any doubt from its function because the two appeared in such a wonderful unison.

The double helix, deservedly, catapulted Watson and Crick to fame, but there were other players who also should be remembered. In addition to Avery and his two associates, there was Sven Furberg (1920–1983) who uncovered important features of the DNA structure in 1949, such as the bases and the sugar rings being perpendicular to each other. Erwin Chargaff (1905–2002) determined that while the relative proportions of the various bases differed considerably in the DNAs of different organisms, the relative amounts of different bases followed strict regularities. There was a one-to-one correspondence between certain bases. Rosalind Franklin (1920–1958) produced X-ray diffraction photographs of DNA that proved its helical structure. While these were crucial contributions, the likes of which would have brought out the DNA structure in time, Watson and Crick's discovery was a masterstroke. They received the Nobel Prize in 1962, sharing it with Maurice Wilkins (b. 1916), who did a comprehensive X-ray crystallographic study of the DNA structure.

There is an aspect of this discovery, in our opinion, that the world of chemistry needs to look at carefully. The double helix structure of DNA has been considered a discovery in biology and the Nobel Prize for it was awarded in the category of physiology or medicine. Yet it could be argued that the discovery was a chemical discovery. Suffice it to say that Watson and Crick used Linus Pauling's approach of utilizing all relevant previous knowledge about structural chemistry and, in particular, model building of the anticipated structure. The X-ray crystallographic experimental data of Franklin and the analytical chemical (chromatography) findings of Chargaff were all the results of chemistry.

One might think that chemistry was forced out of the glory of this great discovery, but this was not the case.

Sculpture of double helix by Charles A. Jencks on the campus of Cold Spring Harbor Laboratory on Long Island. Photograph by Magdolna Hargittai, 2002.

Chemistry or, rather, the chemists were not quick enough to recognize the chemical importance of nucleic acids. The wounds chemistry suffered from being left out of this field were self-inflicted. For some time chemists were reluctant to "waste their clean techniques on the dirty mixtures" of nucleic acids as they were viewed by some. It is a moving episode that Albert Eschenmoser, the noted synthetic organic chemist, himself puzzled by this omission of chemistry, prodded the great natural products chemist Vladimir Prelog (1906–1998) to tell him what he thought about it. Eschenmoser told Prelog: "Vlado, every year during which we did not work on DNA was a wasted year."[5] This was, of course, an exaggeration, but the reality was that chemists did not even include nucleic acids in natural products. This was not only the fate of nucleic acids. As late as 1996, the Nobel laureate Bruce Merrifield, discoverer of chemical synthesis on a solid matrix, complained that "Peptides are certainly natural products, but the classical natural products chemists don't recognize them as such. Peptides are excluded from their repertoire."[5] Merrifield was referring to a recent monograph of natural products chemistry.

The great story-teller Prelog was careful with his words, but finally, a few years before his death, in 1995, he yielded to Eschenmoser's prodding. His statement is composed with a subtle sense of humor. Here is the English translation[5] of Prelog's original statement in German:

> For some time you have prodded me to tell you, why the great Leopold [Ruzicka] and I did not recognize, in a timely fashion, that the nucleic acids are the most important natural products, and why did we waste our time on such inferior substances as the polyterpenes, steroids, alkaloids, etc.
>
> My light-hearted answer was that we considered the nucleic acids as dirty mixtures that we could not and should not investigate with our techniques. Further developments were, at least in part, to justify us.
>
> As a matter of fact, for personal and pragmatic reasons, we never considered working on nucleic acids.

By now, of course, chemical research on DNA has become strong and widespread, and there is no reason for chemists to consider themselves to any degree lesser participants in celebrating the double helix than the representatives of other fields of science. But it is of interest to look back at the bumpy story of DNA and the double helix and how they found their proper place in the mindset of chemists. We can see signs of ambiguity in the relationship between chemistry and the science of biological macromolecules. One of the most conspicuous signs can be seen in name changes in recent years. For example, the Department of Structural Chemistry has changed its name to Structural Biology at the Weizmann Institute. Less disturbing is when other great institutions, like Harvard University, extend the name of their chemistry departments to be Department of Chemistry and Chemical Biology.

In addition to the enormity of the importance of the DNA structure, various aspects of its discovery have been immortalized in literary creations, the most notable of them being Watson's *The Double Helix*. It was first published in 1968 and has remained a best seller ever since. The double helix has become a subject of artistic creation, especially in sculptures. Erwin Chargaff did not mean it kindly when he noted its popularity, but his sarcasm notwithstanding, he was not far off the mark when he said,[6]

> . . . the outstanding charismatic symbol of our time—the spiral staircase leading, I hope, into heaven—has been advertised with a truly remarkable intensity. It has been used as an emblem, it has been put on neckties, it embellishes letterheads, it stands outside of buildings as what might be called commercial sculpture. It has even invaded the higher forms of mannerist art.

There is something breathtaking in the double helix structure, whether it is represented by a diagrammatic sketch or an elaborate design. On the campus of Cold Spring Harbor Laboratory, a recently unveiled sculpture has conspicuous simplicity; the two helices are connected with straight rods and at the top the dividing two helices are turned back into the ground—a symbolic, but also stabilizing feature. A spectacular, large sculpture stands outside the Biomedical Center of Uppsala University ascending vertically as if from a cell and splitting at the top as if getting ready for reproduction.

The discovery of the double helix uncovered one of life's most fundamental secrets. It has helped improve the quality of life and in this its potentials appear to be boundless, although genetic engineering has a long way to go to achieve general acceptance. The double helix has also created a bridge between science and the arts.

Balazs Hargittai is at the Chemistry Department of St. Francis University in Loretto, Pennsylvania, his research interest is in peptide chemistry. István Hargittai is at the Budapest University of Technology and Economics. His latest book is *Candid Science III: More Conversations with Famous Chemists* (Imperial College Press, London, 2003).

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5. I. Hargittai, *Candid Science III: More Conversations with Famous Chemists*, Imperial College Press, London, 2003.
6. E. Chargaff, *Heraclitean Fire: Sketches from a Life before Nature*, The Rockefeller University Press, New York, 1978, p. 106

Young Observers Describe Experiences

At a reception hosted by the U.S. National Committee for IUPAC at the American Chemical Society meeting in Boston on 20 August 2002, three Young Observers reported on their experiences at recent General Assemblies. The USNC has long conducted the Young Observer (YO) program to send "younger," but established chemists to General Assemblies to interest them in the work of IUPAC and to obtain ideas from them on ways of enhancing the Union's work.

The three former young observers spoke highly of their experiences during the past two General Assemblies. Cynthia Larive, of the University of Kansas and a 2001 YO, Frank McDonald of Emory University and a 2001 YO, and Jeff Roberts of the University of Minnesota and a 1999 YO, emphasized the satisfaction they felt being a part of a larger group of scientists working on policy issues that affect the chemistry community. McDonald decided to join the IUPAC Subcommittee on Organic Synthesis after his experience as a young observer. Roberts concluded his remarks with a challenge for IUPAC—to spread the word about the organization, especially to many other young scientists, and involve them early in their career since IUPAC is an important, yet under-recognized organization.

Each year, the USNC hosts this type of reception to thank the Company Associates who support the program and to introduce people to IUPAC and its members. Newly appointed USNC chair Mike Jaffe acted as host for the short program during the reception. Ted Becker, secretary general of IUPAC, gave an overview of the history and the current activities of IUPAC. USNC member Jeanne Pemberton discussed the YO program and introduced the three YOs.

The USNC has announced a similar program to support travel to the IUPAC Congress and General Assembly in Ottawa in August 2003. Ed Przybylowicz, past chairman of the USNC, described the program in a *Chemistry International* Forum article [*CI* Vol. 24, No. 1, January 2002].

www.nationalacademies.org/usnc-iupac/yo

Brief from www.iupac.org/news

- Minutes of 77th Meeting of Bureau, 14-15 September 2002, Paris, France
- Freedom of access to primary experimental data IUBG report
- Information on the coming IUPAC General Assembly and Congress
- IUPAC 2003 Prize for Young Chemists Application deadline 1 February 2003

The Project Place

Information about new, current, and complete IUPAC projects and related initiatives.
See also www.iupac.org/projects

Standard XML Data Dictionaries for Chemistry

A new project has begun under the Committee for Printed and Electronic Publications, entitled "Standard XML Data Dictionaries for Chemistry" (project #2002-022-1-024). It was developed in response to a widely accepted need for IUPAC to extend its leadership in the development of standard chemical terminology from printed to electronic communication, especially through the XML format. The principal objective of this program is to develop an effective means of enabling the use of IUPAC glossaries for creating a standard "namespace" for representing chemical information in digital form. This project seeks individuals interested in participating in any aspects of this task.

For more information, contact the Task Group Chairman Steve Stein <steve.stein@nist.gov>.

www.iupac.org/projects/2002/2002-022-1-024.html

IUPAC Chemical Nomenclature for Chemistry Teachers at Secondary Schools

The Committee on Chemistry Education has initiated a new project to educate chemistry teachers at secondary schools and technical colleges in the Czech Republic about current IUPAC nomenclature of inorganic, organic, biochemical, and macromolecular compounds. The procedure could later be used as a model for replication in other countries.

Knowledge of current IUPAC chemical nomenclature among chemistry teachers at secondary schools and technical colleges in the Czech Republic is rather rudimentary. The faculties educating chemistry teachers do not seem to put sufficient stress on correct and modern chemical nomenclature. The situation is even worse with senior teachers as postgraduate studies in education are not available to them. There is no appropriate solution to the problem. The most important, current IUPAC-nomenclature documents are translated into Czech and published, but their treatment of the topics is difficult and too detailed for the teachers, explained Professor J. Kahovec, the task group chairman undertaking this project. Organizing postgraduate courses for secondary school chemistry teachers is a viable solution.

In the courses that the task group is planning, the fundamentals of current IUPAC nomenclature of inorganic, organic, and biochemical compounds, as well as that of polymers, would be outlined. The rules and the ideas behind them would be explained and illustrated in many examples. At the same time, the most frequent errors in naming would be demonstrated and corrected. A booklet containing a brief outline of nomenclature rules and, possibly, a final exam would form an important part of the course. Experienced nomenclaturists—preferably those taking part in translations of IUPAC documents—who are members of IUPAC or national nomenclature commissions, would give the lectures. The booklet and teaching materials initially prepared in Czech will subsequently be translated in English.

Preliminary inquiries among chemistry teachers showed great interest in such courses. As the number of chemistry teachers at secondary schools and technical colleges in the Czech Republic is quite high, several course offerings would have to be scheduled. A meeting is planned with the Department of Teaching and Didactics of Chemistry of the Faculty of Science of the Charles University in Prague to introduce this course on IUPAC chemical nomenclature into the curriculum for chemistry teachers.

For more information, contact the Task Group Chairman Jaroslav Kahovec <kah@imc.cas.cz>.

www.iupac.org/projects/2001/2001-016-1-050.html

Glossary of Terms Used in Photochemistry

The "Glossary of Terms Used in Photochemistry," last published in 1996 (*Pure and Applied Chemistry* 1996, **68**, 2223), included about 500 terms. Updating and expanding the glossary is needed since errors have been detected with respect to definitions in the IUPAC Green Book *Quantities, Units, and Symbols in Physical Chemistry*, published by the Physical Chemistry Division. In addition, terms related to the use of polarized light in photoinduced reactions should be included. By their very nature, glossaries need frequent updating to keep up with new terms and procedures arising from technological developments.

For more information, contact the Task Group Chairman Silvia E. Braslavsky <braslavskys@mpi-muelheim.de>.

www.iupac.org/projects/2002/2002-024-1-300.html

Impact of Scientific Developments on the Chemical Weapons Convention

As the leading international, nongovernmental organization devoted to the chemical sciences, IUPAC was asked to undertake a review of the impact of scientific developments on the Chemical Weapons Convention. This project included the organization of a workshop, held in Bergen, Norway, from 1–3 July 2002, to explore these issues. Between 80–100 persons attended the workshop. An International Advisory Board, with representation from 17 countries, aided the Program Committee in formulating the program and obtaining the best international scientific input.

In November 2002, as an output of this project, IUPAC provided to the Organization for the Prohibition of Chemical Weapons a report in which scientific and technological advances in the chemical sciences are evaluated. This report is expected to assist the OPCW and the States Parties in preparing for the First Review Conference of the Convention, scheduled for The Hague in April 2003.

Of the "weapons of mass destruction"—biological, chemical, and nuclear—only chemical weapons have a multilateral verification regime. The IUPAC report comes against a backdrop of international concern about potential use of chemical weapons by terrorists or by rogue nations. The report—available on the IUPAC Web site—highlights developments in organic synthesis and changes in chemical plant design that will pose new challenges to the Convention, but it also describes recent and probable future developments in analytical chemistry that may assist in implementation of the Convention. The key issues identified at the workshop are given on page 4 of the report. IUPAC's findings and observations are summarized in 18 points on pages 5–8.

For more information, contact the Task Group Chairman Edwin D. Becker <tbecker@nih.gov>.

www.iupac.org/projects/2001/2001-057-1-020.html

Provisional Recommendations

IUPAC Seeks Your Comments

Provisional recommendations are drafts of IUPAC recommendations on terminology, nomenclature, and symbols made widely available to allow interested parties to comment before the recommendations are finally revised and published in *Pure and Applied Chemistry*. There is currently one document available for review:

Definitions of Terms Related to Polymer Blends, Composites, and Multiphase Polymeric Materials

The document defines the terms most commonly encountered in the field of polymer blends and composites. The scope has been limited to mixtures in which the components differ in chemical composition or molar mass and in which the continuous phase is polymeric. Incidental thermodynamic descriptions are mainly limited to binary mixtures although, in principle, they could be generalized to multi-component mixtures.

The document is organized into three sections. The first defines terms basic to the description of polymer mixtures. The second defines terms commonly encountered in descriptions of phase domain behavior of polymer mixtures. The third defines terms commonly encountered in the descriptions of the morphologies of phase-separated polymer mixtures. The full text is available online, see link below.

Comments by 31 March 2003
To Dr. William J. Work
1288 Burnett Road
Huntingdon Valley, PA 19006 USA
E-mail: wjwork@comcast.net

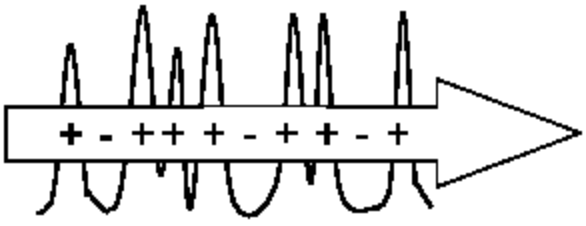
www.iupac.org/reports/provisional/abstract02/work_310303.html

Concepts and Applications of the Term "Dimensionality" in Analytical Chemistry (IUPAC Technical Report)

by K. Danzer, J. F. van Staden, and D. T. Burns

Pure and Applied Chemistry,
Vol. 74, No. 8, pp. 1479–1487 (2002)

The analytical chemistry community has used the term "dimensionality" to mean several different things. On different occasions, analysts speak about "two-dimensional" analytical methods, for example, 2D nuclear magnetic resonance spectroscopy, 2D thin-layer chromatography, "two-dimensional" or "three-dimensional" analytical information, "two-dimensional" or "three-dimensional" images in surface analytical chemistry, and of "m-dimensional" analytical data obtained, for example, as a result of multicomponent analyses. These examples show that the use of the term "dimensionality" is at times contradictory. This confused position does not promote the unequivocal application of the term in analytical chemistry. The aim of this document is to provide a concept for the use of the term "dimensionality" as it is related to analytical information.



One-dimensional information (in z-direction; qualitative signal evaluation, signal identification)

www.iupac.org/publications/pac/2002/7408/7408x1479.html

The "Purple Book" in Portuguese: Compêndio de Nomenclatura Macromolecular

by C. Andrade, F. Coutinho, M. Dias, E. Lucas, C. Oliveira, and D. Tabak (eds.)

e-papers, Rio de Janeiro, Brazil, 2002.
(ISBN 85-87922-31-9)

This compendium of IUPAC recommendations on macromolecular nomenclature provides definitions of terms relating to polymers and rules for naming polymers based on structure or source. An introduction to macromolecular nomenclature and a bibliography of biopolymer-related nomenclature recommendations are also included. The IUPAC-approved terminology and nomenclature are intended to improve communication in the scientific community by providing standardized descriptions of the materials and processes for polymer science and technology.

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

Definitions, Terminology, and Symbols in Colloid and Surface Chemistry

by D. H. Everett

Pure and Applied Chemistry,
Vol. 31, No. 4, pp. 579–638 (1972)

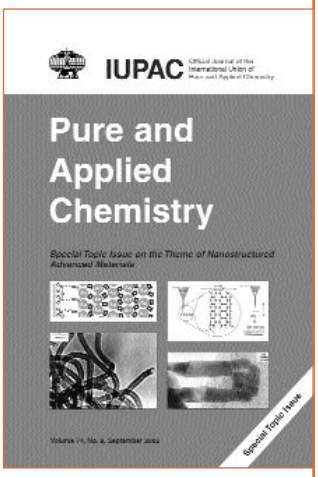
Online version coordinated by L. K. Koopal

Over the past 30 years, the *Manual on Definitions, Terminology, and Symbols in Colloid and Surface Chemistry*, prepared by D.H. Everett, has lost very little of its significance for the community of people working in the field of colloid and surface chemistry. To make this manual widely available to the interested public, the IUPAC Commission on Colloid and Surface Chemistry including Catalysis has decided to reproduce the manual on the Internet. In order to bring more recent recommendations to the attention of the reader, annotations have been added as footnotes that are clearly marked as "(2001)." In most cases these annotations just refer to other IUPAC documents, while in a few cases they provide some new definitions and symbols.

www.iupac.org/reports/1972/3104everett

Nanostructured Advanced Materials

A special topic issue of *Pure and Applied Chemistry*, Vol. 74, No. 9, 2002.
IUPAC, 2002.
(ISBN 0-9678550-5-5)



A focus of frontline interdisciplinary research today is the development of the conceptual framework and the experimental background of the science of nanostructured materials and the perspectives of its technological applications. The subjects of nanoscience and nanotechnology pertains to the synthesis, characterization, exploration, interrogation, exploitation, and utilization of nanostructured materials, which are characterized by at least one dimension in the nanometer domain. Such nanostructured systems constitute a bridge between single molecules and infinite bulk systems. Individual nanostructures involve clusters, nanoparticles, nanocrystals, quantum dots, nanowires, and nanotubes, while collections of nanostructures involve arrays, assemblies, and superlattices of individual nanostructures.

The implications of quantum size and shape effects on the energetics, nuclear-electronic

Typical dimensions of nanostructures and their assemblies
(reproduced from J. Jortner and C.N.R. Rao, *Pure Appl. Chem.* 74(9), 1491-1506, 2002)

Nanostructure	Size	Material
Clusters Nanocrystals Quantum dots	Radius: 1 – 10 nm	Insulators, semiconductors, metals, magnetic materials
Other nanoparticles	Radius: 1 – 100 nm	Ceramic oxides
Nanobiomaterials Photosynthetic reaction center	Radius: 5 – 10 nm	Membrane protein
Nanowires	Diameter: 1 – 100 nm	Metals, semiconductors, oxides, sulphides, nitrides
Nanotubes	Diameter: 1 – 100 nm	Carbon, layered chalcogenides
Nanobiorods	Diameter: 5 nm	DNA
2-D arrays of nanoparticles	Area: Several nm^2 – μm^2	Metals, semiconductors, magnetic materials
Surfaces and thin films	Thickness: 1 – 1000 nm	Insulators, semiconductors, metals, DNA
3-D superlattices of nanoparticles	Radius: several nm	Metals, semiconductors, magnetic materials

level structure, electric-optical response, and dynamics, reveal new unique physical phenomena that qualitatively differ from those of the bulk matter and provide avenues for the control of the function of nanostructures.

This special topic issue of *Pure and Applied Chemistry* includes reviews and research papers based on lectures presented at the second Workshop on Advanced Materials: Nanostructured Materials (WAM II), held from 13–16 February 2002 in Bangalore, India (See Conference report, *CI* May 2002, p.22). This *PAC* issue was coordinated by Professor J. Bull, IUPAC Special Topics Editor and Professor G.U. Kulkarni, chairman of the Local Organizing Committee. The papers addressed recent developments in the broad, interdisciplinary research field of nanostructured materials and are organized under the following categories: synthesis and characterization, spectroscopic and other physical properties, and applications of nanostructured materials.

Perspectives and directions are given in the introduction authored by C. N. R. Rao and Joshua Jortner. That paper highlights some significant aspects of the characterization, interrogation, and response of nanostructures, in conjunction with theoretical modeling of the unique structure, dynamics, and function of quantum structures and their assemblies.

www.iupac.org/publications/pac/2002/7409

IUPAC Materials Initiative

Suggestions, comments, questions regarding IUPAC activities on the subject of Materials Chemistry should be addressed to Prof. John Corish <jcorish@tcd.ie>, chairman of the Subcommittee on Materials Chemistry.

Macromolecule-Metal Complexes

A. Guiseppi-Elie and K. Levon (symposium eds.)
Macromolecular Symposium, Vol. 186.
Wiley-VCH, 2002, pp. 1-185.
(ISBN 3-527-30476-2)

This text is intended for scientists, engineers, and other technical personnel who seek a current assessment of the rapidly growing field of macromolecule-metal complexes. The book is the result of technical contributions to the 9th International Symposium on Macromolecule-Metal Complexes (MMC-9) sponsored by IUPAC, the Polymer Division of the American Chemical Society (POLY, ACS), and Polytechnic University. The symposium, which featured four plenary addresses, was organized by the Herman F. Mark Polymer Research Institute and held 19-23 August 2001 at the Polytechnic University's Metrotech Center in Brooklyn, NY, USA.

The keynote address was delivered by Professor Eli Pearce, president of the American Chemical Society, who spoke on a "Strategy Plan for the American Chemical Society." The other plenary addresses were delivered by Professor Victor Kabanov (Moscow State University, Russian Academy of Sciences) on "Cooperativity Effects in Polyelectrolyte Complexation;" Professor Alan MacDiarmid (Nobel Laureate in Chemistry, 2000, University of Pennsylvania) on "Synthetic Metals: a Novel Role for Organic Polymers;" and Professor Eishun Tsuchida (Waseda University) on "Human Serum Albumin Incorporating Lipidhemes as an Oxygen Infusior."

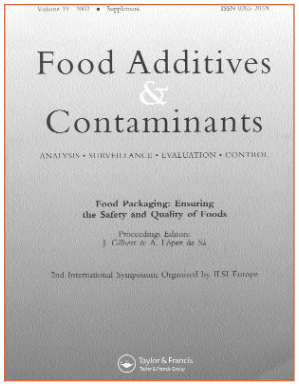
Thematically, the book is organized according to the topical conferences of the symposium. The symposium focused on the role of metal ions, complexes, and metallic clusters in macromolecular systems wherein the polymeric materials were either natural or synthetic organic, or synthetic inorganic. The symposium addressed new directions such as supramolecular assemblies, bio-related applications, and organic and inorganic chemistry. Conferences were held addressing such important contemporary issues as macromolecular-metal complexes in green chemistry and polyelectrolytes and polymer batteries. For the first time at this MMC symposium, a conference was dedicated to macromolecule-metal complexes formed from inherently conductive polymers with the potential for metal-like conductivity. Other conferences addressed electronic, magnetic, and optical properties of macromolecule-metal complexes; bio-related applications; and physical properties of macromolecule-metal complexes.

The symposium chairs were Professors E. Tsuchida, Waseda University, Tokyo, Japan, and Kalle Levon and Yoshi Okamoto, Polymer Research Institute, Polytechnic University, Brooklyn, NY, USA. The first MMC symposium was held in Beijing in 1985. The series of conferences has been successfully held every two years. The MMC-8 was held at Waseda University in Tokyo in 1999 and MMC-10 will be held along the Volga River in Russia.

www.iupac.org/publications/macro/2002/186_preface.html

Food Packaging: Ensuring the Safety and Quality of Foods

John Gilbert and Angela López De Sá (proceeding eds.)
Food Additives and Contaminants 2002, **19**, S1-S228



The papers presented in this Special Issue of *Food Additives and Contaminants* comprise the Proceedings of the Second ILSI Europe International Symposium on Food Packaging—Ensuring the Safety and Quality of Food, held in Vienna, Austria, from 8–10 November 2000. The First Symposium was held in 1996 in Budapest, Hungary (Published in *Food Additives and Contaminants* 1997, **14**, 517–775).

The objectives of the second symposium were to advance the underlying science relating to the safety and quality of packaged foods, to disseminate results of ongoing research, and to stimulate debate on implications for the future. The symposium was organized in collaboration with IUPAC, the Vienna University of Technology, and the European Commission (EC). The EC has supported a number of research and technological development projects on food packaging, migration, and development of analytical methods in the Fourth and Fifth Framework Programmes. A number of these projects, which were recently completed or are still underway, were included in the symposium, either as oral presentations or as posters. In view of the close linkage between the symposium and these EC funded projects in the Framework Programmes, the symposium was granted funding from DG Research as an Accompanying Measures Action.

More than 250 participants from Europe, North America, Asia, and Africa attended the three-day symposium. The multidisciplinary audience included food scientists, chemists, mathematicians, physicists, and microbiologists from industry, academia, and government. Twenty-two presentations were given, of which 20 are published in this proceedings. The presentations were divided into five sessions covering risk assessment of packaging materials; modeling; recycling and re-use of packaging; active, intelligent, and novel packaging; and new analytical approaches. In the proceedings, the papers are organized according to these sessions.

Following the success of the 1996 and 2000 symposia, the ILSI Europe Task Force on Packaging is currently planning a third symposium to be held in 2004 at a European venue.

www.tandf.co.uk/journals/titles/0265203X.html

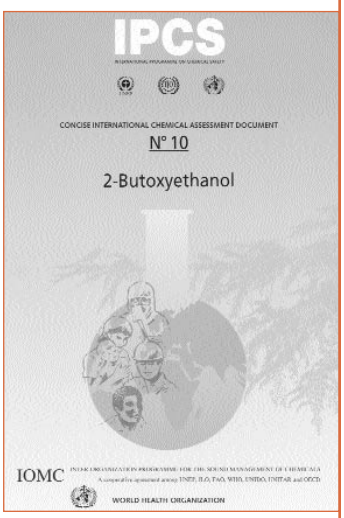
Concise International Chemical Assessment Document

A series of monographs by the International Programme on Chemical Safety
World Health Organization, Geneva (1998-2002)

reviewed by John H. Duffus

Before reviewing this series of publications, it is important to define what they are, what their purpose is, and to describe the procedure by which they are prepared. The procedure is particularly important because it is designed to ensure that the Concise International Chemical Assessment Documents (CICADs) are authoritative and trustworthy sources of the fundamental information required to carry out risk assessments. These assessments then lead to effective risk management of substances used worldwide, helping to ensure human safety and environmental protection.

The CICADs are short documents that provide summaries of the scientific information available on the potential effects of chemicals upon human health and/or the environment. These documents are based on selected national or regional evaluations or on existing International Programme on Chemical Safety (IPCS) Environmental Health Criteria Documents (EHCs). Before acceptance for publication as CICADs by IPCS, the draft documents are subjected to extensive peer review by internationally selected experts to ensure their completeness, accuracy in how the original data are represented, and the



validity of the conclusions drawn. Unless otherwise stated, CICADs are based on a search of the scientific literature to the date shown in the executive summary. International Chemical Safety Cards (ICSCs) on the relevant chemical(s) are attached at the end of each CICAD to provide the reader with the essential summary information on the protection of human health and on emergency action. The ICSCs are produced by a separate peer-reviewed procedure. Further information may be obtained from the Poison Information Monographs, also produced by IPCS.

The primary objective of CICADs is to characterize the hazard and dose–response relationship associated with exposure to a chosen priority chemical. CICADs are not a summary of all available data but include only the information considered critical for characterization of risk. Critical studies are described in sufficient detail to indicate how they support the conclusions drawn. Risks to human health and the environment vary depending upon the type and extent of exposure. Users of the CICADs are encouraged to characterize risk on the basis of appropriate locally measured or predicted exposure scenarios. For the readers' guidance, examples of exposure estimation and risk characterization are provided in CICADs whenever possible.

The flow chart shows the procedures followed to produce a CICAD. The IPCS Risk Assessment Steering Group advises the coordinator, IPCS, on the selection of chemicals for an IPCS risk assessment, the appropriate form of the document (i.e., EHC or CICAD), and which institution should have the responsibility of the document production, as well as on the type and extent of the international peer review. The first draft is based on an existing national, regional, or international review. Authors of the first draft are usually, but not necessarily, from the institution that developed the original review.

The first draft undergoes primary review by IPCS and one or more experienced authors of criteria documents to ensure that it meets the specified criteria for CICADs. The draft is then sent for international peer review by scientists known for their relevant expertise and by scientists selected from an international roster compiled by IPCS through recommendations from IPCS National Contact Points and from IPCS Participating Institutions.

The CICAD Final Review Board ensures that each CICAD has been subjected to an appropriate and thorough peer review; verifies that the peer reviewers' comments have been addressed appropriately; provides guidance on how to resolve remaining issues if, in the opinion of the board, the author has not adequately addressed all comments of the reviewers; and approves CICADs for publication as trustworthy international assessments. Board members serve in their personal capacity, not as representatives of any organization, government, or industry. They are

selected because of their expertise in human and environmental toxicology or because of their experience in the regulation of chemicals and with regard to the need for balanced geographic representation. It is important to note that board members, authors, reviewers, consultants, and advisers who participate in the preparation of a CICAD are required to make a public declaration of any real or potential conflict of interest in relation to the subjects under discussion at any stage of the process in order to ensure impartiality. All of these rules are designed to ensure impartiality and give the CICADs and related documents their authority as the most reliable sources of information for chemical risk assessment.

But what information can you expect to find in a CICAD? The first section is an executive summary, followed by details relating to the identity and physical/chemical properties of the substance(s) considered and the analytical methods used for monitoring. Then, there are reviews of sources of human and environmental exposure, of the possibilities for environmental transport, distribution, and transformation; and of the current status of environmental and human exposures. Next, the evidence linking exposure (dose) to effects and to population response in laboratory animals and in humans is described and assessed, including that from *in vitro* studies and from studies of toxicokinetics and fundamental metabolic processes. Case studies and epidemiological investigations are also considered.

In addition, any information on effects on other organisms in the laboratory and in the field is collated and, finally, an effects evaluation is carried out. This evaluation may lead to suggested criteria for setting tolerable exposure limits or guidance values and suggestions for further research to clarify points of importance. A final section summarizes previous evaluations by international bodies. There is then a list of the references used in preparing the document followed by appendices describing the main source document and listing the members of the peer review group and of the final review board. The relevant ICSCs and French and Spanish translations of the executive summary complete the document.

At the time of writing, more than 40 CICADs have been published and these are listed below.

The Concise International Chemical Assessment Documents

- Acrylonitrile (No. 39, 2002)
- Azodicarbonamide (No. 16, 1999)
- Barium and barium compounds (No. 33, 2001)
- Benzoic acid and sodium benzoate (No. 26, 2000)
- Benzyl butyl phthalate (No. 17, 1999)
- Beryllium and beryllium compounds (No. 32, 2001)
- Biphenyl (No. 6, 1999)
- 1,3-Butadiene: human health aspects (No. 30, 2001)
- 2-Butoxyethanol (No. 10, 1998)
- Chloral hydrate (No. 25, 2000)
- Chlorinated naphthalenes (No. 34, 2001)
- Chlorine dioxide (No. 37, 2002)
- Crystalline silica, quartz (No. 24, 2000)
- Cumene (No. 18, 1999)
- 1,2-Diaminoethane (No. 15, 1999)
- 3,3'-Dichlorobenzidine (No. 2, 1998)
- 1,2-Dichloroethane (No. 1, 1998)
- 2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123) (No. 23, 2000)
- Diethylene glycol dimethyl ether (No. 41, 2002)
- *N,N*-Dimethylformamide (No. 31, 2001)
- Diphenylmethane diisocyanate (MDI) (No. 27, 2001)
- Ethylenediamine (No. 15, 1999)
- Ethylene glycol: environmental aspects (No. 22, 2000)
- Formaldehyde (No. 40, 2002)
- 2-Furaldehyde (No. 21, 2000)
- Limonene (No. 5, 1998)
- Manganese and its compounds (No. 12, 1999)
- *N*-Methyl-2-pyrrolidone (No. 35, 2001)
- Methyl and ethyl cyanoacrylates (No. 36, 2001)
- Methyl chloride (No. 28, 2001)
- Methyl methacrylate (No. 4, 1998)
- Mononitrophenols (No. 20, 2000)
- *N*-nitrosodimethylamine (No. 38, 2002)
- Phenylhydrazine (No. 19, 2000)
- *N*-Phenyl-1-naphthylamine (No. 9, 1998)
- 1,1,2,2-Tetrachloroethane (No. 3, 1998)
- 1,1,1,2-Tetrafluoroethane (No. 11, 1998)
- *o*-Toluidine (No. 7, 1998)
- Tributyltin oxide (No. 14, 1999)
- Triglycidyl isocyanurate (No. 8, 1998)
- Triphenyltin compounds (No. 13, 1999)
- Vanadium pentoxide and other inorganic vanadium compounds (No. 29, 2001)

It is clear that the CICADs are extremely valuable sources of information for anyone concerned with any aspect of chemical safety. They should be the first resource for valid, independently assessed information against which to judge the often poorly founded assertions made by those who have vested interests in exaggerating risks or in playing them down. Many of the CICADs are available on the IPCS Web site <www.inchem.org>. For those interested in the safe use of chemicals, this site contains a treasure chest of freely available information.

www.who.int/dsa/cicads.htm | **www.inchem.org**

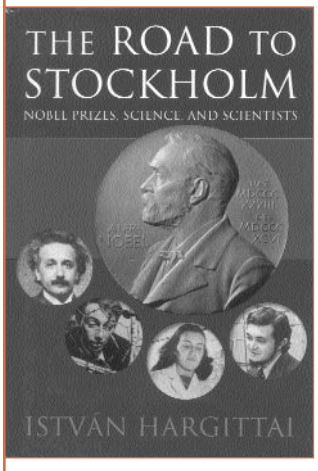
John H. Duffus < j.h.duffus@blueyonder.co.uk> worked at the Edinburgh Centre for Toxicology in Edinburgh, United Kingdom.

The Road to Stockholm: Nobel Prizes, Science and Scientists

István Hargittai, (Oxford University Press, Oxford, 2002, ISBN 0-19-850912-X) (xvii + 342 pp)

reviewed by Joel F. Liebman

Athough István Hargittai is an internationally recognized chemist, *The Road to Stockholm* is not about chemistry or science per se, but rather about scientists. It deals with the psychological and sociological issues that have led to professional greatness and the greatest institutional recognition a scientist can achieve (i.e., the Nobel Prize). Among such issues are the following: upbringing and the effects of deprivation and family strength; education and the role of mentoring and academic pedigree; culture, both national and religious; and competing demands, intellectual, emotional, political, economic, and societal.



The word "Road" in the title is well taken. The book commences with a foreword by Nobelist James D. Watson (co-awardee, Physiology or Medicine, 1962) that outlines some of his path—Hargittai amplifies this at considerable length throughout the book. It is these paths that fill much of this volume. There are many roads, even if not so labeled as I so choose to label them here. Quoting the poet, there's "the road less traveled," the special, unique, ignored observation, characterization, experiment, or insight. There's "the road to Damascus," the sudden epiphany or "Aha!" and spontaneous, instantaneous change of belief, action, or understanding. Recalling the comedian in "the Road to Mandalay," the gentle, joyous excursion and adventure that includes many serendipitous trips and seeming diversions. There is "the road to Rome," one of many but gets the traveler there fastest and first. Paraphrasing the cliché, "the road from perdition," the survival from dysfunctional families or from genocide. Asking the reader to pardon the reviewer's wordplay, there is "the Colossus of Rhodes," the sheer weight and power of achievement and activity.

We often tell our students that science, both idealized and practiced, is value free and crosses all cultures, languages, and backgrounds. Not so, Hargittai reminds us. National, religious, status, and gender issues have all contributed to winning the Nobel Prize—and not winning the prize. The final chapter is a poignant reminder that only three people can win the Nobel Prize in a given area in a given year, and so Hargittai discusses who did not win but could/should have (in other words, who was "robbed," to quote a non-recipient). The chapter also contains some prophecy on possible future recipients.

The book ends with four pages of acknowledgements (nearly a page and a half therein to Nobelists), 45 pages of notes (footnotes and references), two pages of citations to general reading, and 30 pages for the complete list of Nobelists and the associated citations in physics, chemistry, and physiology or medicine through 2001. Perhaps to underscore that the subject matter is the Nobel Prize and the scientists who won it—and some who didn't—and not the science itself, there is a 10-page name index, but there is no subject matter index. There are also some 80 photographs: two of the Nobel medal and the rest of the major persons who populate the book.

It is the reviewer's feeling that Hargittai has written an interesting and important book. *The Road to Stockholm* offers much insight and information to the reader—at the least, we are given a personalized view of scientists, their science, and the world we share.

Joel F. Liebman is professor of chemistry at the University of Maryland in Baltimore.

www.roadtostockholm.com

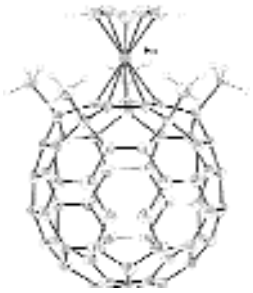
Organometallic Chemistry

by Jon McCleverty

The 20th International Conference on Organometallic Chemistry was held on the island of Corfu from 7 to 12 July 2002. The conference was so well attended—with more than 700 participants—that the original site, based in a traditional but modernized Corfiot conference village, proved too small and operations had to be moved to a large beach hotel. Despite this obvious complication, with its attendant transportation difficulties, the local organizers, coordinated by Professor K. Screttas, are to be congratulated for maintaining calm and good order, effective information, and friendly hospitality, while providing an excellent conference venue.

This international meeting is biennial, and in keeping with its long tradition, covers all of metal chemistry in the organometallic context. There were six plenary lectures, nearly 40 session lectures, and approximately 120 other oral contributions, supplemented by 430 posters. The chemistry covered areas as diverse as nanotechnology, homogeneous catalysis, optical properties, computational chemistry, and were directed in equal measure at fundamental and applied problems. This conference complements very well an IUPAC–sponsored conference held in Taipei in 2001 that covered organometallic chemistry directed towards organic synthesis.

Organometallic chemistry is now thought by some to be a relatively mature field. However, the combination of organic fragments with metals still continues to provide remarkable new compounds, and materials with remarkable chemical and physical properties. So many of the contributions revealed exciting and unexpected results, with accompanying challenges to accepted theory and potential for new applications. What is gratifying is the attendance of a large number of young chemists—proof that the field continues to attract among the best of chemical talent.

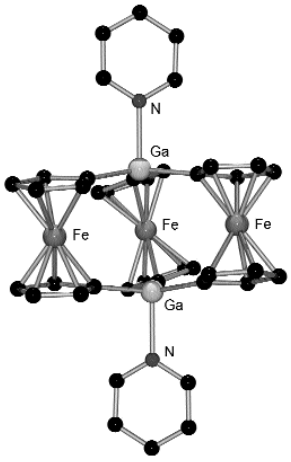


Structure of "bucky ferrocene" presented by plenary lecturer Eiichi Nakamura (University of Tokyo, Japan) in his lecture titled *"The chemistry of η^5-Fullerene Metal Complexes."*

The advisors and organizers of this meeting did a fine job in putting together such an excellent program. The 20th ICOMC will long be remembered as a stimulating and informative conference set in a delightful location.

A selection of lectures from the conference will appear in *Pure and Applied Chemistry*, with Professor Screttas acting as conference editor.

Jon McCleverty is a professor at the University of Bristol, United Kingdom. As an IUPAC fellow, he also acted as IUPAC representative at the 20th ICOMC.



$[\{Fe(C_5H_4)_2\}_3(Ga{\cdot}NC5H5)_2]$
The picture shows three ferrocene-1,1'-diyl units which are linked by two gallium centers to give a carousel structure. The donor-free skeleton is a potential building block in supramolecular chemistry . Presented by plenary lecturer Peter Jutzi (University of Bielefeld, Germany).

Electrical Properties of Polymers and More

by Jung-Il Jin

The 9th International Conference on Electrical and Related Properties of Polymers and Other Organic Solids (ERPOS) was held in the beautiful city of Prague, Czech Republic, from 14 to 18 July 2002. The opening ceremony was held in the afternoon of 14 July in the Carolinum, a historic building of the Charles University in the center of the Old Town. The symposium itself was held from 15 to 18 July in the auditorium of the Institute of Macromolecular Chemistry (IMC) at the Academy of Sciences of the Czech Republic, located in Heyrovskeho.

The opening ceremony began with a welcoming speech to all participants from Professor S. Nespurek, the conference chairman. This was followed by speeches by Professor J. Sworakowski, a member of the International Advisory Board, and myself acting as IUPAC Representative. Professor J. Pfleger, the conference cochairman, led the opening ceremony and introduced the details and itinerary of the symposium program.

Opening lectures were given by Professors H. Inokuchi (Japan) and N. Karl (Germany). Inokuchi pre-

sented an excellent review of 50 years of history in organic conductors. Karl delivered an illuminating and critical review of recent progress in organic field-effect transistors. The excursion through the historic rooms of the Carolinum after the two opening lectures helped participants wash out the tiredness accumulated by the long flight from Seoul to Prague; not to mention all the food and wine served afterwards during the welcome reception.

On the morning of 15 July, Professor K. Ulbrich, director of IMC, delivered a welcoming address before the technical session began. Ulbrich mentioned that this particular meeting was a combination of the 9th International Conference on ERPOS and the 21st Discussion Conference of the Prague Meeting on Macromolecules. He pointed out this was the 62nd Prague Meeting on Macromolecules—testament to how deeply rooted IMC is in the history of polymer science.

In addition, there were 10 main lectures, 25 special lectures, and 90 poster presentations. The list of the main lectures gives a glimpse of the major topics of the conference:

- Z. G. Soos and E. V. Tsiper (USA), Polarization Energies, Transport Gap, and Charge Transfer States of Organic Molecular Crystals
- H.Bässler et al. (Germany), Exciton Dissociation in Conjugated Polymers
- J. Zyss (France), Steering Molecules by Light: From NonLinear Optics (NLO) as a Goal to NLO as a Tool
- D. Haarer et al. (Germany), Charge Carrier Generation and Transport in Photorefractive Applications
- J. Kalinowski (Poland), Recombination Radiation from Organic Solids
- N. S. Sariciftci (Austria), Conjugated Polymer Based Solar Cells
- C. Flytzanice (France), Nonlinear Chiro-Optical Activity in Chiral Organic Molecular Complexes and Polymers
- J.-M. Nunzi et al. (France), Optical Structuring of Plastic Materials for Electronics
- M. Iwamoto (Japan), Interfacial Phenomena in Organic Polymer Films and the Generation of Maxwell Displacement Current
- J.-I. Jin et al. (Korea), Luminescence Properties of Novel PPV Derivatives and Low-Molar Mass Molecules Bearing Carbazole and Oxadiazole Moieties

(From left) Professors A. Miniewicz, J. Sworakowski, S. Nespurek (chairman), J. -I. Jin (IUPAC representative), H. Inoguchi, N. Karl, and J. Pfleger (cochairman) in front of the historic Carolinum building of Charles University in Prague during the opening day of the conference.

All of the oral presentations were very high in scientific quality; the discussions that followed often times were very heated. The scientific quality of poster presentations also was very high. In particular, the panel discussion on "From Molecular Crystals to Polymers and Single Molecules," led by R. W. Munn (UK), J. Sworakowski (Poland), and R. M. Metzger (USA) brought up the importance of research cooperation among the scientists in different disciplines. It was concluded that a conference such as this could catalyze interdisciplinary research coworks that could result in scientifically, as well as technically, more significant contributions. Different approaches being taken among the scientists in different branches also were critically discussed. Such a panel discussion is very important in developing directions not only for research, but also for future conferences.

The excursion to the 15th-century Sychrov Castle and the 11th-century Detenice Chateau was memorable. The concert of the Telleman Quartet in the chateau concert hall took the participants to a different, more humane, and relaxing moment for a while. The informal dinner in the castle restaurant was another unforgettable experience.

The closing ceremony was held 18 July right after the 25th Special Lecture by G. Juska (Lithuania). At this time it was announced that the next meeting (10th International Conference of ERPOS) would be held in 2005 in Angers, France. Jean-Michel Nunzi (Université d'Angers, France) will be the organizer of the meeting.

The 9th conference was attended by 126 participants from 24 countries; just the right size and mix for this kind of conference on interdisciplinary research topics. The organization was superb and the meeting went as scheduled without a single interruption. Most of the credit for the success of this conference should go to Stanislav Nespurek, Jiri Pfleger, and their colleagues at the Institute of Macromolecular Chemistry.

Jung-Il Jin is professor at the Korea University in Seoul, Korea, and vice president of the IUPAC Macromolecular Division.

Polymer Networks

by Robert F. T. Stepto

Polymer Networks 2002, the 16th Polymer Networks Group Meeting, was held 2 to 6 September 2002 in Autrans, France, near Grenoble. It was organized under the auspices of IUPAC by the Polymer Networks Group, the Centre National de la Recherche Scientifique, and the Université Joseph Fourier de Grenoble. Ninety-seven active participants, of whom 20 were students, attended the conference. Notably, the conferees came from 22 countries, showing the worldwide appeal of this specialized conference.

The conference chairman was Professor Erik Geissler of the Laboratoire de Spectrométrie Physique at the Université Joseph Fourier de Grenoble. Financial support was gratefully received from the Ministère de la Recherche, France, the Commissariat à l'Energie Atomique, the Université Joseph Fourier de Grenoble, the Centre National de la Recherche Scientifique, the Région Rhône-Alpes, and Nestlé, Switzerland.

The conference was held in the Maeva Centre at Autrans, a purpose-built conference center in beautiful surroundings in the Vercors National Park. The conference facilities, accommodations, and catering were excellent. The social program included a musical evening in Autrans village church, with an outstanding performance of Mozart, Grieg, Mendelssohn, and Ravel by the Armaiti wind quintet. The program for accompanying persons consisted of a trip through the spectacular Gorges de la Bourne, with a visit to the Grottes de Choranche, and to the picturesque town of Pont en Royans.

The conference was one of a series of biennial conferences organized primarily by the Polymer Networks Group. It maintained the tradition of presenting papers of a high standard on subjects of present-day importance and future potential, combining both fundamental studies and applications. Indeed, the main theme of the meeting was Functional Networks and Gels. The conference program consisted of 13 main lectures (40 minutes), 30 lectures (20 minutes), and two poster sessions, covering 57 posters.

The conference began with two main lectures: Eric Amis (NIST, USA) on Combinatorial Chemistry Applied to Polymer Systems and M. W. Husseini (Université Louis Pasteur, Strasbourg) on Molecular Tectonics as Building Blocks for Solid Polymeric Materials. The functional network topics were varied, covering amphiphilic, high-swelling networks for use as super-absorbing materials; the encapsulation of magnetic and conducting moieties in networks; the biological application of reversible physical gels; and the biomedical drug-release applications of microgels and nanogels, and thermally and pH responsive hydrogels. There were also contributions on filled and nanocomposite polymer network materials and the formation and properties of thermally reversible gels. The conference contained fundamental experimental, theoretical, and modelling papers on the behavior of gels at interfaces, microgels, polymeric network coatings, polymerization and network formation, swelling in gels, and optical properties of polymer networks.

The posters were of an excellent standard and reflected the wide range of topics of the lectures. Importantly, student registrants presented most of the posters and the discussions at the poster sessions were very lively.

Refereed papers from the lectures and posters will be published in a forthcoming volume of *Macromolecular Symposia*. The next meeting in the series, Polymer Networks 2004, will be organized by Eric Amis and Ferenc Horkay and will be held at the National Institutes of Health, Bethesda, Maryland, USA.

Robert F. T. Stepto is a professor at the University of Manchester, United Kingdom, and is president of the IUPAC Macromolecular Division.

16th International Symposium on Plasma Chemistry

22–27 June 2003, Taormina, Italy

ISPC is a biennial international conference with topics encompassing the whole area of plasma chemistry. The aim of the symposium is to present the recent progress in plasma chemistry and its applications. The symposium will be organized into plenary lectures, parallel oral sessions (invited and contributed presentations), and poster sessions. The whole area of plasma processing will be covered, from thermal to nonequilibrium plasmas, and from fundamentals to applications and engineering. In particular, the following sessions are being planned:

- fundamentals of plasma-surface interactions
- gas-phase plasma diagnostics
- modelling in plasma chemistry
- non-equilibrium effects in plasma chemistry
- plasma sources
- plasma processing for microelectronics
- PECVD/treatment of semi-conductors and related materials
- plasma deposition of inorganic and hard coatings
- plasma deposition and treatment of polymers
- clusters, particles, and powders
- plasma chemical synthesis
- plasma spray and thermal plasma material processing
- hybrid plasma/radiation processes

Contributions are solicited in application areas such as biomaterials, waste treatment, barrier and protective coatings, dielectric barrier discharges, plasma welding, microelectronics, hard coatings, ophthalmics, tribology, and others.

The symposium will also include a plasma equipment exhibition and will be preceded by two IUPAC summer schools. The IUPAC Summer Schools on Plasma Chemistry, to be held 18–20 June 2003, are addressed to graduate students, scientists, technical staff, and managers interested in an updated view of modern plasma applications. The schools are as follows:

Thermal Plasma Processing of Materials (Chaired by Professor P. Fauchais, University of Limoges, France), which will cover the following: introduction, overview of industrial plasma processes, thermal plasma thermodynamic and transport properties, plasma generation, plasma characterization, plasma as a processing medium (interaction with a gas, interaction with a condensed material, and interaction with a dispersed medium).

Cold Plasma Processing of Materials (Chaired by Professor R. d'Agostino, University of Bari, Italy), which will cover the following: fundamentals, plasma chemistry of deposition treatment and etching processes, reactor architecture, properties of PECVD coatings and plasma treated surfaces, plasma diagnostics, surface diagnostics, applications of plasma processed materials.

One additional School on Plasma Processes for Microelectronics (Chaired by Professor F. Fracassi, University of Bari, Italy) will also be organized prior to the symposium. This course will cover the most important issues related to dry etching and plasma enhanced chemical vapor deposition, with particular consideration of new and envisaged processes utilized in semiconductor manufacturing. The school is particularly suggested for process engineers, technical staff, and managers in microelectronics.

See Calendar on page 30 for contact information

www.ispc16.org

XVII Mendeleev Congress on General and Applied Chemistry

21–26 September 2003, Kazan, Russia

Mendeleev Congress on General and Applied Chemistry usually takes place every five years and is the most prestigious national meeting of Russian chemists. The Ist Mendeleev Congress on General and Applied Chemistry was held in St. Petersburg in 1907 and was dedicated to the memory of D. I. Mendeleev. The XVI Mendeleev Congress on General and Applied Chemistry took place in St. Petersburg in 1998 and was dedicated to 250 years of chemistry research in Russia. The XVII Mendeleev Congress, which will be presided over by Professor Oleg M. Nefedov, will be held in Kazan, a famous scientific, industrial, and cultural center on the banks of the Volga where the East meets the West. Kazan is a nearly thousand-year old city considered to be a cradle of Russian organic chemistry.

The main goals of the congress are to (i) determine how to develop chemistry, chemical technology, and chemical education; (ii) integrate academic, applied, and university science; (iii) discuss how to use chemistry to solve important economic, ecological, and social problems; (vi) examine the urgent problems and prospects of chemical science; and (vii) broaden interdisciplinary and international co-operation.

The scientific program will cover the following areas:

- Chemical science: the most important achievements and prospects for high technologies and advanced materials
- Supramolecular chemistry and nanomaterials
- Advanced materials
- Chemistry and environmental problems; analysis and control of environmental objects
- Energy and resource saving chemical technologies
- Chemical aspects of the life science
- Chemical informatics
- New instrumental methods in chemistry
- Problems of chemical education
- History and achievements of Russian chemists

Approximately 1500 scientific participants are expected to attend the Congress.

The following meetings will be held within the framework of the congress:

- Russian-American Symposium on Chemical Education
- VII International Conference on Chemistry of Carbenes and Related Intermediates
- Symposium dedicated to the centenary of chromatography discovered by M. S. Zvet
- Roundtable Discussion on "State and Development of Chemical Science in the Former Soviet Union Countries"

Important Dates:

Deadline for Registration Forms and Submission of Abstracts, 1 March 2003

Deadline for Advance Registration fees, 1 June 2003

See Conference Calendar for contact information

www to be announced

Second International Conference on New Biomedical Materials

5–8 April 2003, Cardiff, Wales, United Kingdom

This conference will bring together scientists who have contributed numerous innovative and exciting advances in the field of biomedical materials. Diverse topics will be covered including studies of cell interactions with biomaterials. The assessment of the potential applications for the development of new biomaterials, tissue engineering, and future medical devices and biosensors will be discussed. It will also provide an opportunity to discuss the latest developments in the field and the vision for the future. By linking basic and applied research together this conference is aimed at the stimulation of activity and research on biomedical materials. The interdisciplinary nature of the conference will encourage scientific interchange and cross-fertilization of ideas.

Topics to be covered include:

1 The Need: orthopaedic applications; cardiovascular applications; haemocompatible materials; extracorporeal systems; artificial organs, wound dressings; drug delivery, dental and oral healthcare, and biosensors
2 Basic Research Studies: cell interactions with surfaces, such as bones, polymers; cells involved in wound healing cell movement; cell interactions with other cells; molecular recognition, peptide mimicry; drug delivery, surface plasmon resonance studies; atomic force microscopy; and vibrational spectroscopy
3 Applied Research Studies: bone research; cement; hip replacements; hearing aids; cardiovascular; wound dressings, new smart materials, artificial organs, and biosensors

Contact Information:

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www.appsci.dmu.ac.uk/biomat

Mark Your Calendar

Upcoming IUPAC-sponsored events
See also www.iupac.org/symposia
for links to specific event Web site

2003

6–10 January 2003 • Polymer Characterization • Denton, Texas, USA
11th Annual Course on Polymer Characterization and 11th POLYCHAR World Forum on Polymer Applications and Theory
Dr. Witold Brostow, Department of Materials Science, University of North Texas, Denton, TX 76203-5310, USA, Fax: +1 940 565 4824, E-mail: polychar@marta.phys.unt.edu

6–7 February 2003 • Clinical Laboratory • Barcelona, Spain
2nd European Symposium on Clinical Laboratory and In Vitro Diagnostic Industry
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 7546, E-mail: xfa@csub.scs.es

17–21 February 2003 • Flow Analysis • Geelong, Australia
9th International Conference on Flow Analysis
Prof. Ian McKelvie, Monash University, School of Chemistry, PO Box 23, Victoria, 3800, Australia, Tel.: +61 3 9905 4558, Fax: +61 3 9905 4196, E-mail: ian.mckelvie@sci.monash.edu.au

10–12 March 2003 • Heterocyclic Chemistry • Florida, USA
4th Florida Heterocyclic Conference, Gainesville
Prof. Alan R. Katritzky, University of Florida, Dept. of Chemistry, PO Box 117200 Gainesville, FL 32611, USA, Tel.: +1 352 392 0554, Fax: +1 352 392 9199, E-mail: katritzky@chem.ufl.edu

14–17 April 2003 • Polymer Properties • Mpumalanga, South Africa
6th Annual UNESCO School & IUPAC Conference on Polymer Properties (with a special session on Characterization on Polyolefins)
Prof. R.D. Sanderson, UNESCO Associated Centre for Macromolecules and Materials Institute forPolymers Science, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa, Tel.: +27 21 808 3174, Fax: +27 21 808 4967, E-mail: rds@sun.ac.za

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

19–23 May 2003 • High Temperature Materials • Tokyo, Japan
11th International Conference on High Temperature Materials Chemistry (HTMC XI)
Prof. Michio Yamawaki, University of Tokyo, Department of Quantum Engineering and Systems Science, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan, Tel.: +81 3 5841 7422, Fax: +81 3 5841 8633, E-mail: yamawaki@q.t.u-tokyo.ac.jp

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

22–27 June 2003 • Plasma Chemistry • Taormina, Italy
16th International Symposium on Plasma Chemistry
Prof. R. d'Agostino, Department of Chemistry, University of Bari, via Orabona 4, I-70126 Bari, Italy,
Tel.: +39 080 5442080, Fax: +39 080 5443405, E-mail: dgrc01ch@chimica.uniba.it or info@ispc16.org

30 June – 4 July 2003 • Ionic Polymerization • Boston, USA
International Symposium on Ionic Polymerization
Prof. R.P. Quirk, Department of Polymer Science, The University of Akron, Akron, OH 44325-3909, USA
Tel.: +1 330 972 7510, Fax: +1 330 972 5290, E-mail: quirk@polymer.uakron.edu

6–10 July 2003 • Organo-Metallic Chemistry • Toronto, Canada
12th IUPAC International Symposium on Organo-Metallic Chemistry Directed Towards Organic Synthesis (OMCOS-12)
Prof. Mark Lautens, Department of Chemistry, University of Toronto, Toronto, ON M5S 3H6, Canada
Tel: +1 416 978 6031, E-mail: mlautens@chem.utoronto.ca

7–10 July 2003 • Analytical Chemistry • Gaborone, Botswana
Inaugural Conference for the Southern and Eastern Africa Network of Analytical Chemists (SEANAC)
Dr. Nelson Torto, Department of Chemistry, University of Botswana, P/Bag UB 00704 Gaborone, Botswana
Tel: +267 355 2502, Fax: +256 355 2836, E-mail: seanac@mopipi.ub.bw

21–24 July 2003 • Spectroscopy of Macromolecular Systems • Prague, Czech Republic
22nd Discussion Conference of P.M.M. on Spectroscopy of Partially Ordered Macromolecular Systems
Dr. Drahomir Vyprachticky, Institute of Macromolecular Chemistry, Academy of Sciences of the
Czech Republic, Heyrovskeho nam. 2, CZ-162 06 Praha 6, Czech Republic, Tel.: +420 2 204 03251,
Fax: +420 2 353 57981, E-mail: sympo@imc.cas.cz

9–17 August 2003 • IUPAC 42nd General Assembly • Ottawa, Canada
UPAC Secretariat, Tel.: +1 919 485 8700, Fax: +1 919 485 8706, E-mail: secretariat@iupac.org

10–15 August 2003 • IUPAC 39th Congress • Ottawa, Canada
Chemistry at the Interfaces
Conference Management Office, National Research Council Canada, 1200 Montreal Road, Building M-19,
Ottawa, ON, Canada K1A 0R6, Tel.: +1 613 993 0414, Fax: +1 613 993 7250, E-mail: iupac2003@nrc.ca

7–12 September 2003 • Colloquium Spectroscopicum Internationale • Granada, Spain
33rd Colloquium Spectroscopicum Internationale 2003
Prof. Alfredo Sanz-Medel, Department of Physical and Analytical Chemistry, University of Oviedo,
C/Julian Claveria, 8, E-33006 Oviedo, Spain, Tel.: +34 985 103474, Fax: +34 985 103125,
E-mail: asm@sauron.quimica.uniovi.es

10–15 September 2003 • Organic Chemistry • Cavtat-Dubrovnik, Croatia
13th European Symposium on Organic Chemistry (ESOC-13)
Prof. Vitomir Sunjiic, Ruder Boskovic Institute, Division of Organic Chemistry and Biochemistry
PO Box 180, HR-10002 Zagreb, Croatia, Tel: +385 1 4571 300, Fax: +385 1 4571 30, E-mail: esoc13@irb.hr

Mark Your Calendar

21–26 September 2003 • General and Applied Chemistry • Kazan, Tatarstan, Russia
XVII Mendeleev Congress on General and Applied Chemistry
Prof. Alexander I. Konovalov, A.E. Arbuzov Institute of Organic and Physical Chemistry, Kazan Scientific Center of Russian Academy of Sciences Arbuzov Str., 8, Kazan 420088, Tatarstan, Russia, Tel.: +7 (8432) 739 365, Fax: +7 (8432) 752 253, E-mail: arbuzov@iopc.knc.ru

15–18 October 2003 • Medicinal Chemistry • Krakow, Poland
Polish-Hungarian-German-Italian Joint Meeting on Medicinal Chemistry
Prof. Zdzislaw Chilmonczyk, Drug Institute, Chemska 30/34, PL-00-725 Warsaw, Poland, Tel.: +48 22 851 52 29, E-mail: chilmon@il.waw.pl

2 0 0 4

11–15 May 2004 • Mycotoxins and Phycotoxins • Maryland, USA
11th International Symposium on Mycotoxins and Phycotoxins (ISMP-11)
Dr. Douglas Park, Food and Drug Administration, CFSAN, 200 C Street, SW, Washington, DC 20204, USA, E-mail: dpark@cfsan.fda.gov

4–9 July 2004 • Phosphorus Chemistry • Birmingham, England
16th International Conference on Phosphorus Chemistry (ICPC 16)
Prof. Pascal Metivier, Rhodia, R&D for Phosphorous and Performance Derivatives, Oak House, reeds Crescent, Watford, WD24 4QP, UK, Tel.: +44 1923 485609, E-mail: pascal.metivier@eu.rhodia.com

17–22 October 2004 • Biotechnology • Santiago, Chile
12th International Biotechnology Symposium
Prof. Juan A. Asenjo, Centre for Biochemical Engineering and Biotechnology, University of Chile, Beauchef 861, Santiago, Chile, Tel.: +56 2 6784288, Fax: +56 2 6991084, E-mail: juasenjo@cec.uchile.cl or IBS2004@conicyt.cl

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

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 to 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.

International Union of Pure and Applied Chemistry (IUPAC)

Advancing the worldwide role of chemistry for the benefit of Mankind.

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Bulgarian Academy of Sciences *(Bulgaria)*
National Research Council of Canada *(Canada)*
Sociedad Chilena de Química *(Chile)*
Chinese Chemical Society *(China)*
Chemical Society located in Taipei *(China)*
Croatian Chemical Society *(Croatia)*
Czech National Committee for Chemistry *(Czech Republic)*
Den Kongelige Danske Videnskabernes Selskab *(Denmark)*
National Committee for IUPAC *(Egypt)*
Suomen Kemian Seura *(Finland)*
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Deutscher Zentralausschuss für Chemie *(Germany)*
Association of Greek Chemists *(Greece)*
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Consiglio Nazionale delle Ricerche *(Italy)*
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Korean Chemical Society *(Korea)*
Kuwait Chemical Society *(Kuwait)*
Koninklijke Nederlandse Chemische Vereniging *(Netherlands)*
Royal Society of New Zealand *(New Zealand)*
Norsk Kjemisk Selskap *(Norway)*
Chemical Society of Pakistan *(Pakistan)*
Polska Akademia Nauk *(Poland)*
Sociedade Portuguese de Química *(Portugal)*
Colegio de Químicos de Puerto Rico *(Puerto Rico)*
Russian Academy of Sciences *(Russia)*
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