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International Union of Pure and
Applied Chemistry (IUPAC)

CHEMISTRY International

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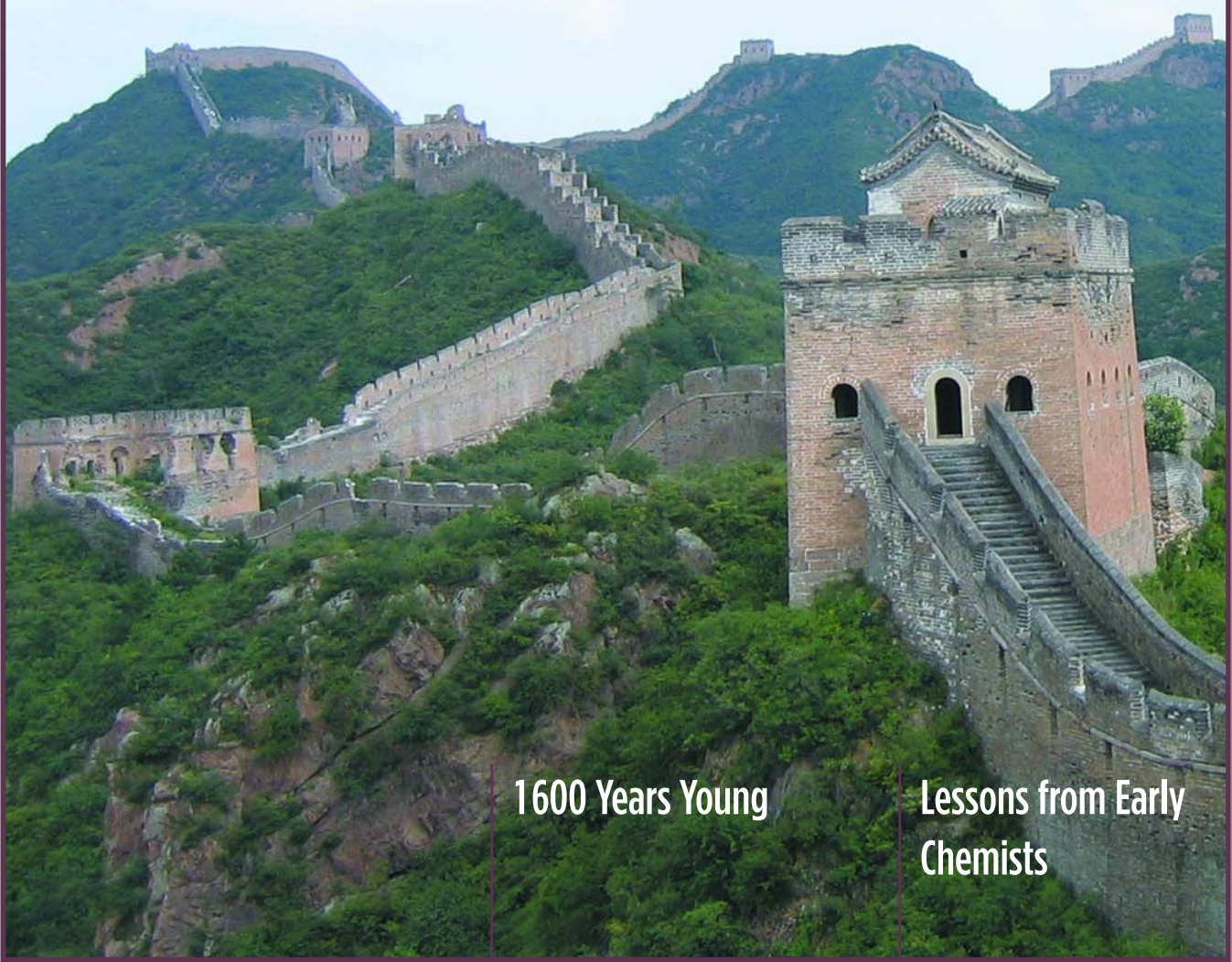
Echoes from Beijing

A Wrap-Up of the 43rd IUPAC General Assembly



1600 Years Young

Lessons from Early Chemists

CHEMISTRY International

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

www.iupac.org/publications/ci

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From the Editor

For IUPAC, its members, and governing bodies, the biennial event that is the General Assembly is a major activity. While the schedule is packed with all sorts of committees meetings, workshops, and task groups, the GA is most of all a unique opportunity for attendees to meet with hundreds of chemists from all over the globe. They make up the IUPAC network and come to the GA serving many different functions, but all with the same goals of creating a better world.

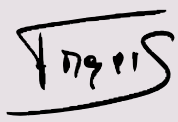
For example, this past August a chemist from Kenya traveled to Beijing as a fellow of the Safety Training program to share with the Committee on Chemistry and Industry his experience as a safety officer in a chemical plant. A task group with fellows from Austria, Belgium, Denmark, and Australia met relentlessly for days over issues related to metrological traceability. Scientists from the world over held a lively discussion to identify IUPAC's niche in improving public understanding of chemistry. Young observers from Brazil, Canada, Chile, France, India, Russia, Turkey, UK, and USA participated in various committee meetings. The Union Officers—currently from Norway, Canada, South Africa, Australia, and Switzerland—convened with as many groups as possible to grasp the state of IUPAC affairs. And finally, delegates from 45 countries and observers from a few more gathered for the Council meeting.

In Beijing: IUPAC President Leiv Sydnes (center) with IUPAC staffers Fabienne Meyers (left), Paul LeClair, Enid Weatherwax, Erin Carter, and Chris Brouwer, CI *Production Editor.*

The GA is not like any other conference; it is a place where scientists meet not thinking about their own research, but about how they can help promote the norms, values, standards, and ethics of the science, which, according to IUPAC's Mission, is what IUPAC is all about.

In this issue of *CI* and the next, you will find accounts from some of the meetings held during the GA and the World Chemistry Congress, organized concurrently by the Chinese Chemical Society and the Institute of Chemistry of the Chinese Academy of Science. It is not extensive coverage, but it will hopefully give a flavor of what happened in Beijing this past August under the IUPAC banner.

The GA and Congress provide an opportunity for the IUPAC family to build special relationships with the local hosts and they help involve the scientific community in that region in IUPAC activities. For that reason, IUPAC is eager to rotate the leadership of the Congress and move the events to various locations around the world. In recent years, the GA/Congress was held in Brisbane, Australia (2001), and in Ottawa, Canada (2003). In August 2007, the GA/Congress will be held in Torino, Italy, and two years later, in Glasgow, Scotland. Hope to see you there!



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CHEMISTRY International November-December 2005 Volume 27 No. 6

Reflections at the End of a Presidency

by Leiv K. Sydnes

As my term as IUPAC president comes to a close, it is natural to reflect upon what has been achieved in the current biennium. Two observations predominate: The Union has improved its performance in several areas and maintains its position as a reliable, nongovernmental organization on the international scene, and secondly, the membership still has to learn to use IUPAC more actively to secure global involvement in its operations.

A most encouraging development within IUPAC during the current biennium is the improved performance of the project system. As pointed out by Vice President Bryan Henry in his Critical Assessment, "the range of projects now covers the whole gamut of chemistry from chemical education, critically evaluated databases, and precise and reliable atomic weights, to the political arenas of chemical disarmament, sustainable development, meeting the needs of developing countries, the requirements of chemical industry, and a plethora of other areas." This is quite noteworthy considering the fact that the project system was fully introduced during the 2002–2003 biennium. Four years have now passed, and it is remarkable that the vice president's critical examination concludes that "the project system is functioning very well, perhaps even better than expected."

In this context it is also important to note that the approval process of recommendations has become faster, and the backlog in the pipeline of the Interdivisional Committee on Terminology, Nomenclature and Symbols has virtually disappeared. The final reports have therefore become available faster in *Pure and Applied Chemistry* (*PAC*) and improved the formal dissemination of the results of a significant part of our scientific activity.

But our pride should not stop here. Let me also point out that our outreach material has been improved in the current biennium and has helped increase the Union's profile. It has been very stimulating to follow the development of this publication and observe that *CI* appears much more interesting and attractive than before. This is partly due to a refreshing layout and talented use of colors, but also because the range and diversity of topics have grown. Another rewarding process has been the rewriting and design brush-up of our brochure portfolio, which now appears more attractive and far more relevant. But let us not regard the current portfolio as our ultimate information material; I therefore urge you to read and review it carefully and, subsequently, let us know what you think.

It is IUPAC's mission to advance the worldwide aspects of the chemical sciences and contribute to the application of chemistry in the service of Mankind. Thus, it is important that the Union addresses global issues, of which water-quality issues are among the most urgent. It is, therefore, quite encouraging that IUPAC has a number of projects addressing these important issues. Several projects are devoted to validation of data and methods of importance in water analysis. Furthermore, the Chemistry and the Environment Division has a project on evaluation of remote sensing techniques for real-time control of the quality of surface water. And we have several projects devoted to arsenic contamination of water, which was thoroughly addressed at CHEMRAWN XV, "Chemistry for Water," in Paris last year. A number of action items were identified, and these are currently being implemented.

IUPAC has also become deeply involved with issues of sustainability, sponsoring conferences on "Green Chemistry" and "Innovative Industrial Processes to Prevent Water Pollution." Within IUPAC this work is carried out under the umbrella of the Subcommittee on Green Chemistry, and encompasses a variety of disciplines of fundamental chemistry. So far, most projects have focused on the development of chemistry that improves the efficiency of chemical processes *and* reduces the formation of hazardous waste. In this way IUPAC assists the chemistry-related industry in its contribution to sustainable development, wealth creation, and improvements in the quality of life.

Another important global issue is chemical weapons. In 2001, IUPAC was called on to provide advice to the Organization for the Prohibition of Chemical Weapons (OPCW) on the impact of scientific advances on the Chemical Weapons Convention.

We must have fulfilled OPCW's expectations, because at the end of last year they invited us to engage IUPAC experts in a joint project, aimed at increasing awareness of the Convention in the scientific community, enhancing knowledge about its key provisions and requirements, facilitating the integration of issues related to the Convention into chemistry teaching, and promoting the professional conduct of chemists and chemical engineers in line with the Convention. A successful workshop was held in the beginning of July 2005 in Oxford, with significant involvement from IUPAC chemists. The workshop report is currently being drafted and will hopefully be available at the end of this year.

In today's media-sensitive societies, rating, standing, and reputation are important issues to consider. In doing so we realize that the chemical enterprise suffers from a dubious public image. Chemicals are so often associated with bad things happening that the presence of chemicals in products and processes are frequently denied. And the positive contributions from chemistry and chemical engineering are barely communicated. For everybody engaged in any of the chemical sciences, this is of course frustrating. This situation is a significant challenge, which industrial and chemical organizations on an individual basis have made efforts to meet by presenting a balanced picture of the benefits and risks involved. Considering the low return on all these efforts, it has been suggested that a range of coordinated activities should be developed and implemented under the IUPAC umbrella, because IUPAC has a global reputation of providing authoritative and unbiased information in the field of chemistry. Ideas along this line have been explored, but IUPAC has not yet managed to deliver as expected in this field. A thorough analysis of the situation was recently produced, with the aim of defining and developing an appropriate niche for IUPAC involvement in the promotion of public understanding of chemistry. This valuable document, which was discussed at the General Assembly in Beijing, will help guide the Union as it formulates a plan of action.

Any successful international organization is characterized by active internal communication. It is not easy to achieve this, and to maintain a vivid internal interaction is a challenge. That was clearly spelled out at the General Assembly in Ottawa in 2003, and it was agreed that IUPAC had to improve in this respect. It is therefore a pity that no improvements in the traditional internal communication have been observed in the current biennium; It is still true that the written correspondence with the 45 National Adhering Organizations (NAOs) is characterized by a low reply percentage (typically four to five replies). Against this backdrop, it has been relatively encouraging to follow the implementation of the Union Advisory Committee. The members of the committee have been kept informed by e-mail and several significant matters have been referred for comments, and feedback. To say that the response has been good would be an exaggeration, but it is encouraging to see that the reply frequency has been more than twice what was achieved when comments were solicited from the NAOs. And the frequency is increasing. It is therefore reasonable to believe that when the UAC has functioned for a longer period of time, the communication between the IUPAC leadership and the member countries will have improved.

Any successful international organization is characterized by active internal communication. It is not easy to achieve this, and to maintain a vivid internal interaction is a challenge.

Finally, I would like to say a few words about IUPAC conferences and symposia. Due to their high scientific quality, these meetings are generally highly regarded and very well attended. However, a strange characteristic of most of these meetings is the absence of active promotion of IUPAC. That is really a pity, and all of us should do what we can to rectify the situation by trying to facilitate the proper presentation at meetings of relevant IUPAC recommendations, technical reports, and reports from task groups, and to discuss ideas for new projects. Perhaps such activities should become a prerequisite to receiving IUPAC endorsement?

In closing, let me thank all of you for having had the opportunity to serve the global chemical community. It has been inspiring to meet a large number of dedicated IUPAC chemists and most enjoyable to experience the service from the committed IUPAC staff. And when January 1st arrives, I wish our new President, Bryan Henry, and our new Vice President, Kazuko Matsumoto, the very best of luck! I am looking forward to being at your service as Past President!

Leiv K. Sydnes <leiv.sydnes@kj.uib.no> has been IUPAC president in the 2004–2005 biennium; he is a member of the Norwegian Chemical Society and professor at the University of Bergen.

A Wrap-Up of the General Assembly

IUPAC held its 43rd General Assembly in Beijing, China, from 12–21 August 2005. This was the first General Assembly to be held in China, or in Asia for that matter. At the Council meeting, Prof. Kazuko Matsumoto of Japan was elected vice president or president elect for 2006–2007. Upon stepping in as president in 2008, she will become the second president from Japan and the first woman president since the Union was established in 1919.

Over the 10 days of the GA, 411 registered participants from 52 countries took part in an intense and intricate schedule of various committee and division meetings and events. Among the highlights of the gathering were a compelling World Chemistry Leadership Meeting that focused on "Chemistry in Asia," a joint meeting of three committees to discuss IUPAC's role in furthering public understanding of chemistry, and an inspiring Safety Training Workshop featuring presentations by recent trainees.

At the Welcome Reception, on Saturday 13 August, IUPAC President Leiv Sydnes made his address on the state of the Union. The text of his address is available on the IUPAC Web site at <www.iupac.org/news/archives/2005/p_report_sydnes.html>. Following the address, IUPAC Secretary General David StC. Black introduced the recipients of the 2004 and 2005 IUPAC Prizes for Young Chemists and presented service recognition awards to the retiring division past presidents, division presidents, and standing committee chairmen. The president also awarded the 2005 IUPAC-Samsung Education Prize to Prof. Pavel Kratochvíl on behalf of the Postgrad-uate Course in Polymer Science at the Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic (see article in IUPAC Wire on page 17).

Jane Nyakang'o of the UNIDO National Cleaner Production Centre in Nairobi, Kenya, giving a presentation at the Safety Training Program Workshop.

President Elect Bryan Henry, Vice President Elect Kazuko Matsumoto, and Secretary General David StC. Black.

This year, Young Observers again participated in sessions of the GA. Following the same model used in 2003, IUPAC and the Canadian, USA, and UK National Adhering Organizations selected 24 chemists, with varied backgrounds and interests, from 9 countries: Brazil, Canada, Chile, France, India, Russia, Turkey, UK, and the USA. Their participation added vitality and a valuable perspective to the committee work in which they participated. In the past, several young observers have become directly involved in IUPAC.

Most of the GA was devoted to division and standing committee meetings, each of which spanned two days. Division Roundups on page 7 (and part II in the next *CI* issue) give brief accounts of these meetings.

On Tuesday 16 August, a joint meeting was held by the Committee on Chemistry Education (CCE), Committee on Chemistry and Industry (COCI), and the CHEMRAWN Committee to discuss public understanding of chemistry. The centerpiece of the three-hour meeting was the presentation of a preliminary report by Peter Mahaffy and his team on "Chemists and the Public: IUPAC's Role in Achieving Mutual Understanding." Mahaffy's forceful presentation —which focused on the constructive and destructive interactions between the general public and IUPAC's public—generated a great deal of discussion among the more than 50 people in attendance. As he explained, the purpose of the project was to ask where we got it right and what needs improvement. A more detailed article on this report and presentation will appear in a future issue of *CI*.

A stellar example of IUPAC's far-reaching impact was a workshop—held Wednesday 17 August and

organized by COCI—that brought together eight recent fellows of the Training Program for Safety and Environmental Protection to share their experiences and plans. Through this IUPAC activity, operated jointly with UNESCO and UNIDO, individuals responsible for safety and environmental protection in chemical plant operations and research facilities in developing countries are given free training at a major chemical facility. The fellows—who came from Egypt, Nigeria, Turkey, Kenya, and Uruguay—relayed inspiring stories of how they used their training to create safety programs in environments where safety is often a secondary consideration at best.

An important part of every GA is the World Chemistry Leadership Meeting, which brings together national and regional leaders from chemical societies, chemical industry federations, and other organizations to discuss current issues in chemistry that may have a potential international impact. The WCLMs are intended to provide a stimulus for future IUPAC involvement in issues where the Union is in a unique position to provide support to the chemical community. The focal point of the meeting was a well-received talk on "Chemistry in Asia" by Prof. Goverdhan Mehta of the Indian Institute of Science, Bangalore, India. Mehta's presentation, which gave a kick-start to a wide-ranging discussion, focused on the challenges and opportunities for chemistry in the century ahead. Among the issues he discussed were the strong interest in chemistry in Asia, the pivotal role for chemistry in sustainable development, environmental concerns related to chemical industry,

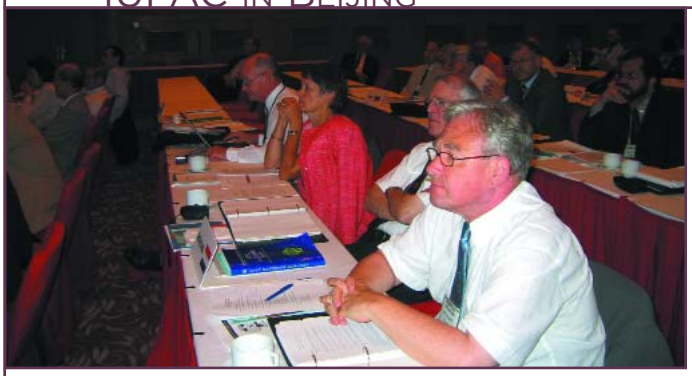
IUPAC President Leiv Sydnes (left) listens as Goverdhan Mehta answers questions after his talk at the World Chemistry Leadership Meeting.

Asia's growing share of chemical trade, and the surging growth in chemistry research in Asia.

The last two days of the GA, 20 and 21 August, were set aside for the Council meeting. One function of the Council is to elect the officers and members of the Bureau. As noted above, the Council elected Kazuko Matsumoto as vice president. A full professor at Waseda University in Tokyo since 1989, Matsumoto will become president in 2008. Within IUPAC, she has been a titular member on the Analytical Chemistry Division (2002–2005). In Japan, she is a member of the chemistry division of the Science Council of Japan, the Engineering Academy of Japan, and the Council for Science and Technology Policy, cabinet office.

The Council also elected the following individuals to be members of the Bureau for the 2006–2009

Service recognition awards were presented to retiring division past presidents, division presidents, and standing committee chairmen (from left): Robert Stepto (Division IV), Anders Kallner (VII), Peter Atkins (CCE), David Moore (V), Werner Klein (VI), Piet Steyn (IUPAC Past President), Gerd Rosenblatt (II), Kip Powell (V) , and Ron Weir (I).



The Dutch delegation at the Council meeting.

term: Chunli Bai (China, *reelected*), Srinivasan Chandrasekaran (India, *reelected*), Stanislaw Penczek (Poland), Elsa Reichmanis (USA), Alan Smith (UK, *reelected*), and Maria van Dam-Mieras (The Netherlands). The following elected members of the Bureau were appointed to the Executive Committee: Chunli Bai (China), Nicole Moreau (France), and Oleg Nefedov (Russia).

The Council rejected a proposal to begin the process of revising the statutes and bylaws to enable the eventual replacement of the Bureau and Executive Committees with an Executive Board. A number of delegations voiced strong opposition to the measure, primarily because they felt it would disenfranchise the division presidents. In light of the outcome, Vice President Henry announced his intention to create an ad hoc committee to revise the Bylaws and a second committee to examine ways to improve the operational efficiency of IUPAC governance.

In other matters, Council approved National Adhering Organization status for the Caribbean Academy of Sciences–Jamaica Chapter, Jordanian Chemical Society, National Academy of Sciences of Ukraine, and the National Academy of Sciences of Belarus. Council approved the suspension of NAO status for those NAOs who have not paid their 2003 and earlier National Subscriptions by 31 December 2005, until such time as the 2003 and earlier National Subscriptions are paid.

Council also approved the Standing Order and Membership of the Editorial Advisory Board of *Pure and Applied Chemistry*. The Bureau proposed and the Council approved a motion that the official language of IUPAC continue to be English. The final act of the Council was to approve the proposal from the Royal Society of Chemistry to hold the 2009 Congress and General Assembly in Glasgow, Scotland.

An interesting diversion at the GA was an exhibit called "The Project Place," which illustrated how IUPAC takes a leadership role in addressing global issues involving every aspect of chemistry. Attendees were able to sample the flavor of IUPAC activities displayed in 40 posters set up on level 2 of the convention center. The exhibit demonstrated how most of the work IUPAC does is channeled through the project system, which utilizes expert volunteers all over the world. If you missed the display in Beijing, it is now online at <www.iupac.org/symposia/conferences/ga05/posters.html> and each poster is also accessible from its corresponding project page.

General Assembly attendees peruse the Project Place posters.

The Project Place was situated so that attendees of the 40th IUPAC Congress could browse the exhibit. Held concurrently from August 14–19, the World Chemistry Congress was organized around the theme "Innovation in Chemistry." The Congress, organized by the Chinese Chemical Society and the Institute of Chemistry of the Chinese Academy of Sciences, was held in the same building as the GA, which allowed GA participants to also attend sessions of the Congress. The Congress itself attracted approximately 1100 attendees from around the world, with large representations from China and other Asian countries.

Coverage of the IUPAC World Chemistry Congress will appear in the Jan.-Feb. 2006 *CI* issue

Division Roundups

Division I. Physical and Biophysical Chemistry
Ron D. Weir, President

Much of the Division I meeting was devoted to reviewing the division's busy biennium. Of the 30 projects that were active at some point between 2004–2005, 6 have been completed, 7 are interdivisional and continuing, and 17 others are ongoing. The titular members of the division were joined at their meetings by four young observers, two from the UK and two from the USA.

The division's pilot project on Evaluation of Kinetic Data for Atmospheric Chemistry (1999-037-2-100) has proved to be very successfully and was the focus of extended discussions. The primary objective of this project was to make IUPAC's evaluated kinetic database available on the Web so that researchers, and any others with an interest in atmospheric pollution, could access it easily. The Web site for the database <www.iupac-kinetic.ch.cam.ac.uk> generates more than 4000 accesses per week and there are now 370 subscribers to the service. These are increasing at the rate of about 10% annually. The success of this project points the way for other databases within the IUPAC project system.

It was pointed out that when the information in the database has appeared in printed journal format, it has resulted in high numbers of references. One such paper that was published in 1997 had 432 references in 89 journals, and a more recent one published in 2000 had 74 references in 26 journals.

Another project reviewed was the revised version of the so-called Green Book, *Quantities, Units and Symbols in Physical Chemistry*, and its various appendices. Arrangements are being made for the finalization of the publication according to IUPAC guidelines, with a plan for publication in 2006.

Following the division elections during spring 2005 and subsequent appointments confirmed at the meetings, there are now 22 division representatives: 10 titular members, 6 associate members, and 6 national representatives. In addition, there are three titular members and seven national representatives on Commission I.1 on Physicochemical Symbols, Terminology, and Units. These scientists and engineers are from 24 different countries and represent almost all of the subject specialities that are the responsibility of Division I.

Division II. Inorganic Chemistry
Anthony R. West, President

Division II reported it had a successful two-day meeting in which members were optimistic about the future and determined to put behind them a tumultuous period in which the division had "bottomed out." Average attendance at the meetings was 16, with several young observers who stayed throughout and contributed significantly to the discussions.

Five new project proposals were discussed; two are ready for submission and should effectively use up the remainder of the division allocation for this biennium. Three more need working up, two in molecules and one in materials, for the next biennium. One of the molecules projects may become a joint project with the Committee on Chemistry Education. Several of the young observers (Russia, UK, USA) are keen to become involved with this project. A sixth project proposal is being presented by a former young observer, now the German national representative, to the interdivisional subcommittee on materials chemistry. This is likely to become a cross-division project on terminology in nanomaterials and nanotechnology and may still be submitted within this biennium.

With elections taking place in September 2005 for four titular members, the division is poised to move in new directions. During his presentation to the Council, Division President Tony West exclaimed, "We are just scratching the surface of materials chemistry. IUPAC can do much more."

Commission II.1. Isotopic Abundances and Atomic Weights
Michael E. Wieser, Secretary

The Commission on Isotopic Abundances and Atomic Weights met for two days of evaluations and discussions under the chairmanship of Prof. Tiping Ding. As well as the normal scientific work of the commission, considerable discussion also took place on ways to make the information produced by the commission of greater value to the wider chemical and scientific community.

As presented in detail in the Wire section on page 18, the standard atomic weights of 16 chemical elements have been revised based on new determinations of isotopic abundances and reviews of previous isotopic abundances and atomic masses.

The Subcommittee on Isotopic Abundance Measurements (SIAM) evaluated published isotope abundance data in order to determine the "best meas-

urements." This task has become increasingly important with the emergence of new analytical techniques that enable the analyst to produce isotope-amount ratio measurements to very high precision. The challenge is to ensure that the uncertainty calculations that lead to the standard atomic weights are consistent. Therefore, members of the isotopic composition of selected elements project are developing systematic and comprehensive evaluation criteria to account for systematic uncertainties during sample preparation and measurement. SIAM also recognizes that the user community is in need of isotopic composition data. In response, project members are developing a database that presents the evaluated isotopic compositions, range of variation of isotopic composition, and the atomic weight as decided by the commission. These evaluation tools are of immediate use to SIAM and will be a fundamental component of its work as the subcommittee incorporates the outcomes of the report on the isotopic compositions of the elements project.

Differences in measured isotope-amount ratios of stable carbon isotopes ($^{13}C/^{12}C$), commonly called delta carbon-13 values, are used to understand processes in oceanography, atmospheric sciences, biology, paleoclimatology, geology, environmental sciences, and food and drug authentication. Progress in these fields requires smaller measurement uncertainties to be achieved. Advances in instrumentation enable increasingly precise measurements. Nevertheless, laboratories measuring the same specimen often disagree by 10 times their reported "uncertainty" of measurement.

The commission recommends that delta carbon-13 values of all carbon-bearing materials be measured and expressed relative to the VPDB on a scale normalized by assigning values of -46.6 parts per thousand relative to L-SVEC lithium carbonate and +1.95 parts per thousand relative to NBS 19 calcium carbonate, and authors should clearly state so in their reports.

Authors are encouraged to report their delta measurement results for the carbon-13 values of NBS 22 oil, USGS41 L-glutamic acid, IAEA CH 6 sucrose, or other internationally distributed reference materials, as appropriate for the measurement method concerned. Adoption of these guidelines should enable laboratories worldwide that are measuring the same sample to report delta carbon-13 values that agree with one another to within the measurement uncertainty.

The commission also formally recognized the significant contributions made by past commission members Dr. Steffen Peiser and Dr. John Gramlich, who both passed away in the past year.

Division IV. Polymer

Robert Stepto, President

Division IV had a successful and lively meeting with 35 people from 15 countries attending. It was the first meeting as the so-renamed Polymer Division. The division had last met in Paris in 2004 as the Macromolecular Division and the change of name reflects the expansion of its work to cover new polymer and polymer-based materials as well as the macromolecules used to form them.

Reports were received from the coordinators of various current projects. During this 2004–2005 biennium there were 14 new projects, 17 publications, and 11 conferences sponsored. The reports and the ensuing discussion at the meeting showed clearly that the organization and management of projects under the auspices of subcommittees, introduced gradually over the last four years, has been successful. It was therefore decided to go forward into the 2006-2007 biennium with five subcommittees:

- Polymer Terminology and Nomenclature
- Structure and Properties of Commercial Polymers
- Polymerization Kinetics and Processes
- Developing Polymer Materials
- Polymer Education

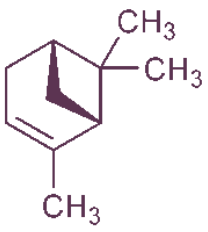
In addition to the subcommittees, projects on molecular characterization will continue to be run in an integrated manner and the successful program of actively seeking conferences to sponsor will continue. Amongst these, the memorable World Polymer Congress in Paris last year will be followed by the WPC Macro 2006 in Rio de Janeiro, 2008 in Taipei, and 2010 in Glasgow.

Elections were completed prior to the division meeting. Jung-Il Jin (Korea) was elected to become division president in January 2006, and Chris Ober (USA) was elected vice president.

Division VIII. Chemical Nomenclature and Structure Representation

Alan McNaught, President

At its meeting, Division VIII discussed a number of exciting developments. The most high-profile of these is the International Chemical Identifier (InChI), a software implementation of which was released in April 2005 and quickly generated a great deal of interest. The Identifier has been widely adopted by database providers and is being considered for use by patent offices in the UK and USA. A subsequent project for development of additional layers and for promotion is under way. The Identifier is thought to have the potential to revolutionize the way we communicate information about chemicals. An article on the project has since appeared in *Chemical & Engineering News* (22 August 2005 issue). Information about InChI is available at <www.iupac.org/inchi/>.



Take for example alpha-pinene—this compound might be known by its PIN (i.e. Preferred IUPAC Name) (1*S*,5*S*)-2,6,6-trimethylbicyclo[3.1.1]hept-2-ene, but our computers will recognize it by its InChI=1/C10H16/c1-7-4-5-8-6-9(7)10(8,2)3/h4,8-9H,5-6H2,1-3H3/t8-,9-/m1/s1.

In other news from the division, a number of publications will be released soon. A revised edition of the *Nomenclature of Inorganic Chemistry* should be in print by the end of the year (see Bookworm section, p. 25). A revised edition of the *Nomenclature of Organic Chemistry*, which also includes recommendations for selection of preferred names for organic compounds, has finished public review and review by ICTNS. Comments are being evaluated and appropriate revisions prepared. These revisions are to be reviewed by means of the division's webboard. Publication is expected in 2006.

In addition, a publication describing nomenclature recommendations for molecular rotaxanes is in the final stages of preparation and will soon be in the review process. Recommendations for graphical representation of stereochemical configuration have completed public review and are now being finalized. More general recommendations for graphical representation of chemical structures are in preparation.

CHEMRAWN

John M. Malin, Chairman

At the CHEMRAWN Committee meeting, 10 committee members and one observer participated. In addition, IUPAC Vice President Bryan Henry attended one session to explain some strategy issues of the Union and to participate in discussions.

The committee reviewed the results of the last conference, CHEMRAWN XV: Chemistry for Water, evaluating in particular the Bangladesh Workshop on water arsenic pollution that was carried out as a post-conference activity. Committee members stressed that CHEMRAWN should consider working with other divisions on future projects in this area because similar situations exist in many countries. The committee expressed appreciation for Raymond Hamelin's work in initiating and organizing this conference.

The committee also discussed upcoming conferences. In preparation for CHEMRAWN XII, a successful Workshop on Soil Fertility and African Food Supplies was held in Tanzania on 7 August 2004. The committee discussed the fact that CHEMRAWN XII still needs a clear financial supporter and that cooperation with other Union bodies is necessary to make the conference a success.

It was also announced that the location of CHEMRAWN XIII: Cleaner Energy has been changed from India to China. Given the present energy situation, the committee is eager to organize this conference. In addition, the proposed CHEMRAWN XVII: Greenhouse Gas Mitigation Strategies is planned for 8–12 July 2007 in Kingston, Ontario, Canada. The scientific committee (composed of 16 scientists) has started to prepare a detailed agenda, substantial preparatory work has already been completed, and some financial support has already been obtained.

Part 2 of the Division Roundups from the 2005 GA will appear in the next issue of *CI* (Jan.-Feb. 2006).

1600 Years Young

Thanks to its Enduring Corrosion Resistance, an Indian Historical Artifact's Appearance Belies its Age*

by Matthew V. Veazey

A distance of approximately 7 200 miles (11 587 km) may separate Troy, New York, USA, and Delhi, India, but the two cities share an important bond for Professor R. Balasubramaniam. While earning his doctorate in materials engineering at Troy-based Rensselaer Polytechnic Institute (RPI) in the 1980s, Balasubramaniam attended a seminar given by the eminent corrosion scientist Helmut Kaesche that discussed one of Delhi's most famous archeological landmarks. Having grown up in India, Balasubramaniam was familiar with Delhi's 24-ft (7.3-m)-tall pillar of iron that has remained largely free of rust since it was fabricated in approximately A.D. 400. However, he cites the Kaesche seminar as the source of his fascination with the artifact.

Returning to his homeland in 1990 to accept a materials and metallurgical engineering assistant professorship at the Indian Institute of Technology, Kanpur (IIT Kanpur), Balasubramaniam began his investigation of the Delhi Iron Pillar in earnest—apart from his other research activities. Specifically, he sought to determine why the pillar exhibits such remarkable resistance to atmospheric corrosion. After more than a decade of independent, self-funded research, he concludes that the property stems from the formation of a protective passive film on the pillar's surface.[1]

These photos show the upper and lower sections of the decorative bell capital atop the Delhi Iron Pillar. The different components were shrunk-fit around a hollow cylinder. Photos courtesy of R. Balasubramaniam, IIT Kanpur.

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A Major Artifact

Originally fabricated and erected 1 600 years ago at Udayagiri near the present-day city of Bhopal in central India, the pillar was relocated to the Quwwat-ul-Islam mosque in Delhi's Qutub Minar Complex approximately seven centuries ago. Constructed of rubble from earlier Hindu temples and now designated a World Heritage Site by the United Nations, the Quwwat-ul-Islam mosque is the first mosque built on the Indian subcontinent. The approximately six-tonne pillar was constructed during the Gupta Period (from A.D. 320 to 600), which is considered the golden age of Indian history.

"The Iron Pillar is considered a major artifact the world over," says Balasubramaniam, now a full professor at IIT Kanpur. "Historians and archeologists consider the pillar to be a very important object of Indian history. The oldest Sanskrit inscription is famous, and its interpretation is still extensively discussed in academic circles."

A Metallurgical Treasure

Balasubramaniam points out that scholarly fascination with the pillar is not limited to students of archeology and history. "Powder metallurgists claim [it] is a living example of an object manufactured by the powder metallurgical route," he says. "Corrosion scientists are aware of the remarkable corrosion resistance of the pillar."

Since the first such analysis in 1912,[2] researchers have estimated that the pillar's average composition is 0.15% carbon, 0.25% phosphorus, 0.005% sulfur, 0.05% silicon, 0.02% nitrogen, 0.05% manganese, 0.03% copper, 0.05% nickel, and the balance iron.[3] "Interestingly, a sample of Delhi pillar iron was subjected to microprobe analysis in order to determine the composition of the elements manganese, chromium, copper, and nickel in the near-surface regions," says Balasubramaniam. "It was found that the composition

of copper [0.05%], nickel [0.05%], manganese [0.07%], and chromium [nil] was uniform through several millimeters into the sample from the surface."[4]

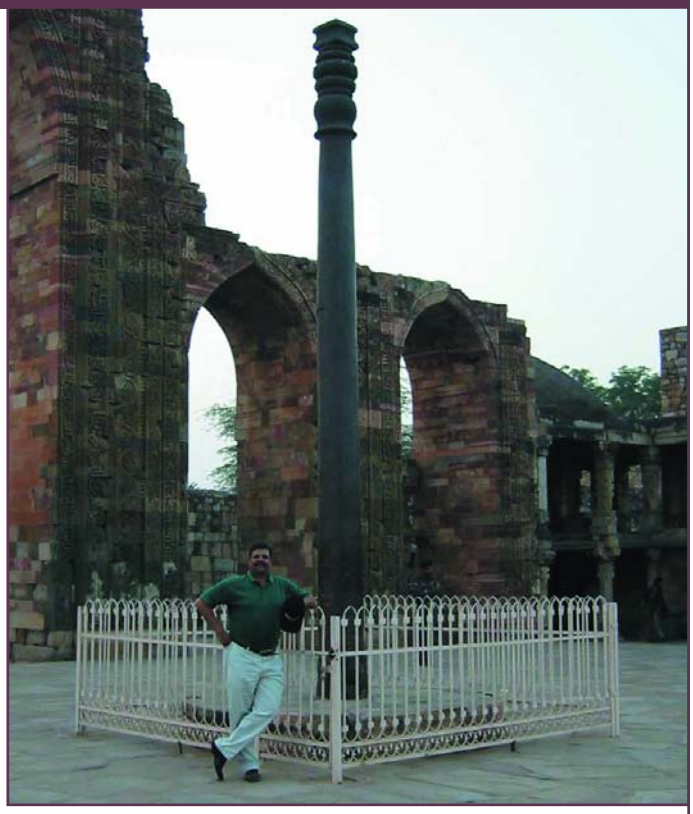
Balasubramaniam says that the pillar's high phosphorus content has kept it from rusting on a widespread basis. "The presence of phosphorus is crucial to the corrosion resistance," he notes, explaining that the phosphorus content is high because limestone was not used as a flux when the iron was extracted. "The absence of calcium oxide [CaO] in slags leads to a lower efficiency for removal of phosphorus from the metal, which invariably resulted in higher phosphorus content. Archeological evidence indicates that the ore for extracting the iron must have been carefully chosen so that a relatively high amount of phosphorus would result in the extracted metal."

Typical of ancient Indian irons, the microstructure of the pillar shows a wide variety of structures, says Balasubramaniam. He adds that the structures also prove the iron was obtained by the direct reduction process rather than casting. "The pillar is a solid body with good mechanical strength," notes Balasubramaniam. He points out that the yield strength is 23.5 tons (21 319 kg)/in^2 (645 mm^2), the ultimate tensile strength 23.9 tons (21 682 kg)/in^2, and elongation 5%.

Forge welding was the process used to manufacture the pillar. Balasubramaniam says that approximately 40- to 50-lb (18- to 23-kg) lumps of iron served as the raw materials. "Forge welding is an operation in which iron lumps were joined together by forging them in the hot state such that fusion is obtained between them," he explains. "Research has indicated that the pillar was manufactured with the pillar in the horizontal position, and the addition of lumps was from the side," he says. "The decorative bell capital is truly a marvelous example of blacksmithy and consists of seven distinct parts. These individual components were shrunk-fit around a hollow cylinder, which was joined to the main body by the aid of an insert."

Environment or Materials?

Balasubramaniam says that two general schools of thought exist to explain why the pillar exhibits superior corrosion resistance: the environment and materials theories. "The proponents of the environment theory state that the mild climate of Delhi is responsible for the corrosion resistance," he says, pointing out that the city's relative humidity (RH) does not exceed 70% for significant periods of time in a given year. "It is known that atmospheric rusting of iron is not significant for humidity levels less than 70%."



In this recent photo, materials engineer R. Balasubramaniam stands near the Delhi Iron Pillar. A new fence protects the base of the column from the large number of visitors to the site. Photo courtesy of R. Balasubramaniam, IIT Kanpur.

Advocates of the materials theory, to which Balasubramaniam subscribes, stress the construction material's role in determining corrosion resistance. "The ideas proposed in this regard are the relatively pure composition of the iron used, presence of phosphorus, and absence of sulfur [and] manganese in the iron, its slag particles, and formation of a protective passive film," he says. The passive film component of the theory stems from Balasubramaniam's research. "The large mass of the pillar also plays a contributory role," he adds.

Although the environment and materials camps comprise the two predominant sides of the debate, Balasubramaniam adds that the literature does feature other, less-widely held theories about the pillar's corrosion resistance. These suppositions include: initial exposure to an alkaline and ammoniacal environment; residual stresses resulting from the surface finishing (hammering) operation; freedom from sulfur contamination both in the metal and in the air; the "cinder theory," which holds that layers of cinder in the metal stop corrosion from advancing; and that surface treat-

ments of steam and slag and coatings of clarified butter were applied to the pillar after manufacture and during use, respectively. "The use of surface coatings is readily discounted because a freshly exposed surface attains the color of the rest of the pillar in about three years' time,"[5] says Balasubramaniam.

Balasubramaniam asserts that the low incidence of corrosion on ancient iron artifacts in more humid parts of India supports the materials theory. "That the material of construction may be the important factor in determining the corrosion resistance of ancient Indian iron is attested by the presence of ancient massive iron objects located in areas where the RH is high for significant periods of the year," he says. The Surya temple at Konarak, located near the Bay of Bengal, and the Mookambika temple in the Kodachadri Hills, which rise near the Arabian Sea, reportedly are two such locations. Balasubramaniam says that ancient iron beams at the Surya temple and an iron pillar at the Mookambika temple all are in very good shape despite their proximity to coastlines.

Protective Passive Film

Balasubramaniam cautions that the Delhi Iron Pillar does rust, but he adds that the passive rust is so protective and thin that it keeps the occurrence—and appearance—of corrosion at a minimum. Because the region just below the decorative bell capital is inaccessible to the public, rust from this location is the oldest undisturbed rust on the pillar. Consequently, Balasubramaniam and a colleague collected rust from this region and characterized it by X-ray diffraction, Fourier Transform Infrared spectroscopy, and Mössbauer spectroscopy.[6] Balasubramaniam says the inspections revealed that the rust contains amorphous iron oxyhydroxides (lepidocrocite [gamma-FeOOH], goethite [alpha-FeOOH], and delta-FeOOH) and magnetite. It also contains crystalline phosphates, including iron hydrogen phosphate hydrate ($FePO_4 \cdot H_3PO_4 \cdot 4H_2O$).

The 1 600-year-old Delhi Iron Pillar. Photo courtesy of R. Balasubramaniam, IIT Kanpur.

Balasubramaniam says that the rust layer becomes increasingly protective—and the rate of corrosion decreases—as its composition changes. "In the initial stages, the rust comprises lepidocrocite and goethite," he says. "These forms of rust do not offer excellent protection and, therefore, the rate of corrosion is still maintained on the high side. Conversion of part of this rust to magnetite does result in lower corrosion rates." However, he adds that cracks and pores in the rust allow oxygen to diffuse and complementary corrosion reactions to occur. "Moreover, reduction of lepidocrocite also contributes to the corrosion mechanism in atmospheric rusting," he says.

According to Balasubramaniam, the catalytic formation of delta-FeOOH initiates the Delhi Iron Pillar's enhanced corrosion resistance. "This phase is amorphous in nature and forms as an adherent compact layer next to the metal-scale interface," he says. "Its formation is catalyzed by the presence of phosphorus in the iron. Upon its formation, the corrosion resistance enhances significantly because delta-FeOOH forms a barrier between the rust and the metal." He says a similar mechanism is at work in weathering steels that contain copper and phosphorus.

"In the special case of Delhi pillar iron and in the general case of ancient Indian irons, the presence of significant amounts [greater than 0.1%] of phosphorus in the metal leads to further effects, which have a direct bearing on their corrosion resistance," says Balasubramaniam. "Due to the initial corrosion of metal, there is enhancement of phosphorus at the metal-scale interface. This phosphorus reacts with moisture, and conditions are created in the rust that are ideal for formation of phosphoric acid [H_3PO_4], which eventually leads to the precipitation of phosphates in the long term."

Balasubramaniam says that several phosphate formation reactions occur. Exposure conditions dictate the nature and type of these phosphates, which demonstrate an inhibitive nature and thus affect corrosion resistance. "Added benefits accrue when the phosphate forms as a continuous layer next to the metal," the researcher says. "In the case of alternate wetting and drying cycles [such as those present in atmospheric corrosion], the amorphous phosphates can transform to crystalline modifications, and in this process there is a large reduction in porosity in the phosphate. This transformation results in further excellent corrosion resistance properties."

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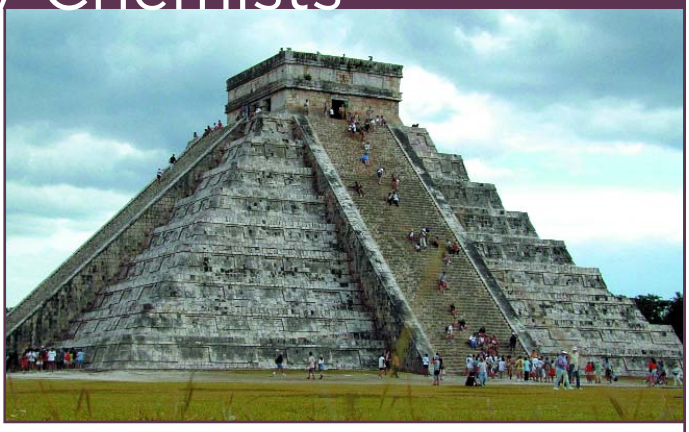
Where is there Wisdom to be Found in Ancient Materials Chemistry?*

by Philip Ball



The Mayan ziggurat at Chichen Itza is one of many technological triumphs of the Mesoamerican culture.

For its innovations in science and technology, the reputation of the Mayan culture is on the rise. The Mesoamerican culture that flourished in Mexico, Guatemala, and the surrounding regions between A.D. 200 and 1000 has been long known to have had a sophisticated understanding of astronomy and mathematics (including the concept of zero), and recently the ziggurat at Chichen Itza has been interpreted as an example of acoustic engineering that uses Bragg scattering from the steps to mimic the call of a sacred bird: a pre-Columbian photonic crystal.

Another technological triumph of the Maya is the extraordinary blue pigment used for murals, a material that still retains its azure brilliance after centuries of exposure to the elements. It has long been recognized to be a composite substance—a natural dye (indigo) mixed with clay—and recent work has shown that the indigo molecules form a highly stable surface complex with the aluminosilicate sheets of the clay, slotting away the organic substance within slit-like channels in the inorganic matrix and protecting it from acids and alkalis.[1] This trick has attracted interest from chemical companies as a way to make durable, metal-free, environmentally benign paints and coatings.

No one can suppress a twinge of envy when their rivals report an ingenious innovation that they wish they had thought of first, or the chagrin when their clever new material turns out to have been preempted five years ago in the patent literature. But when the ingenuity and foresight comes from a civilization that is several centuries old, scientists are invariably delighted. There is a satisfaction in the humbling discovery that the researchers of an earlier era knew much more than we thought.

The history of science is full of such "pre-discoveries" and demonstrations of antique virtuosity. Indeed, outside the laboratory it is a common complaint that our ancestors knew more than we do. Thomas Jefferson (not to mention Cicero) is invoked as witness to the modern degeneration of political rhetoric and discourse; some modernist paintings have begun to fade when the paint was scarcely dry, while Jan van Eyck's masterpieces from the 15th century remain as lustrous and vivid as ever.

No one, to my knowledge, has suggested that today's materials technologists are less able or informed than their historical predecessors. But there has been a recent cluster of instances in which modern methods have revealed fresh reasons for appreciating just how clever ancient artisans and technologists were. Introductions to nanotechnology often cite Michael Faraday's experiments with gold sols as the practical beginnings of the field, but colloidal gold, prepared from the alchemical aurum potabile made by dissolution of the metal in nitric and hydrochloric acids, goes back further than that. A recipe for the ruby-red solution is recorded in 1685 by the German glassmaker Andreas Cassius, and his contemporaries knew how to trap the glorious color ("Purple of Cassius") in silica glass. But that art was known even to the Romans, who made beautiful objects such as the fourth-century Lycurgus Cup (now in the British Museum). Like the recipe for the fabulous Tyrian purple dye, this secret was lost to the West with the fall of Rome.

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Nanotechnologists can now also claim ancestry among the potters of Renaissance Italy. The ceramic

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ware made in the Umbrian town of Deruta in the 15th and 16th centuries sported distinctive metallic and iridescent glazes that were shown a few years ago to contain nanoparticles of copper and silver.[2,3]

A recipe for these nanoparticulate glazes appears in the 16th-century handbook *Li tre libri dell'arte del vasaio* by the Italian artisan Cipriano Piccolpasso. It tells the potter to mix copper and silver salts with vinegar, ochre, and clay and apply them to the surface of already glazed pottery. The modern study shows that this was a delicate and precisely controlled process; for example, the ratio of Cu(I) to Cu(II) ions is crucial to the luster effect.

In part, such examples may come to light not so much through new information about what these historical technologists were doing, as by the emergence of a conceptual framework that makes a longknown technique seems suddenly like the anticipation of a new trend. The relative softness of lime-based mortars used for stonework until the 19th century could be seen as a defect relative to modern cement-based materials. But from the contemporary perspective of smart buildings, the older mortar can be viewed as adaptive, allowing a building to accommodate a degree of ground subsidence or of expansion caused by moisture absorption in freshly baked clay bricks. This benefit was, of course, fortuitous and barely appreciated in the past; now materials technologists are seeking such solutions by design.

Another historical "lesson"—this one, too, now embraced within the field of nanoparticulate technologies—was reported recently from the art of ancient metallurgy. Jonah Erlebacher and coworkers from the Johns Hopkins University drew on the experience of medieval and Incan goldsmiths to prepare gold membranes with nanoscale pores of controlled diameters, which might find uses in catalysis and separation technologies.[4]

The synthesis that Erlebacher and coworkers have developed is based on the ancient technique called depletion gilding, by which means objects made from gold alloy were given the appearance of pure gold. It was a good way to fake great wealth, although the value as a means of peddling counterfeit gold would have been limited: medieval goldsmiths knew well enough how to measure the density of metals using Archimedes' method.

In depletion gilding, an object made of a gold-silver or gold-copper alloy was treated with an etchant to remove the cheaper and less inert metal from the surface layer, leaving behind a microscopically porous layer of gold that was then smoothed and burnished. The etching was usually carried out with nitric acid, which was known in medieval Europe since at least the 13th century. Erlebacher and co-workers used this same etching process on commercial white-gold leaf (a 1:1 alloy of silver and gold) and found that because the process involves the dynamic migration of gold atoms rather than simple excavation of the other metal, the diameter of the resulting nanopores increases with increasing immersion time.

This sort of precise control of microstructure was, of course, totally irrelevant to medieval goldsmiths—not only were they ignorant of how the procedure worked, but they obliterated the porous texture during burnishing. All the same, the historical technique was the direct inspiration for the modern one: microstructural studies of depletion gilding in the 1960s and 1970s identified the bicontinuous "porous membrane" structure, which awakened the interest of Erlebacher and co-workers when viewed against the backdrop of a desire for precisely engineered nanoporous materials.

As in the case of the Mayan blue pigment, such convergence of new and old interests invites us to shower praise on the skills of the ancient technologists. There is nothing wrong with that. But the tendency to present such instances as examples of prescience is almost always misguided. This can result in crude and obvious anachronism, such as when an article of mine on the potters of Deruta was given the title (and I confess that I did not object at the time) "Renaissance Potters were Nanotechnologists." This simply has no meaning, in the same way that it is meaningless to say that, for instance, Tibetan devotional music is composed in a "minimalist" style. There is a critical difference between saying that tempering of iron with hammer and anvil modifies the distribution of dislocations and saying that medieval blacksmiths were defect engineers.

More insidious, however, is the kind of interpretation that attempts to forge links with contemporary science for the purposes of a positivist historical agenda. This was often done in the 19th century, and it resulted in, for example, the denigration of alchemy in the history of chemistry and the concomitant suppression of the alchemical interests of Newton and Boyle. It is still common to find the Copernican theory presented as an attempt at root-and- branch reform of astronomy, rather than as a practical method for simplifying astronomical calculations.

But as far as "materials culture" is concerned, there has been an equal tendency among some documenters of science history (I will not say "historians of science") to go to the opposite extreme: to deny that the inventiveness of the Mayans or the Egyptians or the alchemical artisans had anything to do with real science because it was produced by blind trial and error or mindless recipe-reading, without anything like a respectable theoretical framework to justify it. This is the position, for example, of British biologist Lewis Wolpert, who writes:

> Science produces ideas whereas technology results in the production of usable objects. Technology—by which I mean the practical arts—is very much older than science. Unaided by science, technology gave rise to the crafts of primitive man, such as agriculture and metal-working, the Chinese triumphs of engineering, Renaissance cathedrals, and even the steam engine. Not until the nineteenth century did science have an impact on technology.[5]

Not only does this turn into "non-science" huge swaths of what commonly passes for science today, but it evinces a contempt for any kind of historical perspective on science at all.

Thus, the high-resolution optical microscope did not suddenly make metallurgy a science—but it did, as Cyril Stanley Smith once pointed out, tell the metallurgist more about the history of that science (and art) than any documentary records could:

> Microstructures . . . instantly reveal to a knowing eye the technical history of making the object. Such records are in a universal language, and they are free from the distortion that inevitably accompanies passage through a human mind. Through such records, I have communicated with dozens of craftsmen, including a Luristan smith of 800 B.C., a bronze founder of Shang, China, an ancient Greek goldsmith, and a 13th-century Japanese swordsmith.[6]

Smith, one of the most accomplished translators of historical documents of materials culture, understood completely how one might acquire deep respect for the knowledge and skills of past cultures without forcing them into a 20th-century vessel. Technological innovation—one of the key components of science, and not an adjunct to it—has in the past relied on experimentation, but not aimlessly. If a theory stimulates experiment and careful observation, it surely does not detract from the "scientific" nature of that work if the theory proves later to be utterly wrong. (Vermilion, or artificial cinnabar, might well have been the product of the Islamic alchemists' sulfur-mercury theory of metals, which even provided quantitative, albeit incorrect, predictions for the amounts of sulfur and mercury required in the mix.)

But it would be wrong in any event to insist that experimentation should be grounded in rigorous theory before it deserves to be categorized as science. "Aesthetic curiosity," said Smith, "is the very root of all discovery . . . Discovery is art, not logic, and new discoveries have to be cherished for reasons that are far more like love than purpose."[7] Could it, after all, be anything other than love of their materials that enabled ancient craftspeople to make discoveries that we are only now, with our modern techniques and instruments, beginning to understand? Science was of no help to 19th-century French chemists when they attempted to reproduce the opalescent celadon and *Jun* glazes of Chinese potters of the Song dynasty (960–1279), with their "white clouds" glistening against a "blue sky."

Neither should we picture these ancient technologists throwing any old ingredients into the pot in a rapture of creative excitement. Modern combinatorial methods of materials discovery show how quickly the permutations of ingredients become overwhelming if concocted without any guiding intelligence. Illustrations of ancient Egyptian kiln design attest to the systematic nature of experiments that optimized firing conditions, while ancient and medieval artisans' manuals often record procedures with great care and quantitative detail. "[T]he most remarkable aspect of the chapters of Theophilus [in his medieval work *On Divers Arts*] on glass," writes materials scientist Ian Freestone, "is just how frequently and in what detail they prove accurate."[8] Some of these experimenters, at least, knew how to keep good laboratory notes and made thorough checks of how older recipes stood up in practical terms.

On top of all this, the feedback between experiment and outcome depended on the social context of the work. The Egyptian, Incan, and Western medieval artisans were prepared to devote so much effort to getting the right materials because their artifacts were mostly being made for religious and devotional purposes.

"Separation of aesthetics from technique, of tools from signs, of technofunction from sociofunction," said David Kingery, "is an artificial construct of scholars searching for a reductionist mode of analysis."[9]

Thus, we should continue to be inspired and delighted by the materials prowess of ancient cultures, but we should be wary of placing their achievements in a modern context. They made those things for themselves, not for us.

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1600 Years Young

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Following the "Beacon"

When viewed from a nonscientific standpoint, the Delhi Iron Pillar's ability to resist corrosion has often been called a "mystery." Balasubramaniam is quick to dismiss this response. "There is nothing mysterious about the iron pillar," he says. "The resistance to atmospheric corrosion is due to the presence of a relatively high amount of phosphorus in the pillar. The remarkable corrosion resistance can be understood by applying the basic principles of corrosion research." He adds that the direct reduction technique used to produce the iron is no mystery, either. "The ancient Indian ironmaking technology is well-known," he says. The established scientific facts notwithstanding, Balasubramaniam concedes that one feature of the pillar is difficult to explain. "There is one aspect that is not well-understood and this may be called a mystery, in one sense," he says. "This is the method by which the iron lumps were forge-welded to produce the massive six-tonne structure."

Mystery or not, the Delhi Iron Pillar serves as a guidepost for metallurgists in the 21st century and beyond, asserts Balasubramaniam. In fact, just as a seminar at RPI inspired him to study the pillar, he hopes that his research will motivate others to explore the potential uses of phosphorus-containing iron. "There are so many wonderful options available with phosphoric irons," he concludes, adding that the Iron-Phosphorus phase diagram deserves as much attention as the more popular Iron-Carbon phase diagram. "There is an exciting future in developing phosphoric irons, particularly for corrosion scientists and engineers.[7] The beacon of light showing the way to the future is the Delhi Iron Pillar, with its tested proof of corrosion resistance."

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Note: Balasubramaniam has compiled his entire body of research on different aspects of the Delhi Iron Pillar into a book titled *Delhi Iron Pillar: New Insights* (New Delhi, India: Aryan Books International, 2002). A separate paperback version written for a nontechnical audience, *Delhi Iron Pillar: A Metallurgical Marvel* (New Delhi, India: Foundation Books, 2005), will be published soon.

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IUPAC–Samsung Education Prize for 2005

At the opening ceremony of the 43rd IUPAC General Assembly, held in Beijing, China, in August 2005, IUPAC President Leiv Sydnes presented to Professor Pavel Kratochvíl the 2005 IUPAC-Samsung Education Prize for the Postgraduate Course in Polymer Science that he founded in 1996 at the Institute of Macromolecular Chemistry at the Academy of Sciences of the Czech Republic in Prague. Since its establishment, the course has acquired a worldwide reputation for its high standards and effective training of students in polymer science. The award of USD 5 000 is to assist a deserving student and will contribute to Samsung's goal of stimulating polymer education and research in the world.

The award is managed by the IUPAC Polymer Division Samsung Fund Committee and is part of the generous donation Samsung made to IUPAC in 2003 to help stimulate polymer education and research in the world.

From left: Bob Stepto (President of the Polymer Division), Pavel Kratochvil, Leiv Sydnes, and Jung-Il Jin (Vice President of the Polymer Division) pose after Kratochvíl accepted the IUPAC-Samsung Education Prize from IUPAC President Sydnes.

The Postgraduate Course in Polymer Science

On 21 July 2005, the ninth run of the UNESCO-IUPAC Postgraduate Course in Polymer Science was concluded by a public seminar, at which 9 graduates reported the results of their research carried out during their 10-month stays at the Institute of Macromolecular Chemistry at the Academy of Sciences of the Czech Republic in Prague, Czech Republic.

The institute, with a staff of 240 and more than 100 scientists, is one of the major centers of academic research in polymer science worldwide. For almost 40 years, the institute has been educating young scientists from countries with limited facilities for up-to-date research.

Course graduate Muhammad Shamsul Azim Khan, MS, from Bangladesh reports at the final seminar the results of his project "Synthesis of Functionalized Diphosphonic Acids for Surface Modification of Magnetic Oxides."

The present series of courses started in 1996 under the sponsorship of UNESCO. A few years later, IUPAC granted its sponsorship. The course is financed by the institute and academy, with occasional contributions from IUPAC or UNESCO. The course lasts 10 months and comprises about 50 hours of lectures in modern polymer science and also an introduction into the nomenclature and terminology recommended by IUPAC. However, the students spend most of their time in laboratories working on research projects under the guidance of senior scientists of the institute. They are also invited to participate in seminars, conferences, lectures of visiting scientists, and other educational activities within the institute.

At the final seminar after defending their reports, the students receive a certificate of graduation with UNESCO and IUPAC logos. Follow-up surveys with graduates have shown that the course has been very helpful to their professional promotion in their home countries. The institute continues to cooperate with a number of graduates through joint projects with their home laboratories.

So far, 72 young scientists from the following countries have graduated from the course: Bangladesh, Bulgaria, India, Kazakhstan, Poland, Romania, Russia, South Africa, Ukraine, and Uzbekistan. The results of students' research have been published in international technical journals and presented at conferences. As of May 2005, students have had 87 papers published in international journals and 91 contributions at international meetings.

The 10th course started in October 2005. The admission procedure for the 11th course, to be held in the academic year 2006–2007, will take place in March 2006.

www.iupac.org/projects/2003/2003-041-1-400.html

IUPAC-Richter Prize in Medicinal Chemistry

The IUPAC-Richter Prize in Medicinal Chemistry was established by a generous gift from the Chemical Works of Gedeon Richter, Ltd. (Budapest, Hungary) to acknowledge the key role that medicinal chemistry plays in improving human health. By establishing this prize jointly with IUPAC, Richter wishes to contribute to the international recognition of the role of research in medicinal chemistry, publicize the company's commitment to medicinal chemistry research, and further appreciation of IUPAC's activities.

The prize of USD 10 000 will be awarded to an internationally recognized scientist, preferably a medicinal chemist, whose activities or published accounts have made an outstanding contribution to the practice of medicinal chemistry or to an outstanding example of new drug discovery. The prize will be awarded biennially by a selection committee that will be appointed by the Subcommittee on Medicinal Chemistry and Drug Development of the IUPAC Chemistry and Human Health Division. The first prize will be awarded in 2006.

Gedeon Richter Ltd. is a major pharmaceutical company in Hungary and one of the largest in the Central-Eastern European region. Founded in 1901, the company has more than 100 years' experience in pharmaceutical manufacturing. The vertically integrated firm carries out research, development, manufacture, and marketing of human finished drugs, active substances, and intermediates. Gedeon Richter Ltd. has a growing presence through its commercial subsidiaries in key EU countries, the USA, and Japan. Two-thirds of its annual sales of 599 million USD in 2004 were exported to 80 countries (Russia, USA, EU, Japan, etc.). Production takes place at two sites in Hungary: Budapest and Dorog. The company also has production facilities in Poland, Russia, Romania, Ukraine, and India. The company manufactures about 100 kinds of pharmaceuticals in more than 170 presentations. Among its products are original, generic, and licensed preparations. The products cover numerous therapeutic areas, with special emphasis on the production and development of drugs for the central nervous system, as well as antiulcer agents, cardiovascular and gastrointestinal preparations, and oral contraceptives. Research into drugs of the central nervous system and development of generic products are of primary importance. Based on its traditional skills in steroid chemistry, the company is a significant player in the gynaecological field worldwide.

2006 Call for Nomination Deadline: 31 March 2006
For further information, please contact Professor C. Robin Ganellin at <c.r.ganellin@ucl.ac.uk> or visit <www.iupac.org/news/Richter_prize.html>.

Standard Atomic Weights Revised

Following its meeting, held 10-11 August 2005 at the 43rd IUPAC General Assembly, the Commission on Isotopic Abundances and Atomic Weights (II.1) released the changes to the standard atomic weights of 16 chemical elements. The following changes are based on new determinations of isotopic abundances and reviews of previous isotopic abundances and atomic masses:

	From	To
Aluminium	26.981 538 (2)	26.981 5386 (8)
Bismuth	208.980 38 (2)	208.980 40 (1)
Caesium	132.905 45 (2)	132.905 4519 (2)
Cobalt	58.933 200 (9)	58.933 195 (5)
Gold	196.966 55 (2)	196.966 569 (4)
Lanthanum	138.9055 (2)	138.905 47 (7)
Manganese	54.938 049 (9)	54.938 045 (5)
Neodymium	144.24 (3)	144.242 (3)
Phosphorus	30.973 761 (2)	30.973 762 (2)
Platinum	195.078 (2)	195.084 (9)
Samarium	150.36 (3)	150.36 (2)
Scandium	44.955 910 (8)	44.955 912 (6)
Sodium	22.989 770 (2)	22.989 769 28 (2)
Tantalum	180.9479 (1)	180.947 88 (2)
Terbium	158.925 34 (2)	158.925 35 (2)
Thorium	232.0381 (1)	232.038 06 (2)

These changes in the atomic weights will be published in a new Table of Standard Atomic Weights 2005, which will be submitted for publication in *Pure and Applied Chemistry* by the end of 2005. The commission also continued its review of publications of variations in the natural isotopic abundances. The commission also continued its review of publications of the variation in the natural isotopic abundances. For more details about the Commission meeting in Beijing, see Division Roundups on page 7.

For more information, contact Michael E. Wieser <mwieser@ucalgary.ca>, secretary of the IUPAC Commission on Isotopic Abundances and Atomic Weights.

New CAs Join IUPAC

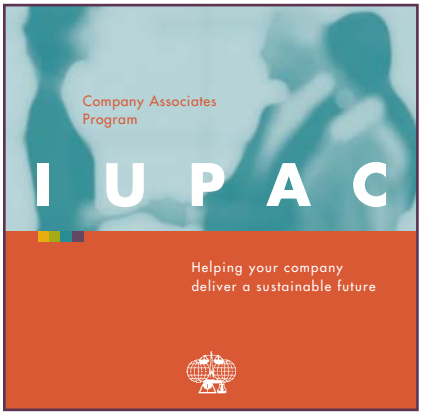
The Kuwait Chemical Society has embraced the challenge set by the IUPAC Committee on Chemistry and Industry (COCI) and has successfully engaged two industrial companies to join IUPAC as Company Associates (CAs):

- **Kuwait Catalyst Company (Shuaiba, Kuwait),** Contact: Mr. Ali A. Al-Othman <aliothman@kcc.kw.com>
- **Kuwait Cement Company (Safat, Kuwait),** Contact: Mr. Mohammad Omar Sayed <alcement@kuwait-cement.com>

Kuwaiti delegates Khalidah Al-Dalama (left) with Sameera Al-Houli at the IUPAC Council (Beijing, Aug 2005). Al-Dalama is a National Representative on COCI.

Last spring, COCI campaigned for the CA program and challenged its members to raise at least two new CAs. Khalidah Al-Dalama <kcs@kma.org.kw>, from the Kuwait Chemical Society (KSC) and National Representative on COCI, lost no time actively recruiting in her region.

Founded in 1982, the KCS has prominent activities on both the local and international levels. On the local level, it embraces, sponsors, and organizes meetings, workshops, and lectures in Kuwait in many fields that might be of interest to chemists, and other professionals, in cooperation with other public-serving societies and governmental or private sectors. It also sponsors other social activities that are enjoyed by its members. On the international level, delegations and representatives of the society have been attending major conferences and meetings, dealing with chemistry and chemical issues, that are organized or held by several international bodies in which the society is an active member.



For more information about the CA program or additional copies of the brochure, please contact the IUPAC Secretariat by e-mail <secretariat@iupac.org>.

IUPAC Poster Prizes Awarded in Denmark

Two IUPAC Poster Prizes were awarded at the annual meeting of the Danish Chemical Society, which was held 9 June 2005 at the University of Southern Denmark in Odense. Posters were presented from all of the Danish Universities by both students and professionals. Two student posters were selected to receive the prize. The first was presented by Stine Magnussen of the University of Southern Denmark, titled "Comparison of Volatile Organic Compound Measurements in Indoor and Outdoor Air in Austria and Denmark." The second was by Kristian Jensen of the University of Roskilde, titled "Methyl Cobalt(III) complexes-DNA Alkylating Agents?"

The meeting featured plenary lectures on topics such as "Chemistry and Climate, or Vice Versa," presented by Claus J. Nielsen of the Department of Chemistry at the University of Oslo, and "Molecular Gastronomy," by Thorvald Pedersen of the Royal Agricultural and Veterinary University.

The IUPAC Poster Prize Program

National Adhering Organizations and eligible IUPAC-sponsored conferences are encouraged to use the IUPAC Poster Prize program as a strategic tool to encourage interest in conferences among young chemists. The Poster Prizes recognize outstanding poster presentations at IUPAC Congresses, at IUPAC division/standing committee-sponsored conferences, and at designated national meeting. Each NAO may pick one conference a year at which to award IUPAC Poster Prizes. Please contact the Secretariat <secretariat@iupac.org> for more information and coordination details.

Fullerene Nomenclature—An Addendum to IUPAC History

A Letter from Stanley S. Brown

The note about fullerenes in the Sept.-Oct. 2005 *CI* (p. 28) prompts me to follow up on your feature in the previous issue, July-Aug. *CI* (pp. 10–12). I enjoyed your account of processing the IUPAC archives, having spent many hours with them at the Oxford Secretariat in preparing the *Supplement to the History of IUPAC 1988–1999*.

The penultimate draft of the supplement included a small section on fullerenes as follows:

> 11.6.4 Fullerene Nomenclature*
> Vice-President Bard, having expressed concern that the Union should take quicker action about nomenclature for newly emerging areas, and with the fullerenes in mind, promptly convened a Working Party, with input from the Commissions on Nomenclature of Inorganic Chemistry and of Organic Chemistry and from the Commission on High Temperature and Solid State Chemistry. He expressed the hope to the Executive Committee (Dublin, 1992) that the work could be undertaken by correspondence during 1992, together with one meeting in 1993, so that draft recommendations on nomenclature could be available within two years.
>
> Progress was duly reported to the Bureau (Oxford, 1992) and to the Executive Committee (Newark, 1993), and IDCNS acted swiftly to review the Working Party's draft recommendations. However, the Executive Committee (Oxford, 1994) and Bureau (Antwerp, 1994) learned that the American Chemical Society's Chemical Abstracts Service was already formulating a somewhat different approach to fullerene nomenclature. Strong efforts were made to harmonize the IUPAC and Chemical Abstracts approaches, but Past-President Bard had to admit to the Executive Committee (Reading, 1995) that his attempt to rapidly develop systematic fullerene nomenclature was a failed experiment. It was clear that IUPAC needed to act at the very earliest stages of newly emerging fields of chemistry. The Executive Committee (Oxford, 1996) recommended that revised recommendations from the Working Party should be published as an interim report, but this outcome was criticized in the Bureau (Oxford, 1996) as being the result of the ad hoc way in which the work had been initiated within the Union. Nevertheless, the Executive Committee (Jerusalem 1997) was advised that the project had been completed and a report was in press. The Committee agreed that future policy and procedures regarding chemical nomenclature should be included in topics to be addressed by the Strategy Development and Implementation Committee.

This section was edited out of the final script. It would surely be a pity if the background to the fullerene problem were to be overlooked!

*Section 11 is titled "Restructuring, Reorientation, Relocation: 1988-1999" and subsection 11.6 is titled "Nomenclature and Symbols."

Emerging Issues in Developing Countries

This series seeks to inform readers, explore new ideas, and promote discussion on themes related to developing countries and emerging analytical communities. Articles in this series are available from <www.iupac.org/publications/ci/indexes/emerging-issues.html>.

Natural Products, a Possibility for the R&D of Drugs for Developing Countries

by Antonio Monge

> *"You see things as they are and ask, 'Why?' I dream things as they never were and ask 'Why not?' " (George Bernard Shaw)*

Natural products of plant origin are of special importance to developing countries. Traditional medicine, which utilizes these compounds, is of great interest and very useful to societies in every continent. In these societies the inventors of therapeutic applications of a plant are not recognized as such. The work is seen as the result of the relationship of man with nature, which remains recorded in the collective knowledge and wisdom of the society. It also appears in the legacy of generations passed down to the men and women of today. Popular opinion makes it a part of the cultural heritage. Conservation of biodiversity and knowledge of the traditional native medicine have often been of seminal importance in the discovery of new drugs. Obviously, this conception differs greatly from the ideas held by developed societies. The ethical demand in the relationships between both parties makes the disconnection striking.

Scientists who research medicinal agents from natural products often encounter a problem that is not well resolved by political institutions and therefore has a deleterious effect on everyone involved, including native populations. The developing countries have the discovery, and the knowledge, but not the means to translate them into tangible products and businesses (i.e., to make a protected invention and bring the benefits back to their society).

Societies differ in what they consider to be common or sacred. It is evident that the first group is susceptible to being patented, while the second group is not. This is most important to keep in mind when dealing with natural products, of animal or plant origin, in the idiosyncrasy of native communities. Symbiotic relationships between man and nature are brought into play. Here, man forms an important part, even though he may depend on technology in order to establish the relationship. One such example is the relationship that can be established between traditional agriculture and the agriculture of today, in which work is carried out with modified seeds.

It is essential that we develop a mechanism to take into consideration the enormous quantity of captive knowledge in developing societies. This will only come to light if systems of recognition are facilitated, as was done previously for other societies when they were initiating their own development. One must keep in mind an important element: equity of treatment.

The system of patents in developed countries was not designed to protect community intellectual property or knowledge. There is no way to recognize such "inventions" in terms of an inventor and, hence, an owner of the invention. When a native community discovers, via spiritual healers, observation, or other methods, any given biological activity in a plant, it is very difficult to establish ownership. In this type of situation, it is not clear to whom recognition should be given; the numerous possibilities include the spiritual healers, the native community, and the country itself.

But when knowledge about a folk medicine is used as the basis of the development of a new drug, with a patentable structure and demonstrated activity, how should the developing society be recognized? The organization that turns such knowledge into a marketable product needs some form of incentive to carry out the development but they would seek to recover its costs (and make a profit) through patent protection. This requires the organization to reveal its discovery, which may or may not be a gain to society.

How do patents contribute indirectly to the common good? This may be a bit ambiguous and confusing, especially with regard to where the limit of the "common good" lies.

Every country has the right to development and especially to an education and to health care. However, health care is conditioned by the availability of medicines. In the invention, development, and production of medicinal agents—cornerstones of any society—no country can remain excluded; to do so would be to deny it the capacity to develop universal healthcare.

So how can a developing country gain from work

continued on page 22

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*.

JCAMP-DX for Electron Magnetic Resonance

In this document, we define a data exchange format initially formulated from discussions at the 35th Royal Society of Chemistry-ESR conference in Aberdeen 2002. The definition of this format is based on the IUPAC Joint Committee on Atomic and Molecular Physical Data Exchange (JCAMP-DX) protocols, which were developed for the exchange of infrared spectra and extended to chemical structures, nuclear magnetic resonance data, mass spectra and ion mobility spectra. This standard was further extended to cover year 2000 compatible date strings and good laboratory practice and the next release will cover the information needed for storing n-D data sets. The proposed recommendations aim at adapting JCAMP-DX to the special requirements for EMR, electron magnetic resonance.

Comments by 31 January 2006

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www.iupac.org/reports/provisional/abstract05/lancashire_310106.html

XML-Based IUPAC Standard for Experimental, Predicted, and Critically Evaluated Thermodynamic Property Data Storage and Capture (ThermoML)

ThermoML is an XML-based emerging IUPAC standard for storage and exchange of experimental, predicted, and critically evaluated thermophysical and thermochemical property data. The basic principles, scope, and description of all structural elements of ThermoML are discussed. ThermoML covers essentially all thermodynamic and transport property data (more than 120 properties) for pure compounds, multicomponent mixtures, and chemical reactions (including change-of-state and equilibrium reactions). Representations of all quantities related to the expression of uncertainty in ThermoML conform to the Guide to the Expression of Uncertainty in Measurement (GUM). The ThermoMLEquation schema for representation of fitted equations with ThermoML is also described and provided as Supporting Information together with specific formulations for several equations commonly used in the representation of thermodynamic and thermophysical properties. The role of ThermoML in global data communication processes is discussed. The text of a variety of data files (use cases) illustrating the ThermoML format for pure compounds, mixtures, and chemical reactions, as well as the complete ThermoML schema text, are provided as Supporting Information.

Comments by 31 January 2006

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www.iupac.org/reports/provisional/abstract05/frenkel_310106.html

continued from page 21

based on community knowledge? Should the patent be a partnership? Should it be licensed freely or are other models for recognition possible? At the very least, can arrangements be developed so that a developing country does not have to pay the patent premium to use the drugs based on their intellectual property.

The author wishes to thank the IUPAC Subcommittee on Medicinal Chemistry and Drug Development and former Medicinal Chemistry Section for their interesting contributions.

Antonio Monge <cifa@unav.es> is a professor of medicinal chemistry and director of Centro de Investigación en Farmacobiología Aplicada at the Universidad de Navarra, in Pamplona, Spain. He is a member of the IUPAC Subcommittee on Medicinal Chemistry and Drug Development.

Critical Evaluation of Stability Constants of Metal Complexes of Complexones for Biomedical and Environmental Applications (IUPAC Technical Report)

Giorgio Anderegg, Françoise Arnaud-Neu, Rita Delgado, Judith Felcman, and Konstantin Popov

Pure and Applied Chemistry
Vol. 77, No. 8, pp. 1445-1495 (2005)

This study involves evaluation of all reported proton and metal ion binding constants for the remaining commonly used complexones, and the identification of recommended values for use in chemical speciation calculations. Within these objectives, a priority was given to compounds of strong medical and environmental importance and to those (IDA and MIDA) that represent complex-forming fragments and decomposition products of higher denticity complexones.

Within a broad variety of applications, complexones have in common the regulation of metal concentrations in widely differing systems. Complexones are used in detergents, textile and paper processing, photographic developing solutions, scale solubilization in processing tanks, electroplating, and as components of agricultural micro-fertilizers. Annual industrial output of EDTA and other complexones in the thousands of tons.

This paper presents critical evaluations of available experimental data, published between 1945–2000, on stability constants of proton (hydron) and metal complexes for seven complexones of particular biomedical and environmental interest: iminodiacetic acid [2,2'-azanediyldiacetic acid, IDA], (methylimino)diacetic acid [2,2'-(methylazanediyl)diacetic acid, MIDA]; 2,2',2'',2'''-{[(carboxymethyl)azanediyl]bis[(ethane-1,2-diyl)nitrilo]}tetraacetic acid (DTPA), 3,6,9,12-tetrakis(carboxymethyl)-3,6,9,12-tetraazatetradecane dioic acid (TTHA); 2,2',2''-(1,4,7-triazonane-1,4,7-triyl)triacetic acid (NOTA); 2,2',2'',2'''-(1,4,7,10-tetraazacyclododecane-1,4,7,10-tetrayl)tetraacetic acid (DOTA); 2,2',2'',2'''-(1,4,8,11-tetraazacyclotetradecane-1,4,8,11-tetrayl)tetraacetic acid. Some typical errors in stability constant measurements for particular complexones are summarized. Higher quality data are selected and presented as "Rec-ommended" or "Provisional."

www.iupac.org/publications/pac/2005/7708/7708x1445.html

Round Robin Test on the Molecular Characterization of Epoxy Resins by Liquid Chromatography

Stepan Podzimek

International Journal of Polymer Analysis and Characterization
Vol. 9, No. 5-6, pp. 305-316 (2004)
DOI: 10.1080/10236660490935718

The great importance of epoxy resins originates from the wide range of applications in many industrial areas. However, only relatively primitive analytical tests are commonly used for routine characterization of epoxy resins. The simple characteristics are often unable to discriminate among different samples, to find structure versus properties relations, and to evaluate production reproducibility. Molar mass distribution of epoxy resins affects their application properties and can be also used as a sensitive measure of the reproducibility of the production.

The main objectives of this project were (i) to study the influence of experimental conditions, in particular the type and number of columns and column calibration, on the molar mass averages obtained by size exclusion chromatography (SEC), and (ii) to figure out attainable reproducibility of SEC results generated in different laboratories, and (iii) to compare SEC molar mass averages with those determined by the absolute methods. Since epoxy resins are typical examples of oligomers, most of the conclusions may be generally applicable to the analysis of other oligomers.

Two commercially available epoxy resins based on bisphenol A (2,2-bis(4-hydroxyphenyl)propane) of different molar mass distribution were selected for the Round Robin Test. The samples were characterized by vapor pressure osmometry (VPO), method of end groups (EG), multi-angle light scattering (MALS) in batch mode, and matrix assisted laser desorption ionization mass spectroscopy (MALDI-MS) to allow comparison of chromatographic results with the data from the absolute methods of molar mass determination.

www.iupac.org/projects/1999/1999-021-1-400.html

Organic Synthesis—*PAC* Special Topic Issue

Tamejiro Hiyama, Conference Editor
Pure and Applied Chemistry
Vol. 77, No. 7, pp. 1087–1296 (2005)

Professor Minoru Isobe (Nagoya University, conference cochair and president of the IUPAC Organic and Biomolecular Chemistry Division) and Professor J. Fraser Stoddart (UCLA, recipient of the Nagoya Gold Medal).

What is the future of organic synthesis? The invention of unprecedented drugs and materials has enriched and expanded the horizons of the human experience in formerly unimagined ways, and owes much to the ever-increasing ingenuity of organic synthesis, and recognition and attainment of new synthetic targets. The impact of organic synthesis on cognate disciplines and on general advancement of science and technology is definitely enormous and will be further strengthened by future challenges and opportunities.

The July 2005 issue of *PAC* is a collection of reviews and research papers based on lectures presented at the 15th International Conference on Organic Synthesis (ICOS-15), held in Nagoya, Japan, 1–6 August 2004, on the theme of organic synthesis. The papers capture the vitality and ongoing promise of organic synthesis, and offer readers an opportunity to participate vicariously in another milestone in its advancement.

A lecture program comprising 10 plenary and 20 invited presentations contributed to a truly exciting conference experience, and the 21 speakers who kindly agreed to contribute papers based upon their presentations have made it possible to capture some of the excitement in this issue of *PAC*.

The Nagoya Gold Medallist, J.F. Stoddart, used the occasion to share an absorbing and very personal perspective on molecular assembly and materials. One prominent lecture topic was advances in the total synthesis of biologically active natural products that have extremely complex structures and often require development of novel synthetic methods. A number of lecturers did justice to this theme with presentations on a variety of extremely elegant and sophisticated new developments in methodology, based upon organometallic catalysts and/or reagents. Finally, the broad theme of asymmetric synthesis using organometallic complexes with chiral ligands or chiral

PAC Special Topic Issues

Special topics have come to be a familiar, albeit irregular, feature of *Pure and Applied Chemistry* (*PAC*, the monthly official journal of IUPAC) in recent years, and were originally conceived as a way of promoting occasional and sometimes extraordinary IUPAC projects. The concept has served to publicize new initiatives, and promote the role of chemistry in multidisciplinary activities and collaboration. For example, the proceedings of two successive Workshops on Advanced Materials were featured prominently as special topic issues. And the series has now been assimilated into the program of established IUPAC events. In addition, projects arising from close collaboration with fellow international bodies have enjoyed similar coverage, with special topic issues on "Natural and Anthropogenic Environmental Estrogens" and "Implications of Endocrine Active Substances for Humans and Wildlife."

Publication policy has also been evolving to ensure that the journal continues to occupy a unique and indispensable niche in the primary chemistry literature. Recent changes have been influenced by the distinctive features of special-topic projects. Most notably, a prerequisite for publication coverage of IUPAC-sponsored events is prior editorial agreement on the desirability and scope of coverage in *PAC*, as is acceptance of centrally coordinated peer review of all manuscripts. The policy recognizes that the core business of *PAC* is to promote representative coverage of the established series of IUPAC-sponsored international conferences, for the good reason that they serve the topical mainstream of the subject with distinction.

Special topic issues will feature more regularly in the future, as a deliberate initiative to showcase some of the most prominent and enduring disciplinary themes on offer in the calendar of established IUPAC-sponsored conferences.

James R. Bull, *PAC* Scientific Editor

organocatalysts was developed in conjunction with combinatorial methodology, which is shown to be highly effective in optimizing catalytic systems.

In his autobiographical essay, J. Fraser Stoddard evokes how his own interest in host/guest and supramolecular chemistry gradually evolved over two decades into a fascination with the chemistry of the mechanical bond. Stoddart traces his hurly-burly life as a scientific nomad "through thick and thin from the Athens of the North to the City of Angels, with brief and not so brief interludes on the edge of the Canadian Shield, in the Socialist Republic of South Yorkshire, on the Plains of Cheshire beside the Wirral, and in the Midlands in the heartland of Albion."

www.iupac.org/publications/pac/2005/7707

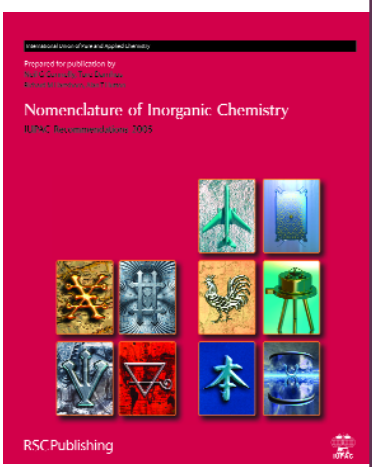
Nomenclature of Inorganic Chemistry* —IUPAC Recommendations 2005

Prepared for publication by Neil G. Connelly and Ture Damhus (senior editors), and Richard M. Hartshorn and Alan T. Hutton
RSC Publishing, 2005, ISBN 0 85404 438 8

Chemical nomenclature must evolve to reflect the needs of the community that makes use of it. In particular, nomenclature must be created to describe new compounds or classes of compounds, modified to resolve ambiguities that might arise, or clarified where there is confusion over the way in which nomenclature should be used. There is also a need to make nomenclature as systematic and uncomplicated as possible in order to assist less familiar users (for example, because they are only in the process of studying chemistry or are non-chemists who need to deal with chemicals at work or at home). A revision of *Nomenclature of Inorganic Chemistry*, IUPAC Recommendations 1990 (Red Book I) was therefore initiated in 1998, under the guidance of the IUPAC Commission on Nomenclature of Inorganic Chemistry and then, after the general restructuring of IUPAC, by a project group working under the auspices of the Division VIII: Chemical Nomenclature and Structure Representation.

The need to ensure that inorganic and organic nomenclature systems are, as far as possible, consistent has resulted in extensive cooperation between the editors of the revised Red Book and the editors of *Nomenclature of Organic Chemistry* (the revised "Blue Book," in preparation). At present, the concept of preferred IUPAC names (PINs), an important element in the revision of the Blue Book, has not been extended to inorganic nomenclature (though preferred names are used herein for organic, i.e., carbon-containing, compounds when appropriate). A planned future project on inorganic PINs will need to face the problem of choosing between the equally valid nomenclature systems currently in use.

The present book supersedes not only Red Book I but also, where appropriate, *Nomenclature of Inorganic Chemistry II* (Red Book II). One of the main changes from Red Book I is the different organization of material, adopted to improve clarity. Thus, Chapters IR-5 (Compositional Nomenclature, and Overview of Names of Ions and Radicals), IR-6 (Parent Hydride Names and Substitutive Nomenclature), and IR-7 (Additive Nomenclature) deal with the general characteristics of the three main nomenclature systems applied to inorganic compounds. (Note that the notation 'IR-' is used to distinguish chapters and sections in the current book from those in Red Book I, prefixed 'I-'). The next three chapters deal with their application, particularly that of additive nomenclature, to three large classes of compounds: inorganic acids and derivatives (Chapter IR-8), coordination compounds (Chapter IR-9), and organometallic compounds (Chapter IR-10). Overall, the emphasis on additive nomenclature (generalized from the classical nomenclature of coordination compounds), which was already apparent in Red Book I, is reinforced here. Examples are even included of organic compounds, from the borderline between inorganic and organic chemistry, which may be conveniently named using additive nomenclature (although their PINs will be different).



One important addition in this book is Chapter IR-10 on Organometallic Compounds. The separation of this material from Coordination Compounds (Chapter IR-9)

* In IUPAC circles, this book (including former editions) is commonly referred to as the Red Book.

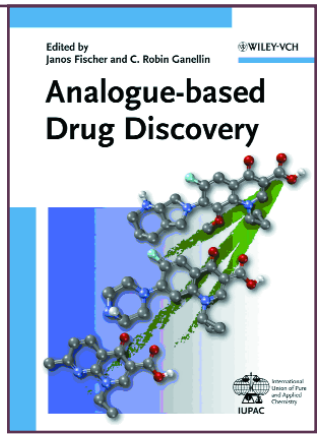
reflects the huge growth in importance of organometallic chemistry and the very different problems associated with the presence of p-bonded ligands. Chapter IR-9 is also considerably changed (cf. Red Book I, Chapter I-10). This revised chapter includes a clarification of the use of the Z and k conventions in coordination and organometallic compounds (Section IR-9.2.4.3); new rules for the ordering of central atoms in names of polynuclear compounds (Section IR-9.2.5.6); the bringing together of sections on configuration (Section IR-9.3) and their separation from those on constitution (Section IR-9.2); and the addition of polyhedral symbols for T-shaped (Section IR-9.3.3.7) and see-saw (Section IR-9.3.3.8) molecules, along with guidance on how to choose between these shapes and those of closely related structures (Section IR-9.3.2.2).

The reader facing the problem of how to name a given compound or species may find help in several ways. A flowchart is provided in Section IR-1.5.3.5, which will in most cases guide the user to a section or chapter where rules can be found for generating at least one possible name; a second flowchart is given in Section IR-9.2.1 to assist in the application of additive nomenclature, specifically to coordination and organometallic compounds. A more detailed subject index is also provided, as is an extended guide to possible alternative names of a wide range of simple inorganic compounds, ions and radicals.

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

Analogue-Based Drug Discovery

J. Fischer and R.C. Ganellin (editors)
Wiley-VCH, 2005 [ISBN 3-527-31257-9]



Statistically, every second drug is an analogue, and their market value amounts to two-thirds of all drugs. Analogues are the most successful way of inventing a new drug and they provide the required improvements in drug therapy.

This is the first authoritative overview of past and current strategies for successful drug development by molecular modification of known leads. The book is a unique resource, which spans the important drug classes in most major therapeutic fields.

Analogue-based drug discovery is discussed among others, for beta blockers, ACE inhibitors, steroids, opiates, stigmines, proton pump inhibitors, platinum anticancer compounds, and anti-infective quinolones. Case studies, by the respective inventors of selected commercially successful drug analogues provide prime advice for new drug development projects based on analogue modification. The book includes a table of the most successful drug analogues as based on the IMS ranking and compares them in terms of chemical structure, mode of action, launch year, and patent priority.

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

Measurement of the Thermodynamic Properties of Multiple Phases

R.D. Weir and T.W. de Loos (editors)
Elsevier, 2005 [ISBN 0-444-51977-7]

This volume (VII) is another in the series of IUPAC sponsored monographs that summarizes the state of knowledge in experimental techniques in thermochemistry and thermodynamics. Following volume VI, *Measurement of Thermodynamic Properties of Single Phases*, this book contains descriptions of recent developments in the techniques for measurement of thermodynamic quantities for multiple phases of pure fluids as well mixtures over a wide range of conditions. The precision and accuracy of results obtained from each method was regarded as an essential element in each description. Throughout the text, the quantities, units and symbols are those defined by IUPAC for use in the international community. *Measurement of Thermodynamic Properties of Multiple Phases, Volume VII* is an invaluable reference source to researchers and graduate students.

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

Polymer Chemistry, Reactions and Processes

A. Deffieux, C. Pichot, and F. Candau (editors)
***Macromolecular Symposia*, Vol. 226**
Wiley-VCH, 2005, pp. 1-302
ISBN 3-527-31329-X

This volume contains key papers given at the World Polymer Congress "Macro 2004," held 4–9 July 2004 in Paris, under the auspices of IUPAC (see September-October 2005 *CI* (pp. 30–31). The volume covers the session devoted to Polymer Chemistry Reactions and Processes, in particular topic 1) Polycondensation, Polyaddition, Chain Polymerization, Catalytic Polymerization, Functionalization; and topic 2) Preparation of Polymers in Dispersed and Unconventional Media.

The contributions under the first topic dealt with either purely mechanistic or synthetic aspects of metallocene and enzyme catalysis, as well as anionic, cationic, and radical initiated polymerisations. These papers cover quite different types of monomers, ranging from olefins and dienes, to heterocycles including saccaridic monomers, with the common aim of understanding the elementary reaction mechanisms and better controlling the polymerization processes.

Due to the versatility of polymerization processes in dispersed media (topic 2), a large variety of polymers exhibiting a wide range of functionalities, properties, morphologies and particle size, can be now prepared. A considerable number of such materials are indeed involved in many diverse applications and intensive research is increasingly devoted to their synthesis and properties. The selected papers cover the following aspects: recent developments in emulsion polymerisation, smart polymer colloids, unconventional preparation methods of dispersed polymers, and organic/inorganic hybrid colloids.

www.iupac.org/publications/macro/2005/226_preface.html

The Periodic Table: Into the 21st Century

Dennis Rouvray and Bruce King (editors)
Research Studies Press, Baldock, England, 2004
ISBN 0-86380-292-3
Pp xix + 396

reviewed by Peter Atkins

My first thought on opening this book was that, because the periodic table is discussed to exhaustion in just about every lecture room throughout the world on just about every day of the year, then there is little need for an international conference on it. Moreover, apart from a few ripples of discussion that have passed through the pages of *CI* over the past few months (relating to the position of hydrogen), and the slow growth of the bottom row as new elements are made and recognized, surely there is nothing more to be said? In fact, I was pleasantly surprised by most of the articles.

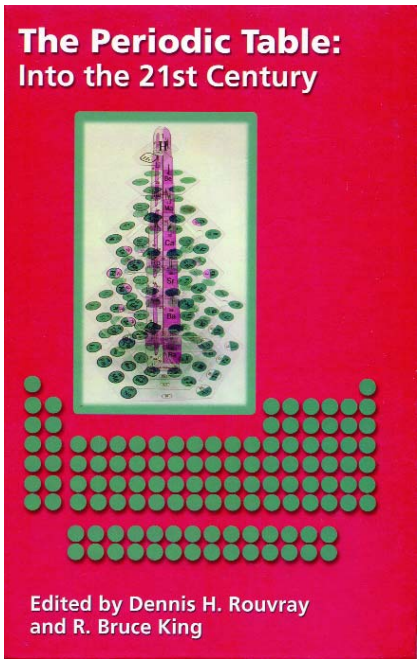
First, a few facts. This book is a collection of presentations made at a conference of the same title held in the Kananaskis region of Alberta, not far from Banff, in July 2003. There are 13 chapters, covering a wide range of aspects of the table, ranging from its history to more recondite aspects of the atomic structures that it in effect portrays.

Dennis Rouvray kicks off with an account of fact and fable in the story of the periodic table, including an account of the various alternatives, the various discoverers of the periodic table, such as de Chancourtois and his famous "telluric screw" of 1862, Odling's table of 1864, and the less-known Gustavus Hinrichs and his table of 1869. He with whom we normally associate the formulation of the table, Mendeleev, came later to the game, with his first table in 1869. Mendeleev is famous for using his table to make three spectacularly accurate predictions (of the elements later to be called gallium, germanium, and scandium), but Rouvray points out that he actually made around 20 predictions, with most proving to be either lucky guesses or completely wrong. Thus, quietly and benignly forgotten are his insistence that there is a series of elements of atomic weight less than that of hydrogen (including newtonium of atomic weight 0.17 and coronium of atomic weight 0.4). He also proposed the existence of six new elements between hydrogen and lithium. Rouvray goes on to point out that none of the discoverers of the periodic table received a Nobel Prize: Mendeleev came close (losing out to Henri Moissan and fluorine in 1906, by a vote of 5:4), and died the following year.

Mendeleev moves to center stage in Michael Gordin's contribution on the short happy life of his, *Mendeleev's Periodic Law*, which is a biographical account of Mendeleev's life and in particular the genesis of the table. For obvious reasons my heart warmed

to his passage about textbooks being much maligned as a scientific genre and the undervaluing of their contribution to science: Mendeleev might never have formulated his table if he had not been grappling with the problem of organizing his *The Principles of Chemistry* (Osnovy Khimii) in 1868/69, which he realized was becoming a rambling compendium of data and needed a system of organization. This long contribution explores the "eka-elements" in more detail and gives a fascinating insight into Mendeleev's thinking.

The historical analysis of the formulation of the periodic table is taken further in the contribution by Masanori Kaji, who provides a useful analysis of the efforts of the main contributors. Hinrichs he places at the foot of the heap, as a representative of the group of researchers in the 1850s who sought numerical patterns in atomic weights. Odling is just a little higher up the heap: Kaji classifies him as someone who considered his table merely as a convenient way to arrange the elements. At level three lie de Chancourtois and Newlands, who understood the significance of the table and speculated about the existence of a periodic law. At the apex, at level four, stands Mendeleev, who understood the complex nature of the periodic law and used it effectively (but not, as we have seen, always with correct outcome). Lothar Mayer, Kaji asserts, somehow managed to span all four levels as his contribution evolved.



Michael Laing and then Eric Scerri survey the variety of portrayals of the periodic table, which still provide a good romping ground for chemists. Readers of this journal will know that suggestions have been made about the position of hydrogen (in the position adopted by Linus Pauling in his textbook); they will probably warm less to Scerri's location for helium among the alkaline earth metals and will probably wish to take issue with what he calls "the tyranny of the chemist."

From chapter six on, we move from history to chemistry, with several chapters more reminiscent of freshman chemistry textbooks. Thus, Geoffrey Rayner-Canham surveys the properties of the elements in the context of the table and identifies patterns richer than the consanguinities of groups and periods. Bruce king goes on to describe the more recondite applications of the table in the context of metallurgy, and Helen Aspinall reviews the chemistry of the lanthanoids.

Where will it all end? Paul Karol points out that on the average, a new element is found every two and a half years, which suggests that at the end of this century there will be around 150 known elements. This reaching out into the unknown generates its own controversies, such as the acceptability of evidence for the creation of a new element and, sometimes with more vitriol, the naming of the element. Karol describes in detail his version of the arguments that took place when names were suggested for the transfermiums, particularly element 106. He concludes on a more conciliatory note, pointing out that IUPAC was shaken by the outrage within the global nuclear community and that "the situation has since settled down and changed enormously for the better."

I do not have space to describe the more theoretic approaches typical of the remaining chapters of the book, which deal with topics such as relativity (Krishnan Balasubramanian), group theory (Maurice Kibler), a variety of rules based on quantum numbers (Valentin Ostrovsky), and the extension of the concepts of periodicity of elements to that of benzenoid hydrocarbons (Jerry Dias). These are of a more specialist character, and show that the table can be mined for deep understanding as well as used for practical applications.

Overall, I warmly recommend this book for the accounts it provides in the early chapters of the historical background and the illumination it gives to the struggles and controversies that led to the current, evolving form of the table.

Peter Atkins <peter.atkins@lincoln.ox.ac.uk> is a professor at the Lincoln College in Oxford, UK, and is chairman of the IUPAC Committee on Chemistry Education.

Nanotechnology: Science and Application

by Mohamed Abdel-Mottaleb

The **International Conference on NanoTechnology: Science and Application (NanoTech Insight'05)** was held in the beautiful, historic city of Luxor, Egypt, from 20–25 February 2005. Over 200 participants—representing leading researchers from 40 countries—contributed to a very successful conference.

The scientific content of the meeting was as diverse as it was high in quality, emphasizing the intrinsic multidisciplinary nature of nanotechnology. Split into two sessions, the program featured 22 plenary lectures, 30 keynote lectures, 48 contributed talks, and 100 posters.

Klaus Müllen (Max Plank Institute, Mains, Germany) gave the opening lecture in which he gave an exemplary lesson on "putting the molecules into molecular electronics" by demonstrating the self-assembly of polycyclic aromatic hydrocarbons into columns and ordered monolayers for the formations of supramolecular wires and two-dimensional crystals. Chemically gated rectifiers were structured at surfaces by using such systems. Beng Ong (Xerox Research Labs, Toronto, Canada) provided excellent proof of the feasibility of this approach to electronics through Inkjet processing of oligothiophene derivatives to produce printed field effect transistors with high on/off ratios. Further examples of molecular electronics and self-assembly approaches where demonstrated by Concepció Rovira (Consejo Superior de Investigaciones Cientificas (CSIC), Barcelona, Spain) and Maria Rampi (Ferrara University, Italy, and Harvard University, Massachusetts, USA). Avik Ghosh (Purdue University, Indiana, USA) and Peter Hänggi (Augsberg University, Germany) elegantly showed how the design and interpretation of physical experiments now benefit from precision calculation of the electronic properties of nanostructures.

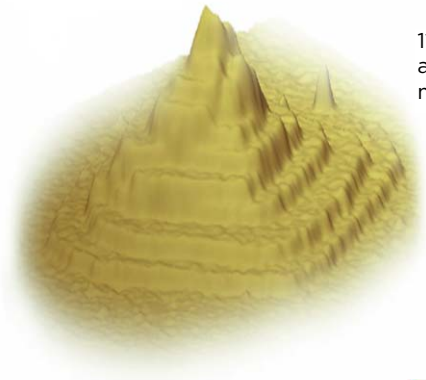
The 10-nm-size regime is often seen as the realm of these bottom-up molecular approaches; however, top-down CMOS (complementary metal oxide semiconductor) techniques are expected to reach sizes of around this value. Hans Lüth (Research Centre, Jülich, Germany) showed how combinations of the two approaches are certain to be fruitful, and reflected on how new device types will become necessary as the quantum mechanical limit is reached.

Self-assembly is a powerful paradigm in the preparation of chemical systems at the nanoscale from the bottom-up approach. In this context Alan Rowan (Nijmegen, The Netherlands) demonstrated the control of polymers over nanostructures by threading a catalyst ring over a polymer chain. Roberto Lazzaroni (Mons-Hainaut, Belgium) additionally exposed the dramatic effects that block polymer composition can have on the nanostructures and properties. Roeland Nolte (Nijmegen, The Netherlands) showed how block copolymers are even self-assembled into vesicles that can house enzymes and whose surfaces can be polymerized to create conducting spheres.

The versatility of the self-assembly approach was clearly shown by the wealth of structures and properties demonstrated by Dirk Kurth (MPI Colloids and Interfaces, Potsdam, Germany), Jaume Veciana (CSIC, Spain), and Raphaël Lévy (Liverpool, UK).

It has been recognized that natural phenomena can act as a guide to unnatural chemical systems. Paul Hansma (University of California, Santa Barbara, USA) showed how the tools of nanoscience are giving new insight into the way in which nature has developed nanostructured materials with crosslinks, which behave as "sacrificial bonds" and fracture before the backbone of the polymers, which break at a force of over 1000 pN. These safeguards are present in systems as diverse as spider silk, abalone shell, and bone; their elegance is that only these reformable bonds are broken (at forces below 500 pN), thus providing a damage protection mechanism.

"Molecular Surgery" on biological structures was



11 layers of 4.7 nm—atomic force microscopy image

6 layers of 10 m—Step Pyramid in Egypt, Netjenkhet Djoser (2667–2648 BC), The 2nd King of Egypt's 3rd Dynasty

Multilayer assembly of a thiophene oligomer. From slide presented by Roberto Lazzaroni.

shown by Min-qian Li (Chinese Academy of Sciences, Shanghai, China), who demonstrated the formation of artificial DNA structures via "molecular combing," and then put the molecules under the knife using an atomic force microscope.

Perhaps the most remarkable chemical feat exposed at the conference was the preparation of a series of triruthenium cluster oligomers, which in the case of the tetramer displays a 14-step reversible sequence of redox processes involving the transfer of 15 electrons. Tasuku Ito (Tohoku University, Japan) showed how judicious choice of ancillary ligands surrounding the complexes can give this effect as well as gradients of potential in dendrimers based on the same module. The systems are surely interesting for molecular electronics.

Perhaps the most remarkable chemical feat . . . was the preparation of a series of triruthenium cluster oligomers . . .

Paul Ziemann (Ulm, Germany) brought the conference to a fitting climax, showing how metal-loaded block copolymers can be used for the preparation of ordered arrays of both gold and cobalt nanoparticles after removal of the polymer matrix by optimized hydrogen plasma treatment. One of the results presented revealed the remarkable fact that Au_{55} clusters are Nobler than bulk gold! The outlook for these processes and materials in the preparation of new devices is very promising.

With the high-caliber lectures and posters presented, the conference succeeded in establishing strong collaborations among advanced research groups in the field and the developing world, widening the benefits of nanoscience beyond developed countries, and promoting female scientists. The participants perceived the conference as a scientific, intellectual, and social success. The organizers of the conference would like to issue a warm thank you to all participants for their scientific contributions and for making the event so memorable.

The next NanoTech Insight conference will take place in Cairo, Egypt, 11–17 March 2007.

Dr. Mohamed Abdel-Mottaleb <mohamed.abdel-motaleb@physik.tu-chemnitz.de> is a research associate at the Technical University of Chemnitz, Germany, and was the chairman of NanoTech Insight'05.

Heterocyclic Conference

by Thomas Tidwell

The **6th Florida Heterocyclic Conference** was held 28 February–2 March 2005 in Gainesville at the University of Florida. The 150 delegates in attendance participated in a varied and rich program including 12 plenary lectures, 11 short lectures, 2 short courses, and an extensive poster session. The short courses were on benzotriazole chemistry—taught by Alan Katritzky (University of Florida)—and organometallic chemistry of heterocycles—taught by Gordon Gribble (Dartmouth University, New Hampshire, USA).

The attendees included many chemists from the industrial sector and from a large number of countries representing five continents. Heterocyclic compounds play a major role in the pharmaceutical industry and in other applications, which accounts for the great interest in the subject. The conference attracted a number of commercial exhibitors, including publishers, chemical suppliers, and instrument makers.

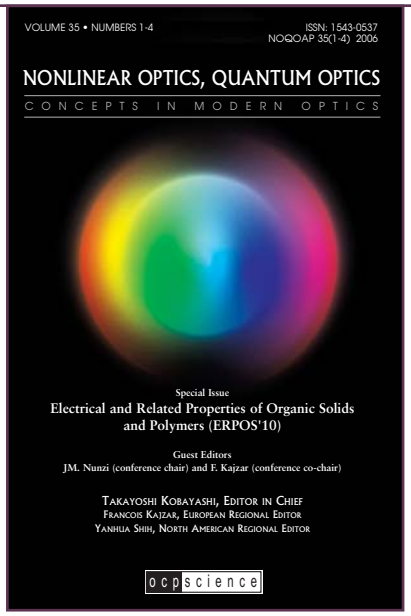
The following scientists gave plenary lectures:

- Alois Fürstner, Max-Planck-Institut für Kohlenforschung, Germany
- Scott Denmark, University of Illinois, Urbana, IL
- Paul Reider Amgen, Thousand Oaks, California, USA
- Paul Krapcho, Dept. of Chemisty, University of Vermont, USA
- Mikael Begtrup, Royal Danish School of Pharmacy, Denmark
- Gary Molander, University of Pennsylvania, Philadelphia, USA
- Paul Hodgson, Pfizer Ltd., United Kingdom
- Margaret Brimble, The University of Auckland, New Zealand
- Mitchell deLong, The Procter & Gamble Company, Cincinnati, Ohio, USA
- John A. Joule, The University of Manchester, United Kingdom
- Dale Boger, The Scripps Research Institute, La Jolla, California, USA
- Rama Rao, Avra Laboratories Pvt Ltd., India, USA
- Richard Larock, Iowa State Univ., Ames, Iowa, USA

Prof. Thomas Tidwell <ttidwell@chem.utoronto.ca> served as the IUPAC representative at FloHet 6. He is currently a professor at the University of Toronto. Tidwell has been extensively involved in the IUPAC Organic and Biomolecular Division for many years; he is currently the division past president.

Electrical and Related Properties of Organic Solids and Polymers

by Jean-Michel Nunzi



The fast development of organic electronic and optoelectronic devices bearing advanced properties prefigures new research and development opportunities in materials and polymers chemistry for the third millennium. Almost every week, we can read in the journals *Science* and *Nature* about the new discoveries in the fields of organic and polymer chemistry applied to electronics and optoelectronics.

In order to transform this insightful research into a new worldwide industrial market-which makes advanced low-cost plastic electronics available to almost everyone-a conference was organized to bring leading chemistry and physics scientists together with young researchers. Advanced renewable energy, communication, and sensing and security systems are expected to emerge in the next decade from this new opportunity in chemistry. These were the main topics of the ERPOS conference held 10–15 July 2005 in Cargese, France.

About 100 participants attended the conference, with 22 invited presentations, 64 talks, and about 50 posters. The different topics were organized in seven sessions: optical storage materials; green functional materials for electronics; polymers for broad-band information technologies; nano-bio-photonics; multi-functional materials for advanced electronics: principles and applications; and optically switchable materials.

A special session on optical storage materials began with an invited talk by H.J. Eichler (Berlin) on "Microholographic Data Storage." Eichler described a bit-storage process that enables an increase in DVD capacity by two orders of magnitude by using the depth of 100 μm thick holographic polymers together with wavelength multiplexing. Holographic storage polymers and applications were also addressed in the talks of A. Miniewicz (Wroclaw), S. Kucharski (Wroclaw) and D. Bogdal (Krakow).

The subject of green functional materials for electronics was introduced by J. Grote (US Air Force Office of Scientific Research (AFOSR), USA), who spoke about DNA-based photonic materials. Grote pointed out that DNA is an abundant natural product with versatile properties: it has transparent photonic waveguides, it is a molecular conductor, and it is a nanosystem templating material. Other important talks were given by G. Aldea (Angers) on a new high-loading totally water-soluble C_{60}-pendant copolymer for electronic devices and layer-by-layer electrostatic self-assembly, and by B.C. Simionescu (Iasi) on functional micro- and nanoparticles fabrication.

ERPOS '10 participants.

A special session sponsored by Keio-COE was held on polymers for broad-band information technologies. Y. Koike (Keio) delivered the plenary lecture on graded-index polymer optical fibers (GI POF) and their applications in telecommunications. GIPOF have less than 10bB/Km losses in the 0.8–1.3μm band and a transmission band in excess of 10Gb/s for 100m cables.

The topic of nano-bio-photonics was addressed by several invited talks from world leaders, giving broad coverage of the domain. Among the many talks were those of N. Peyghambarian (University of Arizona, Tucson, Arizona, USA) on photorefractive polymers and applications, K.D. Singer (Case Western Reserve University, Cleveland, Ohio, USA) on non-dispersive high-mobility discotic liquid crystals for electronics, and A. Djurisic (HongKong) on new organic and inorganic nanoparticles and structures for electronic and laser applications.

Multi-functional materials for advanced electronics were introduced by the plenary talk of S. Saricifci (Linz) on plastic solar cells. Interpenetrated polymer nano-solar cells should soon permit solar yields to surpass 5 percent. Owing to their good performance to price ratio, they should soon become credible renewable energy devices and an economic alternative to silicon cells.

The diversity of organic devices for electronics is an open field for new theories and characterization. Leading experts presented their studies of device modelization at all scales: from the individual molecules which are the building blocks of semiconductors (N. Kirova, Orsay); through charge transport in disordered organic semiconductors (H. Baessler, Marburg); the effect of disorder at interfaces on charge injection in electronic devices (S. Novikov, Moscow); to the energy levels and traps in organic transistors (S. Schrader, Wildau) and bimolecular recombination in plastic solar cells (K. Arlauskas, Vilnius).

Optically switchable materials were introduced by H. Cailleau (Rennes), with time resolved X-ray studies of photoinduced phase transitions in charge transfer organic crystals. Two-photon absorption materials with applications to optical limiting, nanofabrication, microscopy, and phototherapy were introduced by K.S. Lee (Busan), a world-leader in this area.

The proceedings of ERPOS'10 will be published as peer-reviewed papers in a special issue of *Nonlinear Optics and Quantum Optics* (Old City Publishing). The next edition of ERPOS will be organized in Poland by A. Miniewicz in 2008.

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http://sciences.univ-angers.fr/erpos/

Physical Chemistry: Education and Challenges

by Michel Rossi

An **International Symposium on Physical Chemistry: Education and Challenges**, took place at Shaanxi Normal University in Xi'An from 9–11 August 2005, just before the 40th IUPAC Congress in Beijing. This symposium was supported both by the IUPAC Physical and Biophysical Chemistry Division, as well as the Committee on Chemistry Education (CCE). Both organizers of this symposium, Yu Fang of Shaanxi Normal University and ZhongQun Tian of Xiamen University, convened a highly successful meeting that focussed on several aspects of physical chemistry of importance today.

A persistent challenge for chemistry educators is that many, if not most, chemistry students the world over perceive physical chemistry as too difficult. In China, this difficulty will most likely increase as bilingual teaching is gradually introduced into the curricula of selected universities in order to improve communication with the English-speaking world.

Chinese specialists in physical chemistry education, as well as teachers at the university level, agreed a potential obstacle to bilingual teaching would be the willingness of Chinese teachers to bear the brunt of the change. Apparently, the English-speaking abilities of the younger generation no longer represent a significant barrier to communication with the rest of the world. Chinese teachers face a double challenge: modifying their teaching approach, which may have to significantly change once they start teaching in English, as well as overcoming the language barrier itself. However, it was felt that the advantages of the gradual introduction of bilingual education into physical chemistry by far outweighed the potential difficulties that may be encountered. Teachers from Arab-speak

Participants at the International Symposium on Physical Chemistry, each wearing a gift from conference organizers—an example of the excellent hospitality afforded all attendees.

ing countries of North Africa expressed support for this process as did representatives from the European Union who face similar challenges in teaching.

China's access to the world scientific community will greatly benefit from the preparedness of its younger generation of practicing physical chemists who will be facing a field that is undergoing, or has already undergone, significant changes. Materials chemistry, nanoscience, and biological chemistry will from now on be major subjects in physical chemistry in their own right. The consensus of those present was that switching some courses to English represented a win-win situation, both for faculty and staff: Not only will Chinese students benefit from direct interaction with their peers abroad, but it also may lead to more frequent exchanges of visiting faculty, from which both education and research in China may take advantage.

A well-known teacher and textbook author of physical chemistry in China, professor Wenxia Shen of Nanjing University, highlighted both the options that the Chinese teacher in physical chemistry may face in the selection of subject areas as well as some of the modern teaching methods that are available today. On that latter point she claimed that a combination of either static or animated presentations (e.g., Power Point) should be alternated with more "pedestrian" methods such as using chalk and a blackboard, which have proven their worth over time. This, she said, will allow students more time to accommodate and internalize the reasoning of the teacher during more challenging parts of the course, such as key derivations.

Peter W. Atkins of Oxford University, chairman of CCE, presented visualization concepts in physical chemistry that translate the meaning of an expression in a qualitative sense before fully exploring its quantitative ramifications.

The educational component of this conference was underlined by the presence of many junior faculty, graduate students, and masters students from all over China who significantly contributed to the discussions.

The conference also showcased research and development in contemporary physical chemistry in China, as presented by young researchers. This afforded a useful overview of modern physical chemistry research, ranging from classical aspects of electrochemistry and materials chemistry to modern interdisciplinary studies of interfacial processes, molecular dynamics involving solid surfaces, nanoscience, and molecular biology. The thread throughout the presentations was the fundamental understanding from the point of view of physical chemistry principles. As an example, Xinsheng Zhao of Peking University discussed the question of the thermodynamic driving force for key biological or electrochemical processes, which will be increasingly important for classifying and ultimately understanding complex biological processes in molecular biology. In addition, the presentation of Mostafa A. El-Sayed of the Georgia Institute of Technology in Atlanta put the emphasis on the understanding of "old" interfacial phenomena that are well known to "classical" physical chemistry in terms of modern concepts involving thermodynamics, spectroscopy, molecular dynamics, and chemical kinetics in a truly interdisciplinary fashion. Therefore, it may not come as a surprise if the teaching of electrochemistry in China, for instance, occupies a predominant place in the curriculum of physical chemistry as it is key to such novel areas as chemical biology, materials chemistry, (photo)catalysis, and molecular electronics. In contrast, electrochemistry frequently occupies a less visible place in many American or European schools.

Michel J. Rossi <michel.rossi@epfl.ch> is a professor at the Laboratoire de Pollution Atmosphérique at the Ecole Polytechnique Fédérale de Lausanne in Switzerland. He was IUPAC representative at the conference and is currently secretary of the IUPAC Physical and Biophysical Chemistry Division.

Neurotoxic Metals: Lead, Manganese, and Mercury—From Research to Prevention

17–18 June 2006, Brescia, Italy

The **International Workshop on Neurotoxic Metals: Lead, Manganese, and Mercury—From Research to Prevention** will be held in Brescia, Italy, 17–18 June 2006.

Different integrated functions of the nervous system are sensitive targets for metal toxicity. The implementation of preventive programs has lead to a decrease in occupational exposure levels to heavy metals, but environmental exposure has increased so that it is now ubiquitous. New research has shown that adverse effects may occur at "low" levels previously thought to be safe. Given the increasing life expectancy and duration of working life, there is a growing concern about the possible long-term effects on the nervous system of heavy metals such as lead, mercury, and manganese. Therefore, more research is needed into exposure-related health effects so that preventive measures may be implemented by governmental and regulatory agencies.

This international workshop will facilitate information exchange among researchers, risk assessors, regulatory bodies, public health authorities, and stakeholders. Details on each session and topics to be discussed are available on the conference Web site.

See Mark Your Calendar on page 37 for contact information.

www.ntoxmet.it

Polymers and Organic Chemistry

2–7 July 2006, Okazaki, Japan

The **12th International Conference on Polymers and Organic Chemistry (POC'06)** will be held in Okazaki, Japan, 2–7 July 2006. The conference will focus on functionalized macromolecular design and architecture and applications based on fine organic reaction techniques. The conference program will cover the following topics:

- polymer supported reagents
- polymeric catalysts
- polymer in medicine and biochemistry
- polymer for separations
- electro- and light-sensitive functional polymers
- polymers for environmental protection
- processes within functional polymers
- novel functional polymers

Topics related to the synthesis, characterization, and application of functional polymers will be also covered in the conference. A number of renowned chemists have agreed to present plenary and invited lectures: J.M.J. Frechet (USA), Y. Okamoto (Japan), S. Kobayashi (Japan), D.C. Sherrington (UK), K. Ding (China), H. Wennemers (Swiss), D.E. Bergbreiter (USA), Y.-S. Lee (Korea), E. Yashima (Japan), K. Nozaki (Japan), and H.D.H. Stover (Canada).

Deadlines: The second circular and call for papers will be available on 1 January 2006. The deadline for abstract submission is 1 April 2006.

See Mark Your Calendar on page 37 for contact information.

www.tutms.tut.ac.jp/POC06

Biodiversity and Natural Products

23–28 July 2006, Tokyo, Japan

The **25th International Symposium on Chemistry of Natural Products** will be jointly held with the 8th International Conference on Biodiversity from 23–28 July 2006 in Tokyo, Japan, at the Kyoto International Conference Hall. These biennial symposia were first held jointly in 2004 in New Delhi, India. The symposia will focus on the advancement of international collaboration and communication in the interdisciplinary areas involving natural product chemistry and biodiversity-related and pharmaceutical sciences.

There will be six half-day sessions for plenary lectures, and three half-day parallel sessions on eight topics: 1) Isolation and Structure Elucidation of Natural Products; 2) Synthesis of Natural Products and their Models; 3) Biosynthesis and Genetic Engineering on Natural Products; 4) Spectroscopy in Natural Products Chemistry; 5) Molecular Mode of Action on Natural Products and Drugs; 6) Chemical Biology and Related Areas; 7) Chemistry and Biochemistry Related to Biodiversity; 8) Drug Discovery and Developments. Contributed lectures (of 10 minutes) will be selected from poster presentations.

Applications and abstracts for presentations should be submitted before 28 February 2006.

See Mark Your Calendar on page 38 for contact information.

www.tennenyuuki.ne.jp/iupac

Green Chemistry

10–15 September 2006, Dresden, Germany

IUPAC, the German Chemical Society (GDCh), and Consorzio Interuniversitario Nazionale "La Chimica per l'Ambiente" (INCA) are organizing the **1st International IUPAC Conference on Green Chemistry** to be held 10–15 September 2006 in Dresden, Germany. This first-of-its-kind meeting will cover all aspects of environmentally benign and sustainable chemistry. By filling the gap between research and technology in this field, the meeting will stimulate closer linkages between academia and industry.

The symposium will take place in the new lecture hall of the Dresden University of Technology, a beautiful venue abounding with cultural treasures such as the famous Semper Opera House and the magnificent Zwinger Palace. In 2006, the city will celebrate the 800th anniversary of its founding.

See Mark Your Calendar on page 38 for contact information.

www.gdch.de/vas/tagungen/tg/5559.htm

Aromatic Compounds

22–27 July 2007, Tsuna-Gun (Awaji Island), Japan

The **12th International Symposium on Novel Aromatic Compounds (ISNA-12)** will be held 22–27 July 2007 on Awaji Island, located near Kobe, Japan. The goal of this symposium is to further elucidate fundamental principles of synthesis and properties of aromatic compounds, and to extend application of aromatic compounds to many areas of molecular science.

The ISNA-12 program will highlight not only the traditional and fundamental aspects of novel aromatic compounds, such as their theory, synthesis, structure, and properties, but also topics in materials science. These include, for example, supramolecular chemistry based on aromatic compounds; conducting, magnetic, and optical properties of aromatic compounds; and molecular electronics based on aromatic compounds. The program will include plenary and invited lectures, contributed oral presentations, and poster sessions. Young scientists-graduate students and post-doctoral fellows-are encouraged to attend and to take advantage of reduced participation fees.

The symposium venue, Awaji Yumebutai International Conference Center, is on the northeast coast of Awaji Island, which is located near Kobe (30 minutes by car) and is connected by the world's longest suspension bridge.

See Mark Your Calendar on page 39 for contact information.

www.chem.es.osaka-u.ac.jp/ISNA12

Organometallic Chemistry

2–6 August 2007, Nara, Japan

The **14th IUPAC International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS-14)** will be held in Nara, Japan, from 2–6 August 2007. The venue for the event is Nara Centennial Hall, a conference and exhibition center surrounded by beautiful mountains and many cultural and historical spots, including eight assets of World Heritage. Nara, Japan's capital from the years 710 to 785, is located at the geographic center of the Kansai area. It takes one hour from Kyoto and Osaka, and one and a half hours from Kansai International Airport, making Nara a perfect venue for OMCOS-14.

Organic chemistry as the core science of modern technology has been gaining in importance in recent years. Organometallic compounds have played indispensable roles in organic chemistry. OMCOS-14 seeks to bring together researchers from around the world in academia and industry, to share the latest results in chemistry involving carbon-metal bonds and their applications in organic synthesis. OMCOS-14 will not only handle synthetic organic reactions with organometallics, organic reaction under metal catalysis, asymmetric synthesis and asymmetric catalysis, structures and properties of organometallics, but will also consider state-of-the-art applications of organometallic reagents to material and biological science.

See Mark Your Calendar on page 39 for contact information.

Other Upcoming Conferences

Combining and Reporting Analytical Results
6–8 March 2006, Roma, Italy
International APAT–IUPAC Workshop on the role of (metrological) traceability and (measurement) uncertainty for comparing analytical results
www.iupac.org/divisions/V/501

Theoretical and Computational Chemistry
6–10 August 2006, Kunming, China
The Fourth Worldwide Chinese Theoretical and Computational Chemistry Conference (WCTCC)
http://wctcc2006.iccas.ac.cn

Combustion
6–11 August 2006, Heidelberg, Germany
The 31st International Symposium on Combustion
www.combustion2006.org

1st European Chemistry Congress
27–31 August 2006, Budapest, Hungary
www.euchems-budapest2006.hu

Solid State Chemistry
24–29 September 2006, Pardubice, Czech Republic
7th International Congress of the Solid State Chemistry (SSC 2006)
http://ssc.upce.cz

Biotechnology: Milestones towards Sustainability of Human Society

12–17 October 2008, Dalian, China

The **13th International Biotechnology Symposium (IBS)** will be held from 12–17 October 2008 in Dalian, China. As one of the most influential events in biotechnology, IBS is held every four years on a different continent. The 13th IBS is expected to offer a unique opportunity to review the milestones in updated biotechnology, and more significantly, to discuss the biotechnology frontiers and their potential contribution to global sustainability by conquering the various challenges ahead of us. The theme of this symposium is "Biotechnology: Milestones towards Sustainability of Human Society."

The following eight technical sessions will be included: I) Molecular, Cellular, and Genetic Tools; II) Systems Biology; III) Tissue Engineering and Cell Culture Engineering; IV) Advances in Biotechnology Application in Health Care; V) Industrial Biotechnology; VI) Marine Biotechnology and Natural Products Bioprocessing; VII) Environmental Biotechnology; and VIII) Bio-Safety, Bio-Security, and Bio-economy.

Under the auspices of IUPAC, the Chinese Society of Biotechnology, and other academic organizations, this symposium will be co-hosted by Dalian Institute of Chemical Physics of the Chinese Academy of Sciences and Dalian University of Technology. A call for papers will be available in October 2006.

Contact: Profs. F.W. Bai <fwbai@dlut.edu.cn>, W. Zhang <weizhang@dicp.ac.cn>, or J.J. Zhong <jjzhong@ecust.edu.cn>.

Mark Your Calendar

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

2005 *(later than 1 November)*

IUPAC poster prizes to be awarded

6–9 December 2005 • Agriculture • Jesenik, Czech Republic
XXXIth International Conference—Chemistry for Agriculture
Dr. Adam Pawelczyk, Wroclaw University of Technology, Smoluchowskiego 25, 50-370 Wroclaw, Poland, Tel.: +48 (0) 71-3202930, Fax: +48 (0) 71-3203469, E-mail: adam.pawelczyk@pwr.wroc.pl

11–13 December 2005 • Arsenic Remediation • Dhaka, Bangladesh
Bangladesh Workshop on Origins and Remediation of Groundwater Contamination by Arsenic
Dr. Satinder Ahuja, Novartis Corporation (retired), 1061 Rutledge Court, Calabash, NC 28467 USA, Tel.: +1 910 287-2765, E-mail: sutahuja@xaranda.net

2006

IUPAC poster prizes to be awarded

10–13 January 2006 • Green Chemistry • Delhi, India
Second International Symposium on Green/Sustainable Chemistry
Prof. M. Kidwai, Department of Chemistry, University of Delhi, Delhi-110007, India, Fax: +91 11 27666235, E-mail: kidwai_chemistry@yahoo.co.uk

6–10 February 2006 • Photodynamics • Havana, Cuba
4th International Meeting on Photodynamics
Prof. Jesus Rubayo Soneira, Instituto Superior de Tecnologias y Ciencias Aplicadas, Ave. Salvador Allende y Luaces, A.P. 6163, Havana 10600 Cuba, Tel.: + 53 7-2041188, Fax: +53 7-2041188, E-mail: jrs@fctn.isctn.edu.cu

12–15 March 2006 • Heterocyclic Chemistry • Gainesville, Florida, USA
7th Florida Heterocyclic Conference
Prof. Alan R. Katritzky, University of Florida, Dept. of Chemistry, Gainesville, FL 32611-7200, USA, Tel.: +1 352 392 0554, Fax: +1 352 392 9199, E-mail: katritzky@chem.ufl.edu

2–7 April 2006 • Photochemistry • Kyoto, Japan
XXIst IUPAC Symposium of Photochemistry
Prof. Masahiro Irie, Department of Chemistry and Biochemistry, Kyushu University, Graduate School of Engineering, Hakozaki 6-10-1, Fukuoka, Japan, Tel.: +81 92 642 3556, Fax: +81 92 642 3568, E-mail: irie@cstf.kyushu-u.ac.jp

17–21 April 2006 • Polymer Characterization • Nara City, Japan
POLYCHAR-14 World Forum on Advanced Materials (Polymer Application & Theory)
Prof. Masaru Matsuo, Department of Textile and Apparel, Nara Women's University, Faculty of Human Life and Environment, Nara, 630 8263 Japan, Tel.: +81 742 20 3462, Fax: +81 742 20 3462, E-mail: m-matsuo@cc.nara.wu.ac.jp

11–15 June 2006 • Organic Synthesis • Merida, Yucatan, Mexico
16th International Conference on Organic Synthesis (ICOS 16)
Dr. Eusebio Juaristi, Instituto Politecnico Nacional, Departamento de Quimica, Avenida IPN #2508, Esquina Ticoman, Mexico City, DF, 07360, Mexico, Tel: +52 55 50613722, Fax: +52 55 57477113, E-mail: juaristi@relaq.mx

17–18 June 2006 • Neurotoxic Metals • Brescia, Italy
Workshop on Neurotoxic Metals: Lead, Manganese, and Mercury. From Research to Prevention
Dr. Roberto G. Lucchini, Institute of Occupational Health, University of Brescia, Italy, Brescia, Italy, Tel.: +39 0303996080, Fax: +39 0303996080, E-mail: lucchini@med.unibs.it

25–30 June 2006 • Analytical Sciences • Moscow, Russia
International Congress on Analytical Sciences
Prof. Vladimir P. Kolotov, Vernadsky Institute of Geochemistry, Russian Academy of Sciences, 19, Kosygin Str., Moscow B-334 119991 Russia, Tel.: +7 (095) 137 04 86, Fax: +7 (095) 938 20 54, E-mail: kolotov@geokhi.ru

2–7 July 2006 • Polymers and Organic Chemistry • Okasaki, Japan
12th International Conference on Polymers and Organic Chemistry 2006 (POC'06)
Prof. Shinichi Itsuno, Department of Materials Science, University of Technology, Toyohashi, 441-8580, Japan, Tel.: +81 532 44 6813, Fax: +81 532 44 6813, E-mail: itsuno@tutms.tut.ac.jp

Mark Your Calendar

16–21 July 2006 • Macromolecules • Rio de Janeiro, Brazil
41st International Symposium on Macromolecules—IUPAC World Polymer Congress MACRO 2006
Prof. Ailton de Souza Gomes, Caixa Postal 68525, Rio de Janeiro, 21945-970, Brazil,
E-mail: asgomes@ima.ufrj.br or macro2006@linkway.com.br

23–28 July 2006 • Biodiversity and Natural Products • Kyoto, Japan
ICOB-5 & ISCNP-25 IUPAC International Conference on Biodiversity and Natural Products
Prof. Michio Murata, Department of Chemistry, Osaka University, Graduate School of Science, 1-16 Machikaneyama, Toyonaka, Osaka, 560-0043, Japan, Tel.: +81 6 6850 5437, Fax: +81 6-6850-5774,
E-mail: iscnp25@ch.wani.osaka-u.ac.jp

24–29 July 2006 • Solubility Phenomena • Freiberg, Germany
12th International Symposium on Solubility Phenomena and Related Equilibrium Processes (12th ISSP)
Prof. Wolfgang Voigt, Technische Universitat Bergakademie Freiberg, Institut fur Anorganische Chemie, Leipziger Strasse 29, D-09596 Freiberg (Sachs), Germany, Tel.: +49 3731 39 4338, Fax: +49 3731 39 4058,
E-mail: wolfgang.voigt@chemie.tu-freiberg.de

6–11 August 2006 • Pesticide Chemistry • Kobe, Japan
11th International Congress of Pesticide Chemistry
Dr. Hisashi Miyagawa, Division Applied Life Sciences, Graduate School of Agriculture, Kyoto University, Kyoto 606-8502, Japan, Tel.: +81 75 753 6118, Fax: +81 75 753 6123, E-mail: miyagawa@kais.kyoto-u.ac.jp

12–17 August 2006 • Chemical Education • Seoul, Korea
19th International Conference on Chemical Education
Prof. Choon H. Do, Sunchon National University, Department of Polymer Science and Engineering, 315 Maegok-dong, Sunchon, Chonnam 540-742, Korea, Tel.: +82 61 750 3565, Fax: +82 61 750 3565,
E-mail: choondo@sunchon.ac.kr

13–18 August 2006 • Coordination Chemistry • Cape Town, South Africa
37th International Conference on Coordination Chemistry
Prof. K.R. Koch, Department of Chemistry, Univsersity of Stellenbosch, Private Bage X1 Matieland, Stellenbosch 7602, South Africa, Tel.: +27 21 808 3020, Fax: +27 21 808, E-mail: krk@sun.ac.za

3–9 September 2006 • Radical Polymerization • Il Ciocco/Castelvecchio Pascoli, Italy
International Symposium on Radical Polymerization: Kinetics and Mechanism
Prof. Michael Buback, Institut für Physikalische Chemie, Universität of Göttingen, Tammannstraße 6 D-37077 Göttingen, Germany, Tel.: +49 5-513-931401, Fax: +49 5-513-93144, E-mail: mbuback@gwdg.de

10–15 September 2006 • Green Chemistry • Dresden, Germany
First International IUPAC Conference on Green-Sustainable Chemistry
Prof. Pietro Tundo, Dipartimento di Scienze Ambientali, Ca' Foscari, University of Venice, Calle Larga S. Marta, Dorsoduro 2137, I-30123 Venizia, Italy, Tel.: +39 41 2348642, Fax: +39 41 2348620, E-mail: tundop@unive.it

18–22 September 2006 • High Temperature Materials • Vienna, Austria
12th International Conference on High Temperature Materials Chemistry (HTMC XII)
Prof. Dr. Adolf Mikula, Wahringstr. 42, A-1090 Vienna, Austria, Tel.: +43 4277 52606, Fax: +43 4277 52679,
E-mail: Adolf.Mikula@univie.ac.at

11–13 October 2006 • Advanced Polymers • Busan, Korea
Advanced Polymers for Emerging Technologies
Prof. Sung Chul Kim, Department of Chemical Engineering, Korea Advanced Institute of Sci. & Tech., 373-1 Guseongdong, Yuseong-gu, Daejeon 305-701, Korea, Tel.: +82 42 869 3914, Fax: +82 42 869 8435,
E-mail: kimsc@kaist.ac.kr

16–20 October 2006 • Chemistry for Life • Havana City, Cuba
27th Latin American Congress on Chemistry and 6th International Congress of Chemistry and Chemical Eng.
Prof. Alberto J. Núñez Sellés, Center of Pharmaceutical Chemistry, Sociedad Cubana de Quimica, Ave 21 & 200, Rpto. Atabey, Apdo. 16042 Havana, CP 11600, Cuba, Tel.: +53 7 218 178, Fax: +53 7 273 6471,
E-mail: alberto@cgf.co.cu

Mark Your Calendar

2007

IUPAC poster prizes to be awarded

15–21 April 2007 • Phosphorus Chemistry • Xiamen, China
17th International Conference on Phosphorus Chemistry
Prof. Yufen Zhao, Xiamen University, Department of Chemistry, Xiamen, China 361005, Tel.: +86 5922185610 Fax: +86 5922186292, E-mail: yfzhao@xmu.edu.cn

21–25 May 2007 • Mycotoxins and Phycotoxins • Istanbul, Turkey
XIIth International Symposium on Mycotoxins and Phycotoxins
Dr. Hamide Z. Senyuva, Tubitak-Atal, Konya Yolu No. 67, Besevler, 06530, Ankara, Turkey, Tel.: +90 312 2124620/ext.14, Fax: +90 312 2123749, E-mail: hamide.senyuva@tubitak.gov.tr

16–20 July 2007 • Solution Chemistry • Perth, Australia
30th International Conference on Solution Chemistry
Prof. Glenn Hefter, School of Mathematical and Physical Sciences, Murdoch University, Murdoch, WA 6150 Australia, Tel.: +61 8 9360 2226, Fax: +61 8 9360 1711, E-mail: g.hefter@murdoch.edu.au

22–27 July 2007 • Novel Aromatic Compounds • Tsuna-Gun, Japan
12th International Symposium on Novel Aromatic Compounds (ISNA-12)
Prof. Yoshito Tobe, Division of Frontier Materials Science, Osaka University, Toyonaka, Osaka University, Japan, Tel.: +81 6 6850 6225, Fax: +81 6 6850 6229, E-mail: tobe@chem.es.osaka-u.ac.jp

2–6 August 2007 • Organometallic Chemistry • Nara, Japan
14th International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS-14)
Prof. Kazuhiko Takai, Dept. of Applied Chemistry, Okayama University, Faculty of Engineering, Tsushimanaka 3-1-1, Okayama 700-8530, Japan, Tel.: +81 86 251 8097, Fax: +81 86 251 8094, E-mail: ktakai@cc.okayama-u.ac.jp

4–12 August 2007 • IUPAC 44th General Assembly • Torino, Italy
IUPAC Secretariat, Tel.: +1 919 485 8700, Fax: +1 919 485 8706, E-mail: secretariat@iupac.org

5–11 August 2007 • IUPAC 41st Congress • Torino, Italy
Chemistry Protecting Health, Natural Environment, and Cultural Heritage
E-mail: IUPAC.2007@unito.it

Visas

It is a condition of sponsorships 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.

IUPAC Poster Prizes

IUPAC Poster Prizes can be awarded at Division—or Standing Committee—sponsored events. The events are flagged in the previous calendar pages. For more information, contact the IUPAC Secretariat.

How to Apply for IUPAC Sponsorship

Conference organizers are invited to complete an Application for IUPAC Sponsorship (AIS) preferably 2 years and at least 12 months before the Conference. Further information on granting sponsorhsip is included in the AIS and is available upon request from the IUPAC Secretariat or online.
<www.iupac.org/symposia/application.html>.

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International Union of Pure and Applied Chemistry

Advancing 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.

National Adhering Organizations

Asociación Química Argentina *(Argentina)*
Australian Academy of Science *(Australia)*
Österreichische Akademie der Wissenschaften *(Austria)*
Bangladesh Chemical Society (*Bangladesh*)
The Royal Academies for the Sciences and Arts of Belgium *(Belgium)*
Brazilian Chemistry Committee for IUPAC *(Brazil)*
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)*
Det Kongelige Danske Videnskabernes Selskab *(Denmark)*
National Committee for IUPAC *(Egypt)*
Suomen Kemian Seura—Kemiska Sällskapet i Finland *(Finland)*
Comité National Français de la Chimie *(France)*
Deutscher Zentralausschuss für Chemie *(Germany)*
Association of Greek Chemists *(Greece)*
Hungarian Academy of Sciences *(Hungary)*
Indian National Science Academy *(India)*
Royal Irish Academy *(Ireland)*
Israel Academy of Sciences and Humanities *(Israel)*
Consiglio Nazionale delle Ricerche *(Italy)*
Science Council of Japan *(Japan)*
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 Portuguesa de Química *(Portugal)*
Colegio de Químicos de Puerto Rico *(Puerto Rico)*
Russian Academy of Sciences *(Russia)*
Union of Yugoslav Chemical Societies *(Serbia and Montenegro)*
Slovak Chemical Society *(Slovakia)*
Slovenian Chemical Society *(Slovenia)*
National Research Foundation *(South Africa)*
Ministerio de Ciencia y Tecnología *(Spain)*
Svenska Nationalkommittén för Kemi *(Sweden)*
Schweizerische Chemische Gesellschaft *(Switzerland)*
Türkiye Kimya Dernegi *(Turkey)*
Royal Society of Chemistry *(United Kingdom)*
National Academy of Sciences *(USA)*