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Building Bridges in Torino at the IUPAC General Assembly

Radionuclides and Radiochemistry

Nanotechnology—The New Chemistry

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From the Editor

CHEMISTRY International

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

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Managing Editor: Fabienne Meyers
Production Editor: Chris Brouwer
Design: CB Communications

All correspondence to be addressed to:
Fabienne Meyers
IUPAC, c/o Department of Chemistry
Boston University
Metcalf Center for Science and Engineering
590 Commonwealth Ave.
Boston, MA 02215, USA

E-mail: edit.ci@iupac.org
Phone: +1 617 358 0410
Fax: +1 617 353 6466

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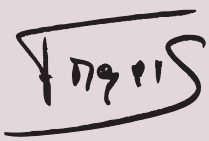
At its recent meeting in August 2007, in Torino, Italy, the IUPAC Council approved the adhesion of three new National Adhering Organizations (NAOs), bringing Cuba, Ethiopia, and Uruguay into the Union. Prior to being "full" members, Cuba (Sociedad Cubana de Química) and Uruguay (PEDECIBA) were associate members, which essentially gave them an "observer" status and allowed them to gradually learn what IUPAC is about. Now, as formal members, they can engage in full in Union affairs, contribute to IUPAC's mission, and benefit from their new status.

Being an NAO is one thing, but being an active member is more beneficial. In his column (page 2), Past President Leiv Sydnes shows that active engagement is a win-win situation for the NAOs and their individual members, and for IUPAC. Becoming or retaining an NAO status may be a struggle for some organizations, but there may be ways and options worth exploring that can lead to a more valuable membership.

It is important to note that IUPAC is a member of the International Council for Science (ICSU). By becoming NAOs, the members of IUPAC benefit from this connection to an over-arching network of scientists. One implication of this relationship is that the Union and its members should observe and actively uphold the principle of the Universality of Science: "This Principle entails freedom of association and expression, access to data and information, and freedom of communication and movement in connection with international scientific activities, without any discrimination on the basis of such factors as citizenship, religion, political stance, ethnic origin, language, sex, or age."

Adherence to IUPAC is also an expression of support for this principle, and as the Union enlarges, this principle becomes more significant. Broadening the Union's membership is also a way to maximize diversity and maintain a global perspective.

As IUPAC welcomes three new NAOs, I wish to echo that welcome to individual chemists and scientists from these regions. If you, as a current member, have a colleague in Cuba, Ethiopia, and Uruguay, drop him/her a note about IUPAC and welcome them personally. If you don't (yet) have a colleague in these regions, be curious and who knows what encounters you might make.



Fabienne Meyers
fabienne@iupac.org
www.iupac.org/publications/ci

Cover: View from the roof of the Lingotto Center of the Olympic Arch, which was built for the 2006 XX Olympic Winter Games.
Photo by Anders Kallner.

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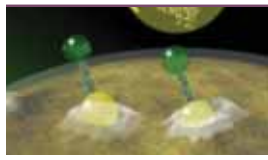


Stamps International 15

Why on Earth Be(come) an IUPAC Member?

by Leiv K. Sydnes

During my term in office, the number of member countries in the Union has grown slowly but gradually, and today IUPAC has 51 full members.* Although this is a significant accomplishment, the number could be considerably higher, so IUPAC has invested a lot of energy in recruitment initiatives. This effort has made clear that a large portion of the global chemical community is unaware of IUPAC membership benefits. Moreover, even chemists from member countries do not always understand the advantages of being an IUPAC member. This column, therefore, is an attempt to reiterate the benefits IUPAC provides to individual chemists and member countries. I believe that IUPAC members who have a solid understanding of IUPAC membership benefits help to strengthen IUPAC and our recruitment efforts.

While IUPAC does provide two excellent publications to each member country (one free subscription to *Pure and Applied Chemistry* and three free subscriptions to *Chemistry International*; total value USD 1997 for institutions), I discuss below some far more significant benefits that member countries stand to gain from joining IUPAC. First, however, I would like to note that the benefits of membership in IUPAC are maximized when a member country and its chemistry community are *actively engaged* members. For a country to achieve scientific and professional gains from IUPAC, both the national body in contact with IUPAC, and members of that country's national chemical community should be actively involved in IUPAC activities.

In my opinion, there are both scientific and economic benefits associated with IUPAC membership. Let me begin with the scientific benefits, not only because they are the more important of the two (and the most appropriate to consider in scientific circles), but also because they are a prerequisite for the latter.

When a country joins IUPAC, her chemical community is eligible to become involved in all of the Union's activities pursuant to certain procedures. Individual chemists who become involved in the scientific and science-based activities of the Union's divisions and committees gain valuable knowledge about IUPAC's operations. Although it may take some time for these chemists to understand and become comfortable with Union procedures, feel at home, and become a part of the Union's network, their initiatives and contributions are both appreciated and needed. Despite the Union's global reach, it is in need of project proposals. IUPAC is interested in projects that are scientific in nature, address educational challenges, or explore how knowledge in chemistry and the chemical sciences can be applied to remedy specific world problems or needs. The Union therefore needs the active involvement of chemists with a range of interests and backgrounds, and I encourage colleagues to volunteer for IUPAC through the national body handling contact with IUPAC.

. . . a large portion of the global chemical community is unaware of IUPAC membership benefits.

When individual chemists become members of IUPAC committees and project groups, it is important to participate fully. Active participation in committee and project work is highly regarded. In this way, individual chemists, whatever their national affiliation, are valuable candidates when titular members (TMs) are elected to the divisions and committees. Election to office is not only a form of international recognition for individual chemists, but for the chemical community in the elector's country. In addition, TMs are entitled to financial compensation for expenses incurred in attending General Assemblies. This can be a particular benefit for chemical communities in countries with lower membership fees.

The Union's international standing and the important work it does on standardization of chemistry

* In August 2007, IUPAC Council approved as full members the Sociedad Cubana de Química (Cuba), the Chemical Society of Ethiopia (Ethopia), and Programa de Desarrollo de Ciencias Básicas (Uruguay). The Council also accepted the resignation of the Asociacion Quimica Argentina. Therefore the current number of 49 will increase to 51 on 1 January 2008 when these decisions are to take effect.

methods and terminology, as well as its critical assessment of data, are a direct result of the high standards and excellent work of individual chemists in IUPAC's divisions, committees, and project groups. This work is crucial, not only for maintaining the quality of the chemical science profession, but also for the basic products and services provided in societies around the globe. Chemists who are participating in IUPAC activities and who have experience in analyzing the environmental, human, and technical impact of chemical products through chemical analyses have firsthand experience with accreditation, quality assurance, and quality control. These chemists' expertise becomes a resource to all national chemical communities via IUPAC membership. This is an important reason to join IUPAC as a full member.

Although most of the concrete scientific and science-based work in IUPAC is performed by individual chemists in divisions, committees, and project groups, the framework, budget, rules, and strategy are decided by Council at the General Assembly, held every other year. All full members of the Union are also Council members, with the right to put forward proposals, fully participate in the deliberations and debates, and vote. When all members attend the Council meeting, the Union benefits. IUPAC encourages participation in Council meetings by providing financial support for the travel expenses of one delegate from each member country—another valuable benefit of full membership.

It is IUPAC's mission to advance the chemical sciences globally and contribute to the beneficial application of chemistry to all people. It is therefore important for the Union to address major global or regional issues, to be involved in solving pressing world problems, and to develop and introduce new practices. Over the years, IUPAC has been aware of a number of global or regional problems, but too often that knowledge has not led to any viable IUPAC initiative because there were no chemists from the relevant region to champion the project. Countries in regions that face significant challenges or problems that could be solved with chemistry therefore stand to gain particular benefit from IUPAC membership; by becoming full members the chemical communities in these countries will be in an excellent position to draw IUPAC's attention to important issues, propose projects to study these issues, and work out action plans.

IUPAC and chemical congresses are closely associated, and only member countries can apply for IUPAC sponsorship for specific events. The chemical communities in many countries, particularly smaller countries, can attest to the scientific and professional inspirations that result from organizing an IUPAC conference. But conferences are more than scientific gatherings; they also bring business to a host country, as participants spend money on travel, accommodations, food, souvenirs, and personal pre- and post-conference trips. Consequently, IUPAC membership is a national investment that may reap rewards on several levels. Thus, from an economic viewpoint, an IUPAC membership and an active chemistry community constitute a sustainable investment that any responsible politician should be willing to support.

For an individual chemist with an idealistic attitude, it might take a while to get used to such thinking; but from my own recent experience having to meet with a few ministers, I came to appreciate that their attention increases when an economical benefit is included in the argumentation. I am therefore willing to emphasize this economical benefit as a strong argument in favor of IUPAC membership.

Leiv K. Sydnes <leiv.sydnes@kj.uib.no> is IUPAC immediate past president; he is a member of the Norwegian Chemical Society and professor at the University of Bergen.

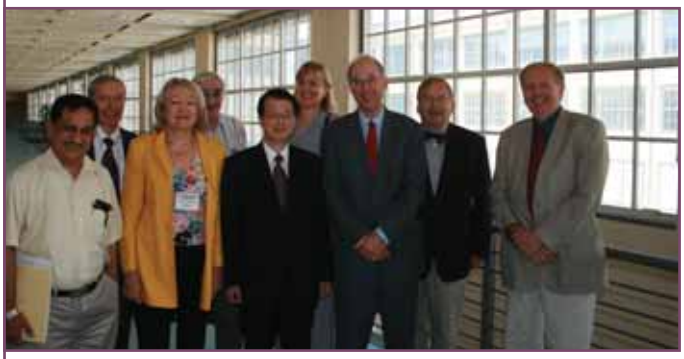
Learn more about recent IUPAC activities.

www.iupac.org/news/archives/2006/report.html

IUPAC in Torino, Italy

IUPAC held its 44th General Assembly in Torino, Italy, from 4–12 August 2007. Over the 10 days of the biennial GA, 440 participants took part in an intense and intricate schedule of various committee and division meetings and events. Among the major events were four Round Table discussions and the World Chemistry Leadership Meeting (WCLM).

Integrated within the Congress schedule were a variety of workshops, including the Safety Training Program of the Committee on Chemistry and Industry; a discussion panel on Ethics in Science and Education that followed the presentation of the play *Should've* (see May-June 2007 *CI*), which was coordinated by the Committee on Chemistry Education; and a session on the Multiple Uses of Chemicals and Chemical Weapons. In addition, the Congress offered CHEM-BIO-TECH, the joint meeting of the IUPAC 1st Symposium on Chemical Biotechnology (ISCB-1) and the 8th Symposium on Bioorganic Chemistry (ISBOC-8).



Current and future members of the Executive Committee (from left): Srinivasan Chandrasekaran, David Black, Nicole Moreau, Oleg Nefedov, Jung-Il Jin, Elsa Reichmanis, Bryan Henry, Christoph Buxtorf, and Leiv Sydnes. Photo by AK.

Members of the U.S. delegation: Mark Cesa (left), Ted Becker, and Elsa Reichmanis. Photo by AK.

The WCLM, which attracted 75 participants, focused on the health and environmental safety of chemical products, emerging issues of societal concern, and the resulting regulatory trends. The innovative Round Table Discussions, which had 67 participants, generated valuable initiatives for the future. More coverage on these events will appear in the Jan-Feb 2008 *CI*.

James Bull (left), PAC *editor, and Christoph Buxtorf, treasurer.* Photo by LM.

The IUPAC Council meeting from 11–12 August had 111 delegates from 43 out of 49 National Adhering Organizations. Every full member of the Union is represented on the Council, and one of their functions is to elect the officers and members of the Bureau. For 2008–2009 the IUPAC Council elected Jung-Il Jin (Korea) as president, Nicole Moreau (France) as vice president, and John Corish (Ireland) as treasurer, while David Black (Australia) was elected to a second four-year term as secretary general. Bryan Henry will become past president. The Council also elected the following individuals to be members of the Bureau for the 2008–2011 term: Anders Kallner (Sweden, reelected), Werner Klein (Germany, reelected), Ram Lamba (Puerto Rico), and Natalia Tarasova (Russia). The following elected members of the Bureau were elected to the Executive Committee: Chunli Bai (China), Srinivasan Chandrasekaran (India), and Elsa Reichmanis (USA).

President Bryan Henry presenting his State of the Union address. Photo by AK.

Council reviewed an agenda of more than 270 pages. This year, to help them with their task, the officers prepared an annotated agenda that lists a time for each item to be reviewed and whether it was for information, discussion, or decision. Over the course of the day-and-a-half meeting, delegates were briefed on progress made during the two-year period since the last meeting in Beijing in August 2005. The Council received the *Statutory Report of the President on the State of the Union* as well a report from the secretary general. Christoph Buxtorf presented the treasurer's

Photo by MHo.

report in which he noted that while the Union's reserves are adequate for the near to midterm, there are possible long-term financial issues that could arise due to the decline in income realized from the Union's journal, *Pure and Applied Chemistry* (*PAC*). The treasurer also noted a number of other developments, including the introduction of a Strategic Opportunities Fund and the success of the project system in promoting the work of IUPAC.

Rebecca Quine (left), coordinator of the 2009 Congress in Glasgow, and Alan Smith, UK Elected Member on the IUPAC Bureau and member of COCI. *Photo by AK.*

As standard procedure, the Council was asked to approve the recommendations approved by the Interdivisional Committee on Terminology, Nomenclature and Symbols and published, or scheduled to be published, in *PAC* from July 2005 through October 2007. The Council also received a series of reports from all divisions and standing committees.

Among the most significant actions taken by Council were the following:

- Council endorsed the plan to obtain United Nations approval of 2011 as an International Year of Chemistry <www.iupac.org/news/archives/2007/IYOC-2011proposal.html>.
- IUPAC added three new National Adhering Organizations, bringing Cuba, Ethiopia, and Uruguay into the Union. The application of the Federación Latinoamericana de Asociaciones Químicas for Associated Organization status was also approved.
- Council approved a proposal from the Colegio de Quimicos de Puerto Rico to host the 2011 IUPAC Congress and General Assembly. The 2009 Congress and General Assembly will be held in Glasgow, Scotland.

Members of the Puerto Rican delegation rejoicing over the Council decision to have the IUPAC Congress in Puerto Rico in 2011: (from left) Carlos Tollinche, Gabriel Infante, and Edgard Resto. *Photo by AK.*

Sultan Abu-Orabi, president of the Jordanian Chemical Society, participating in his first Council meeting as an NAO. *Photo by AK.*

At the Welcome Reception, on Saturday 4 August, IUPAC President Bryan Henry made his address on the state of the Union. The president emphasized that the principal strength of IUPAC lies in the talent, knowledge, and commitment of the more than 1000 volunteers who are involved in the IUPAC project system. He used examples of successful projects to demonstrate how the project system continues to allow the Union to meet its strategic goals.

Already planning for the years ahead and reflecting on the election results: Jung-Il Jin (left), who will become IUPAC president on January 2008, Nicole Moreau, who will become vice president, and Anders Kallner, who will continue as an elected member of the Bureau.

Henry also stressed that one of IUPAC's priorities should be to nurture relationships with organizations whose aims and activities are in harmony with those of the Union. One such organization is the European Association for Chemical and Molecular Sciences, EuCheMS. Another such organization is the International Council for Science (ICSU). Chemistry has played an important role in ICSU from its founding in 1931, with IUPAC being one of its original members. Yet, IUPAC has not been fully involved with ICSU over the last few years. ICSU has recently opened regional offices for Africa, Asia and the Pacific, and Latin America and the Caribbean, and IUPAC participated in the opening conferences at all three sites: Pretoria,

Kuala Lumpur, and Panama. The hope is to use these contacts within these regional offices to help IUPAC become more involved with emerging countries and to extend our programs more effectively to these regions. The president concluded that these are exciting times for IUPAC; although the Union can celebrate many achievements, it should continue to search for effective ways to contribute to the application of chemical sciences to improvements in our global environment and to human conditions.

Francis Gudyanga, representing the International Council for Science. *Photo by AK.*

Following his address, Henry presented service recognition awards to the following retiring officers:

- Prof. Leiv K. Sydnes, retiring as vice president, president, past president
- Dr. Christoph F. Buxtorf, retiring as treasurer
- Dr. H. Luzius Senti, retiring as chairman of the Finance Committee
- Dr. John M. Malin, retiring as chairman of CHEMRAWN
- Prof. Gus Somsen, retiring as chairman of the Project Committee
- Prof. Christopher M.A. Brett, retiring as president of the Physical and Biophysical Chemistry Division
- Prof. Anthony R. West, retiring as president of the Inorganic Chemistry Division
- Prof. Minoru Isobe, retiring as president of the Organic and Biomolecular Chemistry Division
- Prof. Ryszard Lobinski, retiring as president of the Analytical Chemistry Division

A small representation of the Italian support staff (always cheerful!), including Cristina Zanzottera (3rd from left) and Elena Amico di Meane (4th from left), and IUPAC staff Paul Leclair (center), Enid Weatherwax (3rd from right), John Jost (2nd from right), and Fabienne Meyers (right). *Photo by MHe.*

Members of the Russian delegation: Petr Fedotov (left), Natalia Tarasova (newly elected member of the Bureau), and Oleg Nefedov (retiring from the Bureau). *Photo by AK.*

- Dr. Kenneth D. Racke, retiring as president of the Chemistry and the Environment Division
- Prof. Paul W. Erhardt, retiring as president of the Chemistry and Human Health Division

Young Observers Oleg Demchuk (left), from Lublin, Poland, and Ponnadurai Ramasami from Mauritius. *Photo by LM.*

This year, Young Observers again participated in GA sessions. Following the same model used in 2003 and 2005, IUPAC and the National Adhering Organizations of Canada, USA, and UK selected 17 chemists, with varied backgrounds and interests, from 7 countries: Canada, Poland, Romania, Mauritius, Russia, UK, and the USA. Their participation added vitality and a valuable perspective to the committee work in which they participated. In the past, several younger chemists have become directly involved in IUPAC, and from this year's crop, project proposals have already been submitted.

Young Observer Kathleen Kelly (Bristol-Myers Squibb, USA) and John Grosso, member of the US National Committee for IUPAC. *Photo by LM.*

www.iupac.org/news/archives/2007/44th_council/highlights.html

Additional coverage of the IUPAC GA/Congress will appear in the Jan-Feb 2008 *CI*.

Division Roundups

A substantial amount of the GA was devoted to division and standing committee meetings, each of which spanned two days. Following are brief accounts of some of these meetings (part II will appear in the next issue). Prior to the GA, all divisions and standing committees provided a written report that is part of the *Council Agenda* book available online <www.iupac.org/symposia/conferences/ga07/council_agenda.html>.

Division IV: Polymer

Michael Hess, incoming Secretary

The Polymer Division had a very effective and lively meeting over two days during the 2007 GA. About 33 participants from more than 12 countries attended. The individual subcommittees and areas reported their activities since the last meeting that was held at the IUPAC MACRO 2006 conference in Rio de Janeiro, Brazil.

It is important to note that beginning in 2008, Christopher Ober, (Cornell University, USA), who is currently vice president, will become president of the division since Jung-Il Jin was elected IUPAC president and will have to vacate his division leadership.

Members of the Polymer Division pose around a Fiat chassis displayed in the Lingotto conference facility. At the wheel is Division President Jung-Il Jin.

The Subcommittee on Polymer Terminology is presently working on 19 individual projects, a number of them in cooperation with Division VIII. One of the major tasks is to complete the second edition of the *Compendium of Macromolecular Nomenclature* or so-called Purple Book. A number of projects are close to publication or final review, and some new projects are envisaged. There was one publication in the biennium and the Japanese translation of the Purple Book.

The Subcommittee on Structure and Properties of Commercial Polymers addresses important problems in the field of basic research and establishes international guidelines and instrumental methods. Its success is represented by the number of publications—five between 2005 and 2007—and the quotations thereof.

The Subcommittee on Molecular Characterization—established in 2006—is currently working on 10 projects (one of them in cooperation with the Subcommittee of Polymer Terminology) with two publications within the last biennium.

The Subcommittee on Polymerization Kinetics and Processes consists of 32 members from industry and academia. It has two publications within the last two years. New project ideas include critically evaluated rate coefficients for ionic polymerizations, survey of reliable initiator decomposition and initiator efficiency data, critically evaluated chain-transfer rate coefficients and chain-transfer constants, and termination rate coefficients for radical polymerization in aqueous solution. The success of this subcommittee is easily evaluated by the frequency of quotation of its publications.

The Subcommittee on Developing Polymer Materials, established in 2005 at the Beijing meeting, currently has six projects, four of them in cooperation with the Subcommittee on Polymer Terminology. It consists of 38 members (2 from industry) from 14 countries. This subcommittee, which seeks to identify the forefront of polymer science, has projects in the areas of biorelevant polymers and their application, electro-active and field-responsive polymers, self-assembly and aggregation of polymers, and spectroscopy of conducting polymers. Several feasibility studies are presently being prepared.

The project area of Education in Polymer Science, also established in Beijing, has voted to become a subcommittee. Presently, six working areas are covered and there are three projects directly related to practical teaching courses that have had extraordinary success.

Division IV serves as the interface between polymer science and the polymer community, polymer science and society, and polymer science and other disciplines with respect to sustainability, energy problems of global warming, and more. The Polymer Division cultivates international relations through human exchange, intersociety exchange within polymer science/chemistry, and in related chemistry fields. Another point

Photo by AK.

In the legendary chase scene in the 1969 movie **The Italian Job***, a gang races in Mini Coopers throughout Torino, including around the rooftop test track of the famous Fiat Lingotto factory building where the GA meeting took place.*

of activities is the field of sponsoring international conferences and workshops. Division IV has active and productive relations with the Pacific, European and Asian Polymer Federations, the Research Council of Japan, the Japanese Society for the Promotion of Sciences, the Japanese Union of Chemical Science and Technology, and the Chemical Society of Japan. During recent years a directory of societies in polymer science has been established, expanded, and updated. New entries include exchange programs and post-doctoral fellowships.

There were 21 IUPAC-sponsored conferences during the last biennium that produced eight publications (*Macromolecular Symposia*, Wiley). Starting in 2008, two awards will be offered at the biennial IUPAC-MACRO Conferences. One is an award for a senior polymer researcher, made possible through a grant from the Dutch DSM Company (see Wire section, p. 16), and the other is the Polymer International IUPAC Award, which will be given to a younger researcher.

The next meeting will be held in July 2008 in connection with IUPAC-MACRO 2008 in Taipei.

Division V: Analytical Chemistry

Roger M. Smith, Secretary

The location of the Torino GA, in the converted Fiat factory, was an interesting contrast to the usual dull lecture room of a summer weekend in an empty university campus, or to an exhibition hall. We met in the fishbowl-like glass walled rooms of the Torino Polytechnic. Two floors down was an active shopping mall, whose food courts provided a good lunch venue for informal interactions. Outside the coffee area was the circular ramp used in the original *Italian Job* movie. During any dull moments, those members who remembered, could reminisce about the three brightly colored Mini Coopers zooming down the structure.

Division V President Ryszard Lobinski presenting the division report at the Council meeting. *Photo by AK.*

At the meeting, the Analytical Chemistry Division (ACD) continued its tradition of reviewing work in progress, planning new projects, and highlighting topics of particular significance. A novelty was a full-day analytical chemistry session at the IUPAC Congress, which highlighted the work of the division to a wider audience. The posters of major division projects were also presented.

In addition to a discussion on current projects, including those of the Interdivisional Working Party of the Harmonisation of Quality Assurance and the Subcommittee of Solubility and Equilibrium Data, the ACD held a special open session to hear a report by Paul DeBièvre on the "Metrological Traceability of Measurement Results in Chemistry" project. DeBièvre explained how it is necessary to directly trace any measured value to its primary standards (e.g., the kilogram, metre, etc.) for an analyst truly to have confidence in the accuracy of his or her results and an understanding of the uncertainty in the measurement. Usually this will occur through a series of intermediate measurements, but each of these must include a measure of the experimental uncertainty. To make this complex subject clearer to the analytical community, a task group plans to develop a user's guide with practical examples based on real assays, to illustrate how the relationships are identified (see more on page 27).

To identify ideas for future work, division members took part in a brainstorming session in which they spent 5–10 minutes, thinking about specific topics for projects, what they thought should be the future direction of analytical chemistry, and, importantly, how the expectations and requirements of stakeholders can be satisfied. This discussion lead to a number of ideas for new projects and ways in which we might develop greater outreach. The ACD was conscious that the committee has largely academic roots and examined ways to involve more industrial analysts, either as committee members or by closer links with project teams, possibly even as corresponding members. In this context we were pleased to welcome two young observers from industry.

The ACD is continuing its core tasks of developing terminology for the Orange Book (i.e., the *IUPAC Compendium of Analytical Nomenclature*) and the Solubility Equilibrium Database. Both projects are closely involved with the developing interaction between IUPAC and FIZ Chemie.

The editor thanks the following amateur photographers for their contributions: Anders Kallner (AK), Lucille Meyers (LM), Michael Hess (MHe), and Morton Hoffman (MHo).

The division officers for the 2008–2009 biennium will be Ales Fajgelj (president), Ryszard Lobinski (past president), Walter Lund (vice president), and Brynn Hibbert (secretary). The committee also welcomed a number of new titular and associate members and national representatives.

Division VI: Chemistry and the Environment

Willie J.G.M. Peijnenburg, Secretary

Fourteen members of the Chemistry and the Environment Division, and one invited observer, Dr. Christoph von Holst, who is also a task group leader, participated in the 2007 meeting at the GA. Over the course of the meeting, the division (i) reviewed projects and made decisions on existing projects and new proposals, and decided how to allocate the remaining project budget; (ii) finalized the membership for 2008–2009, including Associated Members and National Representatives and appointed divisional representatives to other IUPAC bodies; (iii) reviewed subcommittees activities and provided time for separate meetings; and (iv) met with representatives of the IUPAC Committees on Chemistry and Industry and Chemistry Education.

Thirty-two projects are in progress at the moment, including projects led by other IUPAC divisions and to which Division VI is contributing. Progress of the projects is, in general, most satisfactory, with just two projects in need of reviving since progress is limited. The division allocated remaining project funds for the biennium to three existing projects that had requested continuation and/or additional funds.

Each subcommittee provided ideas for new projects for the next biennium. The ideas will be reformulated into draft project proposals, to be discussed in a teleconference to be held in the spring of 2008.

The composition of the new division committee was decided upon. Most noteworthy is that in addition to the regular slots for titular members, associate members, and national representatives, a proposal was brought forward for a provisional member, who would be an active expert from a scientifically emerging region of Southeast Asia.

Within the subcommittees, several new areas of project activities were discussed, including an ambitious new book series on biophysico-chemical processes in environmental systems.

The next face-to-face meeting of the committee will be in September 2008 in Bari, Italy, which will be hosted by Nicola Senesi.

CHEMRAWN

John M. Malin, Chairman

The CHEMRAWN Committee continues to pursue its goal of improving the quality of life by fostering chemical research applied to world needs. Most recently, the needs addressed have been for pure water, a clean environment, and a sustainable food supply. At its meeting in Torino, the committee accepted a volume summarizing a 2004 meeting on water supplies, received a report on this year's conference on greenhouse gases, and heard plans for a CHEMRAWN meeting on food supplies in Africa that is about to take place. Additionally, the CHEMRAWN committee discussed two major planning and orientation documents.

- The committee was informed that the *Perspectives and Recommendations* volume from CHEMRAWN XV: Chemistry for Water has been published. The volume was distributed at the meeting to all members of the IUPAC Council. It is available through the Maison de la Chimie, Paris, and is posted on the IUPAC website.
- Gary van Loon reported on the successful CHEMRAWN XVII: Greenhouse Gases—Mitigation and Utilization conference, held in Kingston, Ontario, Canada, from 8–12 July 2007. A report on the conference is being prepared for publication in *Chemistry International*.
- Pieter Steyn informed the committee about preparations for CHEMRAWN XII: Sustainable Agriculture and Human Well-Being in Africa, scheduled for 3–5 December 2007 in Stellenbosch, South Africa.
- John M. Malin, chair, reminded the committee that the document *History and Effectiveness of CHEMRAWN Conferences, 1978–2006* is posted for reference at <www.iupac.org/standing/chemrawn.html>.
- Malin outlined a nearly-completed draft document entitled *Details for Organizing CHEMRAWN Conferences*, which should serve as a guide for future conference organizers.

Part I: Their Role in Society*

by Mauro L. Bonardi and David S. Moore

Energy production is not the only use for the energy of the atomic nucleus. Nuclear and radiochemistry and related sciences and technologies—like radioanalytical, radiopharmaceutical, and radiation chemistry—are frequently applied in many branches of science and through technology for the betterment of people around the world.

The Energy of the Atomic Nucleus

The popular perception of the energy released by nuclear processes—such as *neutron induced fission* of ^{235}U, ^{239}Pu (bred from natural U), or ^{233}U (bred from natural ^{232}Th) or *nuclear fusion* of hydrogen isotopes—is that it is used for energy production (i.e., *heat*, and from that *electricity* and, in the future, nuclear-hydrogen or *hydricity*) or nuclear weapons. Indeed, scientists knew as early as the 1940s that the energy release from 1 kg of ^{235}U is equal to that of the combustion of either 2 000 tonne of oil equivalent or 3 000 tonne of coal equivalent. In a nuclear weapon, this energy corresponds to the detonation of 20 000 tonne of TNT (1 tonne TNT = 4.184 GJ). During the nuclear fission of this mass of ^{235}U, a mass of roughly 1 g (less than 0.1 percent of the initial mass)—calculated through the equation $\Delta E = \Delta m\ c^2$—is converted into energy. Therefore, nuclear fission has an enormous advantage as a clean source of energy and with the further advantage that there are no greenhouse gas emissions.

Presently—in spite of the negative perception of nuclear technologies—only 441 nuclear power plants (NPPs) produce 16 percent of worldwide electricity (33 percent in the 22 countries of the OECD, with maxima of 80 percent and 82 percent in France and Lithuania). At the present time, 34 to 40 NPPs are under construction in 12 countries, while around 30 are planned in several countries <www.world-nuclear.org>. The environmentalist James Ephraim Lovelock, creator of the Gaia hypothesis, says "opposition to nuclear energy is based on irrational fear" <www.ecolo.org/lovelock>.

According to the *International Energy Outlook 2004* of the OECD, the worldwide demand for energy will double by 2050, while the demand for electricity will double by 2025. Large and densely inhabited developing countries such as China and India will place a particular burden on resources. Electricity produced from nuclear power represents a sustainable solution to the global energy problem that will result from this demand, especially considering the very small level of radioactive wastes produced annually by the global nuclear industry (i.e., 200 000 m^3 of medium and intermediate level nuclear wastes and 10 000 m^3 of high-level wastes). It is noteworthy that the global amount of energy presently consumed worldwide in one year—corresponding to an "equivalent" power of 13 TW thermal—could be produced by the fission of merely 5 million kg of either ^{232}Th (in thermal breeder reactors), ^{235}U or ^{239}Pu. Compare this to the burden on ecosystems of CO_2 released by the combustion of fossil fuels at a rate of 0.8 million kg.s^{-1}. It should be noted that ^{232}Th is present in the Earth's crust in amounts four to seven times greater than U.

Non-Energetic Applications of the Energy of the Atomic Nucleus

Nuclear materials, however, are used for more than energy production. Non-energetic applications of the energy of the nucleus affect the biomedical field, the environment, cultural heritage, research, advanced technologies, security issues, and human wellbeing. Nuclear processes, such as the decay of radioactive species (i.e., radionuclides), are widely used for combating human diseases (i.e., radiopharmaceutical chemistry), foodstuff irradiation for sterilization and preservation purposes (i.e., radiation chemistry), and the safeguarding of cultural heritage and the environment (i.e., radioanalytical and radiation chemistry). They are also used for heating and lighting in difficult environments and for an extensive range of other, often surprising, applications.[1,2] The American Nuclear Society <www.ans.org> recently estimated that the number of employees and scientists engaged worldwide in the non-energetic use of the energy of the nucleus in research, industry, government, hospitals, transportation and safety, environmental protection, life sciences, materials sciences, bio- and nano-technologies, and space exploration is much larger than

* Part II will focus on issues related to terminology; it is scheduled to appear in the Jan-Feb 2008 *CI*.

Table I—Milestones in Nuclear Science

(C, P: leading to Nobel Prizes in Chemistry or Physics)

1895 P	discovery of X-rays by Wilhelm Conrad Röntgen; atomic prelude to nuclear sciences, led to first human radiography
1896 P	"activity" of U salts by Henri Becquerel; Was it related to Röntgen's X-rays?
1898, 1911 C	first radiochemical separation: Po and Ra from U ores by Marie Sklodowska and Pierre Curie: term radioactivity was "invented," perspectives in life sciences
1908 C	radioactive decay and properties of radioactive elements by Ernest Rutherford
1920s, 1943 C	radiotracer technique by György von Hèvesy, first application of ^{32}P in medicine
1921C	chemistry of radioactive substances and isotopes in nature by Frederick Soddy
1922C	mass spectrometry of large number of isotopes by Francis Aston
1929 P, 1942	cyclotron by Lawrence, first nuclear reactor by Enrico Fermi and Walter Zinn
1934C	heavy hydrogen (deuterium) by Harold Urey
1934P	neutron thermalization and activation by Enrico Fermi and co.
1934	"hot atom" nuclear recoil effect by Leo Szilard and Thomas Chalmers
1932, 1935 P	neutron discovery by James Chadwick
1935 C	syntheses of new radioactive elements by Frédéric Joliot and Irène Joliot-Curie
1939 C, 1940	nuclear fission by Hahn, Strabmann, Meitner, Frisch and Petrzhak, Flerov
1949 C	^{14}C dating by James Arnold and Willard Libby
1951 P	nuclear transmutation by accelerator by John Cockcroft and Ernest Walton
1951 C	first 5 transuranium elements (Np, Pu, Am, Cm, Bk) by Glenn Seaborg and Co.
1956	first $^{99}Mo/^{99m}Tc$ "generator" for radiodiagnostics by Walter Tucker*
1958 P	radioanalytical applications of Pavel Chěrenkov – Sergei Vavilov effect
1960s	gamma camera for radionuclide emission radiodiagnostics (Hal Anger camera)
1961 P	Mössbauer effect and spectroscopy by Rudolph Mössbauer
1963 P	nuclear shell structure by Maria Göppert-Mayer and Hans Jensen
1967 P	nuclear energy production mechanisms in stars by Hans Bethe
1970s	thyroid cancer radiodiagnostic and radiotherapy by ^{131}I; ^{123}I for radiodiagnostics
1976, 1985	2-[^{18}F]-fluoro-2-deoxy-D-glucose (2-FDG) for brain studies, tumor seeking
1980	tomographic radiodiagnostic techniques (SPET, PET, PET/CT, spiral PET)
1990	labelling of brain and tumor receptors, investigations on dementiae senilis
1994 P	neutron diffraction and spectroscopy by Bertram Brockhouse and Clifford Shull
1997	polyphosphonates for bone metastases pain palliation labelled with ^{186g}Re, ^{153}Sm
1999	oligopeptides for metabolic radiotherapy labelled with ^{64}Cu, ^{90}Y, ^{177g}Lu
2001	alpha emitters for high-LET metabolic radioimmunotherapy: ^{211}At, ^{225}Ac///^{213}Bi
2002 P	cosmic X-rays by Riccardo Giacconi; circle of Röntgen X-rays closed ?

*10 million radiodiagnostic investigations in North America annually, same in Europe and Japan.

the number of people working in the nuclear power industry.

Radionuclides, Labelled Compounds, and Radiopharmaceuticals

Table I shows a select list of relevant discoveries and related Nobel Prizes in Chemistry and Physics associated with the nuclear sciences, emphasizing those with significant applications in the diagnosis and treatment of illness. Since the discovery of radioactivity in 1896, just after the discovery of X-rays in 1895 by Wilhelm C. Röntgen, there has been a wide range of beneficial applications of nuclear technology to human health.

Even excluding all the radiodiagnostic and radiotherapeutic techniques based on the use of X- and gamma rays (radiography, CT, cobaltotherapy, gamma-knife), or accelerated particle beams that irradiate pathological tissues (electron beams, IMRT, proton and heavy ion hadrontherapy), there are many techniques based on the use of both sealed and unsealed internal radioactive sources. Among these are endocavitary radiotherapy and brachytherapy of tumors and other tissues, which have been in use for half a century. More recently, brachytherapy of prostate cancer has involved using Ti or stainless steel seeds containing ^{125}I—or ^{103}Pd—that are inserted permanently into a patient's body, and cause minimal discomfort.

More relevant for the nuclear and radiochemistry community are the applications of radiopharmaceutical compounds labelled with radioactive nuclides produced either by a nuclear reactor or an accelerator. The first are obtained by neutron capture or fission and are *neutron rich* and in general decay by beta minus (*negatron*) emission; they are suitable for metabolic radiotherapy after being administered to humans (and animals) as labelled chemical species. The latter are normally *neutron poor* and decay by electron capture and/or *positron* emission; these are used for radiodiagnostic and molecular imaging in 2D by gamma-camera, and more recently by SPET, PET, PET/CT, and spiral-PET tomographic equipment with 3D capability. In addition, a number of novel alpha emitters recently have been proposed for high-LET radionuclide targeted *radioimmunotherapy*, while applications of a range of low energy monoenergetic Auger and IC emitters (^{64}Cu, ^{111}In, ^{117m}Sn) are under investigation for selective irradiation of DNA inside cell nuclei, after internalization of properly labelled species through cellular and nuclear membranes.[2,3] Table II shows the primary specifications of a labelled compound to be used on living organisms, humans, animals, and cells.

Table II—Analytical and Radioanalytical QC/QA of a Labelled Compound (e.g., radiopharmaceutical)

Measurand: quantity or parameter	Symbol or acronym	Typical range
chemical purity	CP	sub-ppm traces
radiochemical purity	RCP	%
radionuclidic purity (isotopic, non-isotopic)	RNP	%
activity (i.e., radio-activity) a SI derived quantity	A	MBq to GBq
specific activity	A_S or **a**	GBq.μg^{-1}
isotope dilution factor	IDF	dimensionless
activity concentration	C_A or c_A	MBq.g^{-1}
biological purity	BIOP	
stability with time (all previous parameters)		

Since the discovery of X-rays a century ago, the application of radionuclides and labeled compounds in many branches of nuclear science and technology has led to a vast array of improvements in both energy production and quality of life. The role of different branches of nuclear and radiochemistry proved fundamental to this purpose.[2]

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3. *Handbook of Radiopharmaceuticals: Radiochemistry and Applications*, Welch M.J., Redvalny C.S., Eds., Wiley, New York, USA, 2003.

Mauro L. Bonardi <mauro.bonardi@mi.infn.it> is a professor at the Universita degli Studi di Milano, Accelerators and Applied Superconductivity Laboratory, in Segrate, Italy. David S. Moore <moored@lanl.gov> is at the Los Alamos National Lab, in Los Alamos, New Mexico, USA.

Nanotechnology—The New Chemistry

In an earlier article (Jan-Feb 2006 CI*, p. 8), the author asked "Does Nanotechnology Have a Sporting Chance?" and reviewed briefly the hype surrounding the field. In a later article (Nov-Dec 2006 CI, p. 10), he illustrated how lessons from Mother Nature are resulting in the design of new nanotechnology applications. In this third piece, Smith reviews how the subject of nanotechnology has penetrated each divisions/discipline represented in IUPAC.*

by Alan Smith

Although nanotechnology is not something new, the term itself is a relatively recent way of describing work at the atomic or molecular level. If you look back at the Nobel laureates in chemistry or physics, many of the recipients could be described as nanotechnologists. Physicist Richard Feynman, who received the Nobel Prize for Physics in 1965, is regarded as the father of nanotechnology since he had the vision to realize that changes in properties would be found at the nano-scale. However, it was not until 21 years later, in 1986, that two other Nobel laureates in physics, Heinrich Rohrer and Gerd Binnig, used scanning tunnelling microscopy to observe objects on the nano-scale.

Another 21 years on, and we wonder how we managed without the term nanotechnology. In the interim, some chemists have received the Nobel Prize for their nano-scale work, the most notable being Rick Smalley, Harry Kroto, and Robert Curl for their work on fullerenes.

We hear so much about the flagging popularity of chemistry, but it is encouraging to see that nanotechnology is spicing things up for the chemist. There is not one division or standing committee in IUPAC that is unaffected by the advances in nanotechnology. In this feature, I would like to review how nanotechnology relates to the many disciplines represented in IUPAC.

Physical and Biophysical Chemistry (Division I)

Physical chemistry is an essential part of understanding the interactions that go into achieving novel properties that are now being found at the nano-scale. Practical applications range from modelling to produce nanoparticles of a consistent size to examination of interactions at interfaces that provide improved biocompatibility for tissue engineering.

Inorganic Chemistry (Division II)

Nanoparticulate titanium dioxide is being used in a diverse range of products, from sunscreens that offer protection from cancer causing ultraviolet (UV) radiation to nano-coatings on windows where the titanium dioxide actually uses UV light to break down dirt in self-cleaning windows. There also are air purifiers on the market that use similar catalytic processes, such as NanoBreeze.

Other examples include the cerium oxide nanoparticles used in diesel fuel, which make it more efficient for engines, provide better mileage, and reduce emissions from exhaust pipes.

Precious metals offer another interesting area of nanotechnologoy in chemistry. Scientists have found, for example, that gold nanoparticles offer significantly improved catalytic properties. And nanoparticulate silver, which provides anti-microbial properties, is being used in a variety of products, such as wound dressings, baby milk cartons to prevent cross-contamination, food storage containers, and in the plastic parts of refrigerators to prevent mold formation. If Napoleon only knew that he lost his campaign in Russia because (although he had silver cutlery) his troops were using wooden spoons that supported microbial growth!

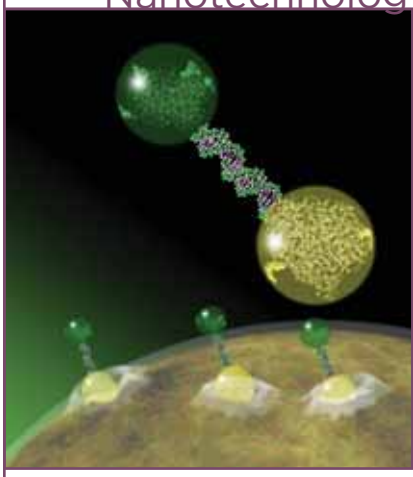
Organic and Biomolecular Chemistry (Division III)

Organic chemistry is having a large influence on the pace of nanotechnology development. For example, improved composites are not achievable if the nano-ingredient is not dispersed well in the polymer, so selection of the right "compatibilizer" is essential. There also is a great deal of work going on related to functionalizing carbon nanotubes for sensors.

A roadmap for the application of dendrimers into new materials—another discovery produced by nanotechnology—has been produced by scientists in Europe, and it describes their use in new inks, paints, and composites. Medical applications are at an early stage for these organics, but they offer great potential since dendrimers represent engineering at a biological-size scale. They show excellent potential as carriers for imaging contrast agents for enhanced organ, vascular, or tumor imaging, and for diagnostics.

Polymer (Division IV)

Nanocomposites are already finding extensive applications, where modified clays, carbon nanotubes, and particulates are providing barrier properties, lighter weight and stronger polymers, and functionalized surface applications. In order to save energy, most car manufacturers are using clay composites to replace



Dendrimer complex docking on cellular folate receptors. *Source: Michigan Center for Biologic Nanotechnology.*

heavy metal parts in cars. Even the fuel lines in new cars are going plastic through the incorporation of carbon nanotubes into the polymers to dissipate a charge. However, it is with carbon nanotubes that we will see real weight reductions because they may offer components that are 50 to 100 times stronger than steel, at one sixth the weight. The implication of this for the aviation industry is revolutionary.

It is interesting to note, too, that car tires have been using carbon black nanoparticles for about a century now. This is the largest use of nanoparticles worldwide, at 6 million tonne per annum. Clay-based nanocomposites also provide barrier properties, and are being used in food packaging applications to give longer shelf life by eliminating oxygen and UV. Functional films are just thin nanocomposite layers, which offer surfaces that are anticorrosive, antiglare, antimicrobial, antiscratch, and heat resistant.

The Polymer Division's project in nanoscience is aimed at proposing a list of terms and definitions for aggregation and self-assembly in polymers.

Analytical Chemistry (Division V)

There is considerable analytical activity in nanotechnology, especially with developments in atomic force microscopy. Viewing nanoparticles, for example, is essential, since novel properties are only achieved at the nano-scale. In addition, there is a need to develop equipment to assess the extent and variety of new properties that are achievable with nanotechnology. Although there is currently emphasis on particle size and distribution, it is becoming clear that surface area is a crucial factor.

Chemistry and the Environment (Division VI)

In 2002, Michael Crichton (author of Jurassic Park and other science fiction books) published *Prey*, a story that depicted clouds of nanorobots turning every living thing into grey goo before the hero manages to stop them. Unfortunately, many people thought that this type of catastrophe was possible, and nanoparticles became the focus of environmental and health groups and non-governmental organizations. The resulting publicity led some groups to demand a complete moratorium on manufactured nanoparticles, while others suggested that the best policy is to proceed with caution.

The essential point is that the majority of what is described as nanotechnology has been around since creation. However, for certain nanoparticulates we need to carry out the usual tests and risk assessments that would be carried out with any new substance. Free nanoparticles, as opposed to those locked into a composite, for example, are more likely to be a problem, and manufacturers are most likely to be affected. In the same way, major companies are not going to take risks by putting untested material into their products.

Many developments in nanotechnology are viewed as having a beneficial effect on the environment. Pesticide companies are looking at nanotechnology to ensure that their products reach the intended targets, eliminating waste and soil contamination. Longer-lasting surfaces, improved by particular nanocoatings, should extend the life of many products and processes.

IUPAC chemists are involved with these issues as well; at the recent IUPAC Congress in Torino, Italy, scientists described how nanoparticulate titanium dioxide is incorporated into cement for buildings thereby helping to break down environmental pollution in the atmosphere.

Chemistry and Human Health (Division VII)

Some of the most significant developments in nanotechnology will come in the field of healthcare. Work on new diagnostics indicate that increased sensitivity at the nano-scale will enable problems to be detected before they have affected the body, thereby reducing patient suffering and the length of hospital stays. Developments in nanotechnology also are benefiting tissue engineering, with new materials and surfaces that are more biocompatible. Nanotechnology also is providing benefits to the field of drug delivery.

Nanotechnology is being focused on some of the most significant healthcare problems, including cardiovascular diseases, cancer, musculoskeletal and inflammatory conditions, neurodegenerative and psychiatric diseases, diabetes, and infectious diseases. In the USA, significant funding is going to nanotechnology and cancer therapy, some of which is directed toward investigating better targeting of problematic cells.

Division VII has a project that could be described

as nanotechnology entitled Prototype Analysis of Molecular Biomarkers in Cancer.

Chemical Nomenclature and Structure Representation (Division VIII)

This division has undertaken the complex task of nomenclature for rotaxanes and for fullerenes.

Committee on Chemistry Education (CCE)

CCE has nanotechnology on their agenda. It is estimated that there are now over 500 products on the market that are based on nanotechnology. These are interesting and varied products, so it is easy for both children and the general public to grasp the significance of nanotechnology.

Chemrawn Committee

CHEMRAWN XIV: Towards Environmentally Benign Processes and Products, described new catalytic routes to chemicals, but more recent work on nanoscale catalysts suggests that there is great potential here for new production routes. Chemrawn XV: Chemistry for Water, discussed using nanotechnology membranes to provide clean water.

Because there are concerns in some quarters about nanotechnology, reports about its beneficial effects are being issued, specifically as they relate to the developing world. These effects have the potential to be a future CHEMRAWN conference topic.

Committee on Chemistry and Industry (COCI)

Some people have suggested that nanotechnology is the next industrial revolution, and there is not one industry sector that is currently unaffected by nanotechnology.

Although it is not possible to mention all the exciting nanotechnology developments in this space—we are only seeing the "tip of the iceberg"—it is likely that many more Nobel Prize winners will be nanotechnologists.

Alan Smith <SmithAZT@aol.com> is an associate director of the UK government's Micro Nano Technology Network, which is coordinating activities in nanotechnology throughout the UK. He is a member of the IUPAC Bureau and a member of the Committee on Chemistry and Industry.

See also www.iupac.org/publications/ci/indexes/stamps.html

Stamps International

For a Healthy Smile . . .

The addition of fluoride to drinking water supplies, at a level of ca. 1 ppm, is a health practice prevalent in communities across the USA and other countries that has undoubtedly contributed to the reduction of tooth decay in the general public since its inception in the 1940s. Even though water fluoridation is not universal, fluoride is also often added in small amounts (ca. 0.5%) to toothpastes and other oral hygiene products and thus its beneficial effect does reach a large segment of the population.

The stamp from Iceland that accompanies this note was issued on 9 October 1987 to promote oral hygiene and shows a girl brushing her teeth with a fluoride-containing toothpaste before going to sleep, a pretty clear message about the importance of such practice. On the other hand, the Brazilian stamp was issued on 15 July 1977 to celebrate the 3rd International Congress of Odontology, held in Rio de Janeiro on 15–21 July of that year. It prominently displays a rod of Asclepius, the emblem of the medical profession. The Portuguese words for water and fluorine (agua and fluor, respectively) and the chemical formulas of water and sodium fluoride appear several times in the background, thereby underscoring the value of water fluoridation to prevent dental caries. Sodium fluoride, together with stannous fluoride (SnF_2) and sodium monofluorophosphate (Na_2PO_3F), are the three most common sources of fluoride currently added to toothpaste formulations.

Written by Daniel Rabinovich <drabinov@email.uncc.edu>.

Performance Materials: A Symposium and New Award

Under a new agreement, the IUPAC Polymer Division and DSM Innovation Center B.V. will organize a symposium on performance materials to be held during each biennial IUPAC World Polymer Congress. A Performance Materials Award in the amount of EUR 50 000 also will be presented during one of the plenary sessions of the congress program at each symposium. DSM will cover the cost of the symposium, including speakers' fees and travel costs, and any technical equipment required.

A six-member Nomination Committee will nominate candidates for the Performance Materials Award. DSM and IUPAC will each be represented by two members on the Committee, and DSM will also appoint two independent members. The Judging Committee for the award will be comprised of three members representing DSM and two members representing IUPAC. A DSM representative will chair both committees. The award will be presented at the next three World Polymer Congresses. IUPAC and DMS will evaluate whether future awards will take place.

www.dsm.com

2008 IUPAC–Richter Prize in Medicinal Chemistry: Call for Nominations

The 2008 IUPAC–Richter Prize will be presented in June 2008 during the American Chemistry Society's 32nd National Medicinal Chemistry Symposium in Pittsburgh, Pennsylvania, USA, where the recipient will also give a plenary lecture on the subject of his or her research. The recipient will also give the lecture at a medicinal chemistry symposium in Europe. Symposia organizers will likely contribute to the recipient's travel expenses.

The prize of USD 10 000 will be awarded to an internationally recognized scientist, preferably a medicinal chemist, whose activities or publications have made an outstanding contribution to the practice of medicinal chemistry or the discovery of a new drug.

The 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.

Applicants can be by nomination only, with just one person needing to serve in that capacity, although five individuals should be listed as referees. The application package must be submitted electronically and should contain a complete resume, a professional autobiography of not more than two pages, and a one-page summary of the activities, accomplishments, and/or publications of the applicant that have had the most significant impact on the field of medicinal chemistry. The material will be forwarded confidentially to an independent selection committee appointed by the IUPAC Subcommittee on Medicinal Chemistry and Drug Development.

The application deadline is 31 December 2007. For further information, please contactC. Robin Ganellin at <c.r.ganellin@ucl.ac.uk>.

www.iupac.org/news/Richter_prize.html

IUPAC to Support the International Chemistry Olympiad

On 10 July 2007, IUPAC President Bryan Henry signed a Memorandum of Understanding with Manfred Kerschbaumer, chairman of the Steering Committee of the International Chemistry Olympiad (IChO), to formalize IUPAC's support for IChO.

A gold medal from the 1997 International Chemistry Olympiad in Montreal, Canada.

IUPAC will provide USD 10 000 to the IChO to help economically disadvantaged countries participate in the Olympiad. Countries that wish to apply for support may submit a written request to the chair of the Steering Committee of the IChO. IChO will manage, administer, and distribute the funds according to the following criteria:

- countries that cannot afford the participation fee and therefore cannot participate in the IChO
- countries that cannot travel with a team of four students
- countries that cannot travel with two mentors.

The unused portion of any grant will be provided to next year's host. In future Olympiads, the IUPAC president (or his or her nominee) will be invited to speak at the closing ceremony of the IChO and to take part in the gold medal presentations. Financial support will begin for the 40th IChO in Budapest, Hungary, in 2008.

A Report on the 39th International Chemistry Olympiad

by V. Lunin, N. Tarasova, and E. Lokteva

From 16–23 July 2007, Moscow hosted the 39th International Chemistry Olympiad, which gathered together 256 high school students from 68 countries. This Olympiad was the third one to take place in Moscow: In 1972 only 7 countries participated, while 45 participated in the one held in 1996.

The opening ceremony took place in a square at M.V. Lomonosov Moscow State University. The participants were welcomed by V.N. Fridlyanov, deputy minister of Education and Science of the Russian Federation, the president of the Olympiad; V.A. Sadovnotchi, rector of Moscow State University; and V/V/Lunin, dean of the faculty of chemistry. The parade of countries was followed by a concert and fireworks.

The program of the Olympiad consisted of experimental and theoretical problems. The tasks were prepared by members of the Scientific Committee, led by professor V.V. Eremin. As the participants and their coaches commented later, the complexity of the tasks was unprecedented. The theoretical portion of the exams included problems dealing with practically all fast-developing branches of chemistry, including proton tunneling in propane-dial, catalysis with nanoparticles, theory of autocatalytic reactions, the Fisher procedure of water titration, silicates as the basis of the Earth crust, arthrosclerosis treatment, and intermediates of the biosynthesis of cholesterol. The experimental portion of the test were no less interesting.

The problems took two days, and during the free days the students visited many interesting places in the Russian capital, including a boat ride on the Volga River; the ancient city of Sergiev Posad, where one of the most famous Russian monasteries, Troitse-Sergiev Lavra, is located; the Moscow Zoo, and the circus. Participants made a lot of friends and became acquainted more thoroughly with Russian history and culture.

The total number of awards was large: 60 percent of participants received an award of some type. The following medals were awarded: 31 gold, 56 silver, and 71 bronze. Splendid results were achieved by the teams from China, Russia, and Poland—every member of these teams received a gold medal. The South Korean team received three gold and one silver medal. Among the gold medal winners were students from Germany, France, Vietnam, India, Lithuania, Taipei, Thailand, Turkey, Slovakia, Hungary, Canada, and Iran. The gold medal winners with the four highest results were Lei Xu and Yuan Fang of China and Leonid Romashov and Vasiliy Vorobyev of Russia.

As the history of the Chemistry Faculty of MSU manifestoes, the future scientific career of the winners is optimistic. Many of them enter MSU and later on become the members of the Olympic movement as the coaches, authors of the tasks, or members of the organizing committees. Just one example: the coach of the Russian team Alexei Zeifman was the absolute winner of the 2004 and 2005 Olympiads, another coach, Alexandre Belov, got the gold medal in the year 2003.

The closing ceremony took place in the Act Hall of MSU. The winners received awards from the hands of members of the Russian Academy of Science, representatives of chemical business, and the representative of IUPAC. After that, the concert gathered together the stars of the Bolshoi Theatre and the young winners of the prestigious musical competitions.

Participants were asked to name the problems they consider the most important. It turned out

"Modern chemistry has a problem—we are incredibly good at transformation, but people don't feel our magic. Relax, show people that chemistry (and chemists) gives you pleasure, that you can smile around it. In the process you will demonstrate that chemists are humans and not machines. You will make friends for life, and help chemistry be part of the human condition."

—a quote from Roald Hoffmann that appeared in *Catalyzer*, the daily newspaper produced by the Olympiad.

that the young chemists are thinking about global issues: Aminatul Munirah Kasim, Malaysia, said that "unity and education are the most important problems of the world. I want to take part in improving the world's education because I feel it is the way of solving all the problems." Matias Gomee Elias, Argentina, said "Poverty and pollution seem to be the most urgent problems in the world. In my country, I think, it is so because of a lack of education. As a chemist, I would be grateful if I could solve everyday problems (for instance, diseases)."

A student conducts experiments for the practical exam portion of the Olympiad.

The Olympiad would not have been possible without the generous sponsorship of the government of the Russian Federation and the following chemical companies: Tokyo Boeki, Lykoil Neftekhim, Base Element, and Potanin's Charity Fund.

www.icho39.chem.msu.ru

Standard Atomic Weights Revised

The IUPAC Commission on Isotopic Abundances and Atomic Weights (II.1) met in Pisa, Italy, just prior to the 44th IUPAC General Assembly held 4–12 August 2007, in Torino, Italy. The commission meeting recommended significant changes to the standard atomic weights, A_r(E), of five chemical elements. The following changes are based on new determinations of isotopic abundances and reviews of previous isotopic abundances and atomic masses:

	From	To
lutetium	174.967(1)	174.9668(1)
molybdenum	95.94(2)	95.96(2)
nickel	58.6934(2)	58.6934(4)
ytterbium	173.04(3)	173.054(5)
zinc	65.409(4)	65.38(2)

The values are presented in a concise notation whereby the standard uncertainty is given in parenthesis next to the least significant digits to which it applies; for example, A_r(Zn) = 65.38(2) is the concise form of the expression A_r(Zn) = 65.38 ± 0.02.

In addition, the recommended value for the isotope amount ratio of $^{40}Ar/^{36}Ar$, which may be of importance to geochronologists, has been changed from 296.03(53) to 298.56(31).

These changes will be published in a new Table of Standard Atomic Weights 2007, to be submitted for publication in *Pure and Applied Chemistry* by the end of the year. For more details about the commission, see <www.iupac.org/divisions/II/II.1>, or contact Michael E. Wieser <mwieser@ucalgary.ca>, secretary of the commission.

www.iupac.org/news/archives/2007/atomic-weights_revised07.html

Release of InChI Version 1.02 beta; Introducing InChIKey

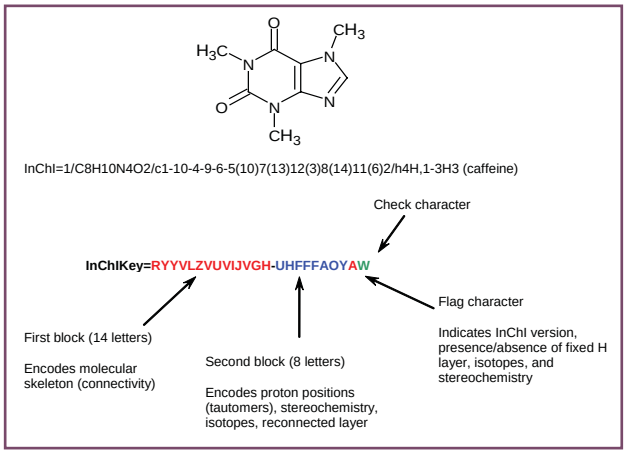
On 5 September 2007, IUPAC announced a new beta-release of its International Chemical Identifier (InChI) software. The Identifier is an open source, non-proprietary, unique, machine-readable structure-based identifier for chemical substances that may be used in printed and electronic data sources, providing an easier way to link diverse data and information compilations.

The principal new features of this release is that it provides a fixed-length (25-character) condensed digital representation of the Identifier to be known as InChIKey. In particular, this key will:

- facilitate web searching, previously complicated by unpredictable breaking of InChI character strings by search engines
- allow development of a web-based InChI lookup service
- permit an InChI representation to be stored in fixed-length fields
- make chemical structure database indexing easier
- allow verification of InChI strings after network transmission

An example of InChI, with its InChIKey equivalent, is shown on page 19. There is a finite, but very small probability of finding two structures with the same InChIKey. For duplication of only the first block of 14 characters this is 1.3 percent in 10^9, equivalent to a single collision in one of 75 databases of 10^9 compounds each.

Another new feature of this release is a restructured InChI-generating software that separates key steps



in its creation from an input chemical structure file. Among other uses, this allows intermediate results to be checked, enabling easier testing and development of InChI-based applications.

The new release may be downloaded from the IUPAC website <www.iupac.org/inchi>. Users are encouraged to report their experiences, or problems, make comments, and request additional information by contacting the InChI project coordinator Alan McNaught, at <mcnaught@ntlworld.com>.

www.iupac.org/inchi/release102.html

Chemical Risk Assessment Methodology

The World Health Organization (WHO) International Programme on Chemical Safety (IPCS) has published new information about its Project on Harmonization of Approaches to Assessment of Risk from Exposure to Chemicals (Harmonization Project). New materials include:

- a brochure outlining a workplan of new activities on international harmonization of risk assessment methodologies
- the August 2007 newsletter, providing updates on activities already underway
- an updated strategic plan
- the record of the 8th Harmonization Project Steering Committee

These documents and more detailed information on each of the activities already underway are accessible from the WHO project webpage at <www.who.int/ipcs/methods/harmonization/en>.

IPCS has also released the draft document *Mutagenicity Testing for Chemical Risk Assessment* for public review, with comments due by 23 November 2007. The document may be downloaded at <www.who.int/ipcs/methods/harmonization/areas/mutagenicity_testing/en>.

For more information, contact Carolyn Vickers at <vickersc@who.int>.

How does this relate to IUPAC?

Michel Mercier, the first director of IPCS, was a founding member of the former IUPAC Commission on Toxicology. Many of the original members had concerns about the toxicity of metals, an issue that continues to generate interest and that recently culminated in the IUPAC definition of "chemical speciation." The definition is crucial to current developments that focus on the differential toxicity of the different chemical species of metallic elements. The current developments in turn, revealed a need to develop new analytical techniques to identify these species and to characterize exposures that may or may not be harmful. (see *Pure Appl. Chem.*, Vol. 72, No. 8, pp. 1453–1470, 2000)

Following the IUPAC initiative on chemical speciation, a number of members of the former commission and the current Subcommittee on Toxicology and Risk Assessment contributed to a recent IPCS Environmental Health Criteria Document, EHC 234, *Elemental Speciation in Human Health Risk Assessment* (2006).

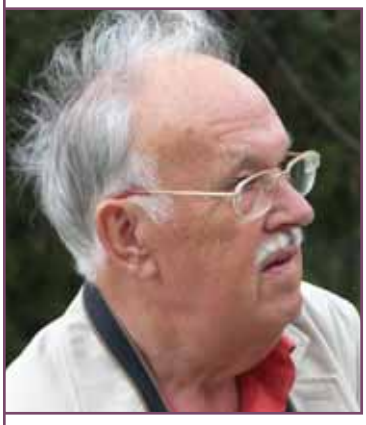
Interested in terminology, John H. Duffus (IUPAC Subcommittee on Toxicology and Risk Assessment; Edinburgh Centre for Toxicology), prepared a text on toxicology for IPCS courses; he discovered that the lack of an agreed upon terminology cost participants at international meetings a great deal of time—often as much as a day.

A Tribute to Professor Aubrey D. Jenkins

Tempus fugit! **Aubrey Dennis Jenkins, emeritus professor of polymer chemistry at the University of Sussex, UK, a distinguished, respected, and long-serving member of IUPAC, celebrated his 80th birthday in September 2007. He spent many years serving the scientific community through his work in industry (with Courtaulds Ltd. and Gillette Industries Ltd.) and**

academia at the University of Sussex and as a visiting professor in the Czech Republic, Switzerland, and USA. He served as dean of the School of Molecular Science at the University of Sussex for five years. He also served the community as a board member for the Brighton District Health Authority, Haywards Heath College, and the West Sussex Institute of Higher Education.

Jenkins had many mentors during his career, including T.B. Price, M.F. Gardener, R.E. Norris, Silvanus P. Thompson, Alexander Findlay, A.J. Allmand, Sir Christopher Ingold, Sir Harry Melville, C.H. Bamford, Colin Eaborn, O. Wichterle, R. Cahn, Paul Flory, and Sir John Cornforth. In turn, many of his former students later became distinguished scientists in academia or industry, including Richard Wane, Roy Lehrle, Francis Andrew, "Gaf" Roberts, and Ernesto Engel.



Aubrey D. Jenkins

Jenkins' scientific pursuits focused largely on the kinetics of radical polymerisation. He was the first scientist to propose "buried" or "trapped" radicals, and he made significant contributions to the understanding of retardation and inhibition of polymerization. More recently, his work on the prediction of radical and monomer reactivity led to an alternative to the *Q-e*-scheme of Alfred and Price. Known as the "patterns scheme," he continued to work on the underlying concepts after his retirement in 1992, work that has resulted in 10 more publications. He has published more than 130 research papers, was tapped as an expert in lawsuits, and lectured at conferences throughout his career. He continues to engage in research and publish.

Jenkins also was a fellow of the Royal Society of Chemistry, a fellow of the former Royal Institute of Chemistry, a member of the Society of Chemical Industry, and has been a member of IUPAC since 1976. He served as chairman of the Committee on Macromolecular Nomenclature from 1977 to 1985 and was for eight years secretary of the Macromolecular Division. He was a member of the UNESCO European Expert Committee on Polymer Science, Industry, and Environment; the British Library Scientific Committee; the British National Committee for Chemistry; and the British Committee for IUPAC. He served as secretary of the UK High Polymer Research Group from 1991–2002. He has also served on the editorial boards of the *European Polymer Journal*, the *Journal of Macromolecular Science*, *Resource Recovery and Conservation*, *Die Makromolekulare Chemie*, and continues to be a highly valued member of the editorial board of *Polymer International*. He has been awarded the Heyrovsky Gold Medal for Chemistry of the Czech Academy of Sciences and is an honorary member of the Argentine Society for Organic Chemistry.

His personal hobbies include classical music, photography, and travel. Jenkins is married to Jitka Jenkins, who is also a polymer chemist.

by Michael Hess, July 2007

Errata

Gerard P. Moss, professor at Queen Mary, University of London, provided the following clarification regarding an article about William Perkin's discovery of mauveine that appeared in the March-April 2007 *CI*, pages 4–7.

> "In the preamble of John Malin's feature describing CHEMRAWN, he quotes Bryant Rossiter, first chair of the CHEMRAWN Committee. Unfortunately, the first statement attributed to Rossiter is erroneous: The 18-year-old William Perkin did discover mauveine in 1865, but it was in his father's house in King David Lane, in the East End of London, not Cambridge. At the time, he was studying at the Royal College of Chemistry in Oxford Street, London, under August W. Hofmann (not Hoffman). The Royal College is the earliest constituent institution, renamed Imperial College, London, in 1907."

Herding AnIMLs (no, it's not a spelling mistake): Update on the IUPAC and ASTM Collaboration on Analytical Data Standards

by Tony Davies

Working on international standardization projects is difficult. Working on international standardization projects where two standardization bodies with their own rules, guidelines, and working practices are collaborating together is doubly difficult. The recent 2007 IUPAC General Assembly (GA) in Torino, Italy, gave the IUPAC CPEP Subcommittee on Electronic Data Standards (SEDS) the occasion to invite their ASTM partners in the Analytical Information Markup Language (AnIML) project to participate in a joint meeting. With both groups well represented by their respective officers and interested parties, some very important decisions were made.

During the 2001 GA in Brisbane, the clear need for IUPAC to establish itself as the international standardization body for chemistry in the digital age was documented and addressed with the initiation of the XML in Chemistry initiative. Several projects have arisen out of this decision, including the newly available XML versions of the Gold Book online and the successful completion of the XML Data Standard for Thermochemical Information ThermoML. Those involved with the third major project—the joint development of the Analytical Information Markup Language (AnIML) with the ASTM International Subcommittee E13.15—have recently made strong progress following a period in which a lot of background work was necessary.[1]

Why Create an Analytical Information Markup Language?

Historically, the availability of "rival" standards in the field of analytical instrumentation has only served to confuse users and vendors alike. The partial completion of the old Analytical Instrument Association netCDF-based binary standards for mass spectrometry and chromatography, and their abandonment of work on an infrared spectroscopy standard ended a period of conflicting and misleading presentations at international meetings around the world.[2] This had hampered work on the IUPAC JCAMP-DX ASCII standards and led to a dispersion of scarce talent between the two standardization activities.[3] When the SEDS subcommittee realized that both their experts and those of the ASTM were working simultaneously on a new XML-based data exchange standard for analytical data, it was clear that the previous situation had to be avoided at all costs.[1]

The successful completion of such an exercise, with the widespread deployment of well-documented internationally recognized standard data formats, will constitute clear advantages. Users will benefit from the greatly simplified long-term storage and retrieval of analytical data, and the more advanced techniques of data mining and knowledge generation. Proving conformity to regulatory compliance demands record retention, which is far simpler if data are in a vendor-neutral standard format. Practically, exporting data from a computer associated with a specific instrument in the laboratory to your office desktop, where often further data analysis and reporting is expected to take place, will be made much simpler. With the increasing use of process analytical technologies and design for manufacturing strategies in the pharmaceutical sector, often data from many diverse instrument types and vendors have to be brought together in a single analysis package where the actual "results" will be computed.[4]

Instrument vendors and third-party software houses have also realized major cost savings by adopting the standard formats, not only for their own internal use between systems, which often originate from different software development groups on different continents, but also so they can claim their products are "compliant ready." Nowadays, a vendor's products will not sell if it cannot clearly demonstrate how they will smoothly integrate into the existing laboratory IT environment and workflows of their customers. Stand-alone island solutions are a thing of the past. Often major contracts are awarded for software solutions that better integrate with existing IT infrastructures as the return on investment is easier to prove to senior management. The deployment of standard formats is a major contributor to such advanced integration.

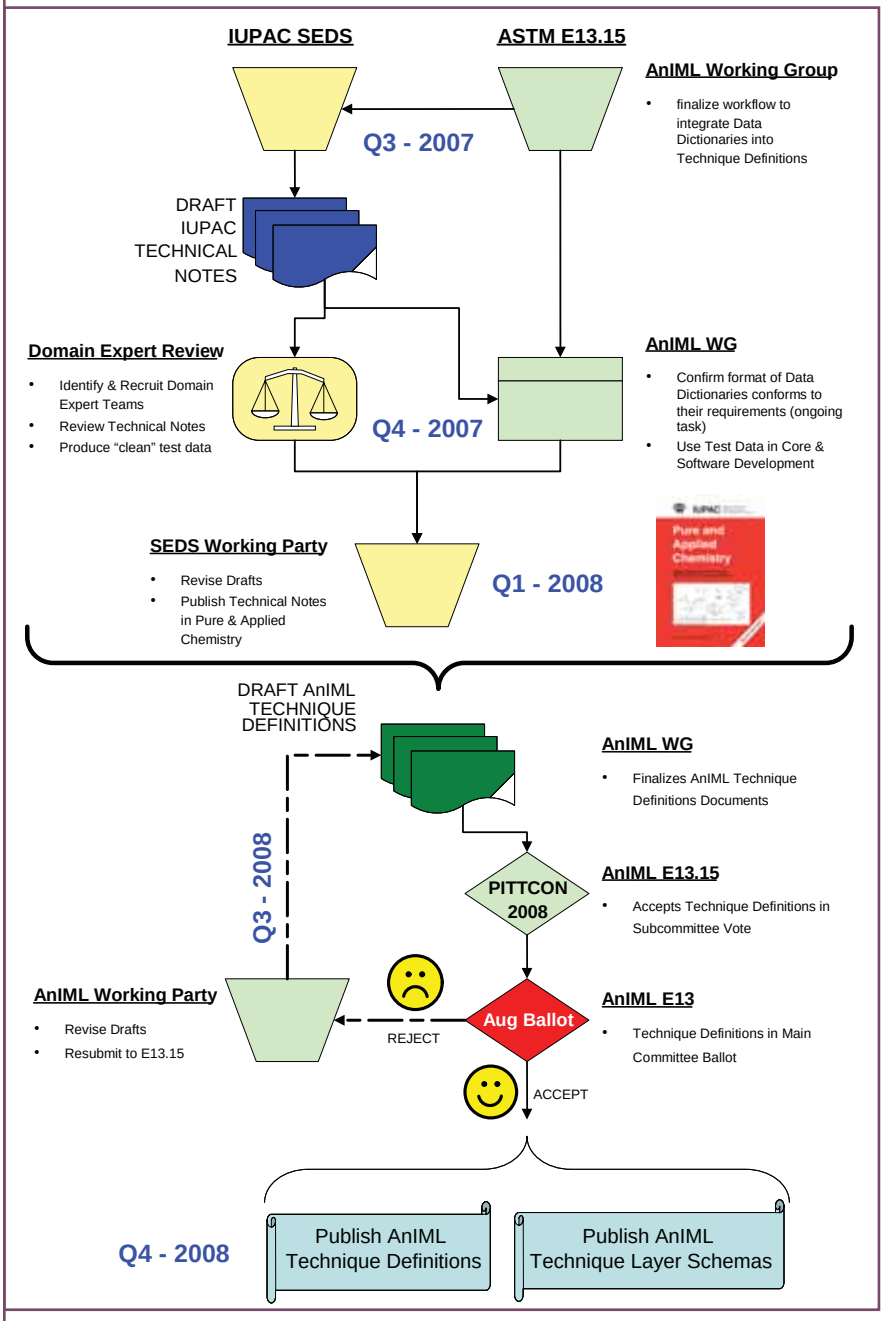
Recent Progress

Much work has already been achieved by bringing IT specialists up to speed on the complexity of analytical chemistry data types and formats. This process sometimes yields interesting results in which multidimensional data types, such as liquid chromatography UV/mass spectrometry hyphenated experiments, need to be stored. Conversely, the chemistry experts have had a lot to learn about the intricacies and capabilities of the XML language, including the recent introduction of naming standards. Fortunately, some vendors and users have been gaining experience in converting large volumes of data from very different historical legacy analytical systems into vendor-neutral XML files.

In order to accommodate the different demands of a very diverse user group, difficult decisions have been made. For example, the expectations involving audit trails and electronic signature capture that a user working in a fully regulated pharmaceutical industry company might have can be met, but significantly increase the complexity of the structure of the AnIML file.

Even though prototype systems have been available since 2004 that support early alpha versions of the AnIML standard and despite numerous lectures and seminars held around the world, not much has actually been published or finalized. This is one of two major issues that we successfully addressed in Torino. The second issue involves completing the streamlining and clarification of the competencies of the various members of this project. The plan is for ASTM to concentrate on the technical aspects of the new standard and for IUPAC to standardize the terms and data dictionaries.

Overview of workflow to finalize AnIML standards.



Next Steps for Completing the Standards

There has been some confusion and criticism from some task group members over the fact that the requirements document, generated relatively early in the project, has remained an internal document. It was agreed at this meeting that the document should be published as a IUPAC technical report since it essentially sets the goals and boundaries for the AnIML format and is a key document for any new vendor or user coming across AnIML for the first time. The document had been reviewed by the authors, both prior to and during the meeting. Its adoption will appear on the agenda of

the next full task group meeting after which it will be submitted for publication.

As agreement on the data dictionaries is an essential precursor to the finalization of any of the standards, the initial versions will draw extensively, and almost exclusively, on the IUPAC/JCAMP-DX and ASTM ANDI standards that have already been published. Bearing this in mind, it was agreed to use the domain or technique-specific knowledge available within IUPAC to draft technical notes for the data dictionaries in chromatography, mass spectrometry, infrared spectrometry, nuclear magnetic resonance spectrometry, and the other so-called phase-one techniques (NIST will document the UV-Vis Data Dictionary). These drafts will be completed and made available during the rest of 2007. The drafts will be reviewed by technical experts and provided to the development teams who will integrate them into the IT technical documentation of the standard to identify any issues that need to be resolved before publication.

Formal adoption of the AnIML standards themselves will follow the ASTM process during 2008, and with tentatively a formal adoption planned to start at the ASTM E13.15 Business Meeting during the Pittcon Conference in spring 2008, with formal ASTM adoption at the end of 2008 provided no members veto the adoption.

Appeal

As you can see, as with all such standards development processes, we are extremely reliant on volunteers from the scientific community. If you feel like you can contribute, we would very much encourage you to come forward, even if it is only as a reviewer of the Technical Notes as they are made available.

Participants at the Torino meeting were Mohan Cashyap (GlaxoSmithKline, Ware, UK), Tony Davies (ALIS, Analytical Laboratory Informatics Solutions Ltd, Dortmund, Germany, and SEDS chair; <antony.n.davies@gmail.com>), Maren Fiege (Waters Informatics, Frechen, Germany, and ASTM E13.15 member), Gary Kramer (NIST, Gaithersburg, USA, and ASTM E13.15 subcommittee chair), Peter Lampen (c/o ISAS, Institute for Analytical Science, Dortmund, Germany, and SEDS secretary), Robert Lancashire (University of the West Indies, Kingston, Jamaica, and CPEP and SEDS member), and Dave Martinsen (ACS, and ASTM E13.15 secretary). We would like to thank Ben Mezoudj of Adobe in Germany for ensuring that the Adobe Connect eConferencing facility was working and available for the meeting.

References

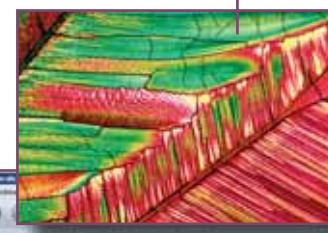
1. R.J. Lancashire and A.N. Davies, "The Quest for A Universal Spectroscopic Data Format," *Chem. Int.*, 28(1) 10–12, 2006 <www.iupac.org/publications/ci/2006/2801/3_lancashire.html>.
2. A.N. Davies, "Data Transfer Standards—The Unidata netCDF Standard," *Spectroscopy Europe*, 4(5), 36–39, 1992. (The ASTM standards and associated guides "Standard Specification for Analytical Data Interchange Protocol for Chromatographic Data" and E2077-00 "Standard Specification for Analytical Data Interchange Protocol for Mass Spectrometric Data" are available from the ASTM website for a fee. To locate them, search the Standards page with the keyword netCDF <www.astm.org>.)
3. R.S. McDonald and P.A. Wilks Jr., "JCAMP-DX: A Standard Form for the Exchange of Infrared Spectra in Computer Readable Form," *Applied Spectroscop*y, 42(1), 151–162, 1988. (This was the first JCAMP-DX standard to be published. All of the JCAMP-DX standards are available from <www.iupac.org/jcamp>.)
4. P. Lampen and A.N. Davies, "JCAMP-DX to ORIGIN Utility Tools for Making Spectra Available to Chemometricians," *Spectroscopy Europe*, 16(5), 28–30, 2004 <www.spectroscopyeurope.com/td_col.html>.

www.iupac.org/standing/cpep/wp_jcamp_dx.html

Multiple Uses of Chemicals: Clear Choices or Dodgy Deals?

Chemical processes determine much of who we are. Chemistry in the brain provides our sense of being and helps determine how we act. The oxygen we breathe is created by the chemical processes in plants, and the consumer products we buy are the result of chemical processes. Chemistry is central to life on earth, and many major global issues today require chemical solutions, including reducing pollution of the earth's atmosphere, providing clean water, improving food supplies, and developing new medicines. Chemistry thus has enormous potential to contribute positively to global well being.

But chemistry has not always been used for the common good. Ninety years ago, during World War I, chemists and chemical engineers used their knowledge to perfect weapons that were based on the physical and toxic properties of chemicals. The use of chlorine, phosgene, and mustard gas in WWI resulted in some 1.3 million casualties, and it is now estimated that 90 000 died soon after exposure. Many others died years later from lung injuries sustained on the battlefield after inhaling the various chemical warfare gases and aerosols.



Crystal of pseudoephedrine under the microscope of Michael Davidson (Molecular Expressions). Pseudoephedrine, a powerful cold and allergy medicine, can be misused to create crystal meth.

In WWI, chemists considered it their duty to contribute to their country's war effort. Munitions had to be produced to suit military strategy. But the carnage of WWI had a lasting impact. It led to calls for treaties outlawing chemical warfare. The 1925 Geneva Protocol and, 70 years later, the Chemical Weapons Convention (CWC), both enforced chemical disarmament.

Under enforcement rules, governments must ensure that their citizens do not develop or promote chemical weapons. Chemists have a crucial role to play in this process. If the proscriptions of the CWC are to succeed, chemists must support both the letter and the spirit of these treaties. Because chemists will be needed to make chemical warfare agents and test the suitability of new agents for use in munitions, chemists may be put in the position of deciding whether they will help make chemical weapons or refuse to do so.

The law is clear: making chemical weapons is illegal. However, not all chemists are aware of the law, and many do not know about the CWC. There is a need to inform chemists about the treaty and the choices they may have to make in their careers.

To address these issues, the Organization for the Prohibition of Chemical Weapons (OPCW) and IUPAC held a conference in Oxford, UK, in the summer of 2005. Two things came out of this conference: first, the decision to form a working group to consider the best methods to promote codes of conduct for chemists and, second, the recognition that there is a need for educational material that will both encourage chemists to consider the implications of their work and inform them about the CWC and the OPCW.

Subsequently, an international working group* was established to develop an educational package that will foster debate on the issues. Four working papers were produced that cover the many uses of chemicals, the CWC, the toxicology of selected chemical warfare agents, and codes of conduct. Approximately six pages long, the papers have been peer reviewed and tested in workshops in the UK, Russia, South Korea, and Italy (see text box below). Workshop participants have included

*Members of the IUPAC/OPCW Working Group: E.D. Becker (USA); A. Fratadocchi (Italy); A.W.M. Hay (UK and chairman); P.G. Mahaffy (Canada); R. Mathews (Australia); B. Rappert (UK); R. Robson (CEFIC); O.P. Sharma (India); R.A. Spanevello (Argentina); N.P. Tarasova (Russia); and R. Trapp (formerly of OPCW).

Echoes from the Most Recent Workshop

During the 41st IUPAC World Chemistry Congress in Torino, Italy, IUPAC members organized a workshop on 6 August 2007 titled **Multiple Uses of Chemicals and Chemical Weapons**, led by Alastair Hay, Natalia Tarasova, and Alberto Fratadocchi. The workshop concluded with a session on the duality of chemistry for both useful purposes and chemical weapons warfare, chaired by R. Pfirter and A. Fratadocchi.

Some 30 conference delegates took part in the workshop. In a 20-minute introductory talk to explain the background of the project, workshop participants were told that the objective of this IUPAC project was to produce teaching material that both emphasizes the importance of chemistry in the global economy, but also points out that chemistry has not always been put to beneficial uses.

Participants formed small workshop groups to debate a range of issues that were raised in the introduction, including how to control the misuse of chemicals and who should exercise these controls—questions that are also contained in the teaching materials prepared by the IUPAC project team. The debates were lively, indicating that the project material will stimulate classroom discussion.

chemistry students, teachers, university professors, diplomats, and specialists in chemical warfare. The four papers have been translated and are available in the working languages of the OPCW—Arabic, Chinese, French, English, Russian, and Spanish.

The working papers are designed for use by university and high school chemistry teachers. They provide enough material for a one-hour lecture, or more. The papers were written with the objectives of promoting chemistry, providing information about the CWC, and encouraging debate. Because the field of chemistry has had negative press in the past, some might argue that encouraging chemists to discuss chemical warfare issues will only worsen its public image. Another argument is that most chemists do not have any interest in producing chemical weapons. However, the fact that chemistry professionals played a central role in the development of chemical weapons and their use in Iraq in the 1980s, together with existing (though declining) stockpiles, means that this issue is of more than just historical interest. The public knows about these issues, and chemists should discuss them. Chemists should be ready to confront this history and ensure that it is not repeated. Finally, these should be conscious choices.

These working papers are meant to foster discussion, encourage chemists to debate the past, and consider the implications of their work today. The papers make it clear that chemical weapons are illegal, and that chemists who choose to make them will be breaking the law. They cover the multiple uses of chemicals, indicating, for example how easy it is to convert a common ingredient in cough linctus into an addictive and highly dangerous street drug. The replacement of a hydroxyl chemical grouping on the side chain of the cough suppressant pseudoephidrine by a hydrogen atom changes the molecule into the drug methamphetamine. The change can be made using a simple chemical reaction. (The paper does not say how to make the change, only pointing out that it can be done.) The paper also discusses the multiple uses of chemicals like thiodiglycol, one of the starting points in the manufacture of mustard gas but a chemical commonly used in many ballpoint inks and fabric dyes. The widely used industrial solvent isopropanol is another example, because it is a key ingredient for making sarin.

After introducing these topics, the working papers encourage debate on a number of issues, including the information about pseudoephidrine and methamphetamine, and drugs in general, that should be made available publicly; the controls that should be in place for chemicals; who is responsible for these controls; the responsibility chemists have regarding access to chemicals; and the identification of other chemicals that create dual-use concerns. Ideally, these discussions should be held in small tutorial groups where there is likely to be a wide range of views, and views that may be strongly held. Some chemists will be familiar with the issues either as individuals or as parents that are concerned about the welfare of their children; these experiences may make for a more engaging debate.

Two additional working papers provide background and basic information on chemical warfare issues. These papers are also intended to promote discussion. The control of drugs and the control of chemical weapons raise very similar issues, which may help students who have less knowledge of chemical weapons.

The final paper in the series is on codes of conduct. Codes of conduct in a specific discipline often provide ethical rules and guidelines, though they may be very general and not enforceable. Sometimes these are educational or advisory codes on workplace ethics or conduct, but they may be more specific enforceable codes that govern accreditation in a profession. These latter codes may be very specific or too inflexible for a rapidly changing profession, and may not address ethical issues in detail. A healthy debate among chemists will determine the type of code that encourages legal and moral behavior on these issues.

Accessible information and photographs on this topic may be found at <www.iupac.org/multiple-uses-of-chemicals>. The four background working papers, available in all six languages, may also be accessed on the site. Additional papers and case studies may be added to the site as well. It is our hope that these papers will be informative, and that they will foster debate about these issues among chemists and educators.

This completes IUPAC project 2005-029-1-050. For more information, contact Alastair Hay <a.w.m.hay@leeds.ac.uk>.

Alastair Hay presented a version of this article at the OPCW Academic Forum in The Hague, on 18–19 September 2007. That version will appear in the Academic Forum proceedings.

www.iupac.org/projects/2005/2005-029-1-050.html
www.iupac.org/multiple-uses-of-chemicals

Establishing an East Asian Network for Organic Chemistry

Estimates indicate that Asia produces some 30 percent of the chemistry research done worldwide. Although this is a positive development, this research is currently concentrated in only a few countries in Asia.

Earlier cooperative networks, such as the Network for the Chemistry of Biologically Important Natural Products and the UNESCO Network for Natural Products have either ceased operating entirely or languish through a lack of funding. There is now an opportunity—indeed, a responsibility—for IUPAC to take the initiative in this matter and establish a new Asia network. An Asia network would also complement a major initiative of the Japan Society for the Promotion of Science (JSPS) to catalyze cooperative research in Asia.

The collaborative new East Asian Network for organic chemists have broad objectives, and is now closely linked to JSPS Asian Core Program, and the Cutting-Edge Organic Chemistry in Asia which started in October 2005 in order to build and foster a sustainable program of high-quality organic chemistry research, education, and chemistry-based applications.

Princess Chulabhorn Mahidol delivered the Nagoya Medal Special Awards Lecture on "Recent Investigations of Cytotoxic Natural Products from Thai Plants" at the first International Conference on Cutting-Edge Organic Chemistry in Asia (ICCEOCA-1) held in Naha, Okinawa, Japan on 16–20 October 2006.

The first meeting facilitated of the Network was held on 16 October 2006, as a satellite of the Asian CORE Program's first International Conference on Cutting-Edge Organic Chemistry in Asia. The meeting was entitled Strategic Planning for a New East Asian Network for Organic Chemistry, and provided the following sessions: "Modern Mass Spectrometry," presented by Matthias Pelzing of Bruker Daltonics, Australia, and "Computational Organic Chemistry," presented by Yundong Wu of the Hong Kong University of Science Technology.

Asian Core Program

The JSPS Asian CORE program is designed to create world-class research hubs in selected fields within the Asian region while fostering the next generation of leading researchers by establishing sustainable collaborative relations among research and education institutions in Japan, Korea, and China (in both Beijing and Taipei). Thailand, Singapore, Philippines, and Malaysia are also IUPAC non-NAO member countries.

The Asian Core Program's first International Conference on Cutting-Edge Organic Chemistry in Asia took place in Naha, Okinawa from 16–20 October 2006. Minoru Isobe gave the opening address. R. Noyori presented the gold medal in the Nagoya Medal Special Award ceremony to H.R.H. Dr. Princess Chulabhorn Mahidol of Thailand. The keynote speakers included H.R.H. Princess Chulabhorn, and Nobel prize-winning chemists R. Noyori and Y.-T. Lee. A report on the first International Conference is available free online, and published in *Chem. Asian J.* 2007, 2, 452–454, [doi: 10.1002/asia.200600423].

For more information and comments, contact Task Group Chair Minoru Isobe <isobem@agr.nagoya-u.ac.jp>.

www.iupac.org/projects/2005/2005-039-2-300.html

Critically Evaluated Rate Coefficients for Free-Radical Polymerization Part 6: Propagation Rate Coefficient of Methacrylic Acid in Aqueous Solution (IUPAC Technical Report)

Sabine Beuermann, Michael Buback, Pascal Hesse, Frank-Dieter Kuchta, Igor Lacík, and Alex M. van Herk

Pure and Applied Chemistry
Vol. 79, No 8, pp. 1463–1469, 2007
doi:10.1351/pac200779081463

Critically evaluated propagation rate coefficients, k_p, for free-radical polymerization of methacrylic acid, MAA, in aqueous solution are presented. The underlying k_p values are from two independent sources, which both used the IUPAC-recommended technique of pulsed-laser-initiated polymerization (PLP) in conjunction with molar mass distribution (MMD) analysis of the resulting polymer by size-exclusion chromatography (SEC). Different methods of measuring the MMD of the poly(MAA) samples have, however, been used: (i) direct analysis via aqueous-phase SEC and (ii) standard SEC with tetrahydrofuran as the eluent carried out on poly(methyl methacrylate) samples obtained by methylation of the poly(MAA) samples from PLP. Benchmark k_p values for aqueous solutions containing 15 mass % MAA are presented for temperatures between 18 and 89 °C. The Arrhenius pre-exponential and activation energy of k_p at 15 mass % MAA are 1.54×10^6 L mol^{-1} s^{-1} and 15.0 kJ mol^{-1}, respectively. Also reported are critically evaluated k_p values for 25 °C over the entire MAA concentration range from dilute aqueous solution to bulk polymerization.

www.iupac.org/publications/pac/2007/7908/7908x1463.html

Explanatory Dictionary of Key Terms in Toxicology (IUPAC Recommendations 2007)

Monica Nordberg, John H. Duffus, and Douglas M. Templeton

Pure and Applied Chemistry
Vol. 79, No 9, pp. 1583-1633, 2007
doi:10.1351/pac200779091583

The objective of the "Explanatory Dictionary of Key Terms in Toxicology" is to give full explanations of the meaning of toxicological terms chosen for their importance and complexity from the point of merging chemistry and toxicology. This requires a full description of the underlying concepts, going beyond a normal dictionary definition. Often linguistic barriers lead to problems in obtaining a common understanding of terminology at the international level and between disciplines. The explanatory comments should help to break down such barriers. The dictionary consists of about 68 terms chosen from the IUPAC "Glossary of Terms Used in Toxicokinetics," organized under 22 main headings.

The authors hope that the following groups will find this explanatory dictionary helpful: chemists, pharmacologists, toxicologists, risk assessors, regulators, medical practitioners, regulatory authorities, and everyone with an interest in the relationship of chemistry to toxicology. It should also facilitate the use of chemistry in relation to risk assessment.

www.iupac.org/publications/pac/2007/7909/7909x1583.html

A second part to this explanatory dictionary has recently been initiated as project 2006-020-1-700. The "Explanatory Dictionary of Terms Used in Toxicology" (PART 2) identifies about 20 additional terms that have caused communication difficulties, and expands their explanations in an effort to clarify their meanings and, in the end, the meaning of related scientific papers, reviews, or other documents. Together, Parts I and II of the Explanatory Dictionary should help chemists meet the increasing needs of government for chemical risk assessment by clarifying communication between chemists, toxicologists, and risk assessment specialists. This will, in turn, help ensure that chemistry practices remain safe and continue to benefit human health.

For more information contact <monica.nordberg@ki.se>.

www.iupac.org/projects/2006/2006-020-1-700.html

Quantities, Units, and Symbols in Physical Chemistry: 3rd edition

—also known as the IUPAC Green Book

prepared for publication by E.R. Cohen, T. Cvitas, J.G Frey, B. Holmstrom, K. Kuchitsu, R. Marquardt, I. Mills, F. Pavese, M. Quack, J. Stohner, H. Strauss, M. Takami, and A.J. Thor
RSC Publishing, 2007
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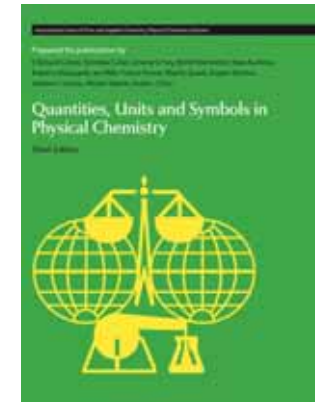
The first *IUPAC Manual of Symbols and Terminology for Physicochemical Quantities and Units* (the Green Book) of which this is the direct successor, was published in 1969, with the object of "securing clarity and precision, and wider agreement in the use of symbols, by chemists in different countries, among physicists, chemists and engineers, and by editors of scientific journals." In 1988, it underwent major extension and revision and was given the simplified title *Quantities, Units and Symbols in Physical Chemistry*.

This third edition of the Green Book, *Quantities, Units, and Symbols in Physical Chemistry*, is based upon the most up-to-date sources for fundamental constants, data, and nomenclature in the fields of chemistry and physics. As with previous versions, this edition has been written to enable clear understanding in an interdisciplinary environment and to convey information in a global multidisciplinary arena in which chemistry plays a central role. Examples are provided to explain how to avoid ambiguity in conveying information.



The third edition has a significantly extended index that provides a dictionary of terms and symbols and useful conversion tables. Information in the Green Book is synthesized from IUPAC, IUPAP, and ISO. The second edition has been available online as a PDF file, and the third edition will be available as a PDF one year after publication.

This is the definitive guide for scientists and organizations working across a multitude of disciplines requiring internationally approved nomenclature.

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

Not convinced that the Green Book is an invaluable reference to have? Try the quiz below . . .

1. What is the symbol for amount of substance (also called chemical amount)?
2. What is the definition of the SI base unit for amount of substance, the mole?
3. What is the affinity of a chemical reaction?
4. How is it defined, and what is its SI unit?
5. Define the extent of reaction ξ (SI unit: mole) for a chemical reaction?
6. What is the SI unit, and the commonly used unit, of molar electric conductivity?
7. What do the acronyms RADAR, REMPI, RHEED, and STEM stand for?
8. Name 12 different quantities for which the symbol μ is commonly used?
9. Define the number-average, mass-average, and *Z*-average molar masses of a polymer.
10. How is the reduced spin-spin coupling K_{AB} in NMR spectroscopy related to the more familiar (indirect) spin-spin constant J_{AB}? Why is K_{AB} sometimes a more useful quantity?
11. The magnetic susceptibility of a sample is described as "-15 cgs ppm." Convert this into SI units.
12. Give the present definition of the metre.
13. The integrated absorption intensity of the 1479 cm^{-1} band ion of the infrared spectrum of benzene is recorded to be 2.34 km mol^{-1}. Convert this (i) into an integrated cross-section in pm^2, and (ii) into an intensity in atm^{-1} cm^{-2} at 20°C.
14. The étendue of an optical instrument is a measure of its throughput, or light gathering power. Define fluence; give its symbol, and SI units.
15. Define the coulomb integral J_{ij} and the exchange integral K_{ij} between two molecular orbitals ϕ_i and ϕ_j in Hartree-Fock SCF-MO theory.
16. There are two accepted definitions of the electronegativity χ of an atom; give them both. In what units is χ usually recorded?
17. What are the meanings of the units ppb and ppt? When should they not be used?
18. Give the SI prefixes for 10^{-15}, 10^{-18}, 10^{-21}, and 10^{-24}.
19. What is the definition of the year?
20. Will the year 3200 be a leap year?

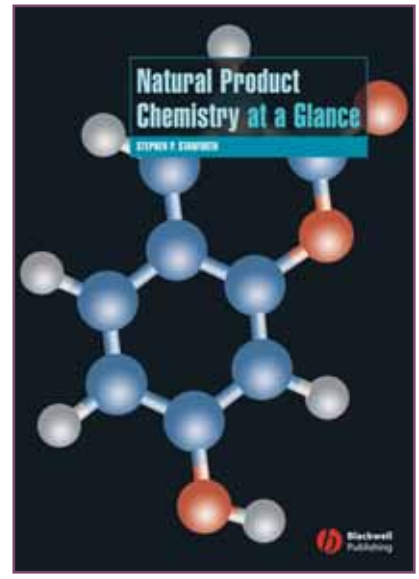
Compiled by Ian Mills (Vol 16, No. 1. 1994, *CI*) following the publication of the second edition of the Green Book in 1993.

Natural Product Chemistry at a Glance

Stephen P. Staniforth, Blackwell Publishing, 2006
ISBN 1-4051-4562-5

reviewed by Mary Garson

Natural Product Chemistry at a Glance is a concise primer on natural products in which the author points out the striking mechanistic parallels between biosynthesis and many common organic reactions. This book is intended for senior undergraduates studying chemistry who have some familiarity with organic reactions and mechanistic concepts. The book may well suit the British and European markets, but it is unlikely to be suitable for the North American market where natural products is a topic covered at the graduate course level. In my experience, natural products is taught within a course on medicinal chemistry, something this textbook does not provide.



The book begins with a brief introduction to primary and secondary metabolites, and is then divided into six short sections that address the origin of fatty acids, polyketides, shikimate metabolites, terpenes, and alkaloids. (A final section provides answers to the mechanistic problems that are scattered throughout the text; the 141-page book also includes an index.)

Although the book jacket states that it "will serve as an initial platform for more advanced excursions" into natural products, the text does not capture the current "chemical biology" approach to natural products chemistry, nor does it put the numerous examples of natural product structures in an appropriate biological context—which would make it hard for a reader to use it as the basis for more advanced reading. The entire field of chemical ecology is covered in two brief paragraphs, and there is only occasional mention of the origin or medicinal effects of metabolites. A page of references provides some suggestions for additional reading, but the most recent reference is 2003, and those covering polyketides are from 1997—not recent enough given that this rapidly evolving research field is constantly updated through review literature.

Technically, the book is a useful catalog of natural products biosynthesis, however, it is too brief in some subject areas. The section on polyketide biosynthesis, for example, does not provide a good sense of the current state of this discipline. In relation to the important training example of 6-methylsalicylic acid, the biosynthesis is discussed starting from a tetraketide precursor, consequently the progressive mode of polyketide biosynthesis is not adequately explained. The brief section on labeling studies is not adequate either, since there were few accompanying diagrams that show individual labeling results. In fact, the reader is referred back to the earlier discussion on 6-methylsalicylic acid, but to an incorrect diagram. A mechanistic textbook also should discuss the chorismate to prephenate rearrangement, given its medicinal chemistry significance. In addition, the older term "pyrophosphate" is used in place of the more common term "diphosphate" in the section on terpene biosynthesis.

Finally, the graphics in a chemistry textbook are important, and I found a number of problems with the diagrams in this book. In some diagrams, for example, the biosynthetic origin of carbon atoms are identified using letters, which was visually distracting and contrary to the asterisks, squares, or other symbols used in most biosynthesis textbooks. Despite the condensed format, the text and diagrams were also repetitious in content. For example, Figures 2.12 and 3.8 use different abbreviations to represent the enzyme, "SCoA" and the "SEnz" descriptor, respectively, which is confusing for a student. In addition, some of the structures in the graphics are not aligned , such as the carbonyl groups in Figure 4.61.

Although the educational concepts behind this series of "at-a-glance" books are sound, I would not strongly recommend this textbook for students. It would, however, be a good reference guide.

www.blackwellpublishing.com

Mary Garson <m.garson@uq.edu.au> is a professor at the School of Molecular and Microbial Sciences at the University of Queensland, in Brisbane, Australia.

Macromolecules for a Sustainable, Safe, and Healthy World

by Christopher K. Ober

A strategic conference entitled **Macromolecules for a Sustainable, Safe, and Healthy World** (IUMACRO-07) took place in Brooklyn, New York, USA, 10–13 June 2007. Jointly organized by the IUPAC Polymer Division, and the Polymer Chemistry and PMSE Divisions of the American Chemical Society, the conference assessed the challenges facing the intersecting fields of polymer science and technology. The conference was the first meeting sponsored jointly by the three organizations.

The conference was held on the campus of Brooklyn Polytechnic University in the heart of Brooklyn, with accommodations at the New York Marriott at the Brooklyn Bridge. There were 251 participants, many of them students. The conference had strong international appeal, with participants from 24 countries and 6 continents, though many attendees were American. The welcome reception and conference banquet were held at the New York Botanical Gardens.

The conference was inspired by the 2002 IUPAC Strategic Polymer Conference held in Kyoto, Japan. It was the second strategic meeting sponsored by the Polymer Division to assess the current fields of polymer science and technology and strategize about the future. Professor Jung-Il Jin, Polymer Division president, opened the conference. Two presentations followed, one by Christine-Alsen Norodom of UNESCO covering education for sustainable development, and a panel discussion, chaired by Dennis Smith, that focused on current challenges for the field of polymer science. These sessions set the tone for a highly interactive conference focused on global issues and the role of polymer chemistry in solving important societal problems.

The conference format provided two plenary lectures each morning and afternoon, followed by four related parallel lecture sessions. The eight plenary speakers and their topics were as follows:

- Joseph DeSimone from the University of North Carolina at Chapel Hill, USA, presented "Engineered Drug Therapies via Lithographic Processes from the Electronics Industry"
- Richard Gross of Brooklyn Polytechnic, in Brooklyn, New York, spoke on biopolymers
- Michael Grünze of the Universitäte Heidelberg, Germany presented "Polymer Nano-Brushes: Preparation and Physical Characterization"
- Nobel laureate Alan Heeger, of the University of California at Santa Barbara, USA, presented "'Plastic' Electronics and Opto-electronics—Recent Progress in Santa Barbara"
- Yasuhiro Koike of Keio University in Japan presented "Photonic Polymers: Bringing Us back to Face-to-Face Communication"
- Lene Lange of the University of Copenhagen, Denmark, presented "Plant Cell Wall Polymers as the Basis for Bioenergy—Challenges and Options"
- Myongsoo Lee of Yonsei University in Korea spoke on the topic "Reversible Nanostructures from Rod Amphiphiles"
- Qi-Feng Zhou of Peking University and Jilin University in China presented "Mesogen-Jacketed Liquid Crystalline Polymer (MJLCP) and its Use in Property and Structure Design of New Materials"

Speakers and conference attendees on the steps of the Brooklyn Polytechnic campus.

In addition to the plenary speakers, there were 72 invited lecturers and 51 contributed oral presentations, a total of 123 lectures. More than 30 speakers were from outside the USA, adding to the international character of the conference. The 68 poster sessions were lively and well attended.

Of the four sub-sessions for the meeting, two focused on health and global security, with one each on sustainable energy and environment and industrial design. Attendance at these sessions was generally high. Details of the program can be found at <http://people.ccmr.cornell.edu/~cober/IUMACRO>.

One highlight of the conference was the Biopolymer Award, presented to Robert Lenz, of the University of Massachusetts at Amherst, for his contributions to polymer and biopolymer science. Richard Gross, one of the conference co-organizers, presented the award. The conference also included a minisummit with the leaders of several international polymer societies discussing potential areas of collaboration with the IUPAC Polymer Division. The focus was on international education in polymer science for developing countries and on international conferences aimed at younger scientists, with follow-up discussions planned for the next World Polymer Congress in Taipei.

The program ended with a closing ceremony that included statements by Jung-Il Jin, and Professor Abe of Tokyo Polytechnic University in Japan. The conference was organized by Kalle Levon and Richard Gross of Brooklyn Polytechnic, Dennis Smith and Anthony Guiseppi-Elie of Clemson Universty (South Carolina, USA), Hiroyuki Nishide of Waseda University, Japan, and myself.

Christopher K. Ober <cober@ccmr.cornell.edu> is the current vice president of the IUPAC Polymer Division. Ober is currently at Cornell University's College of Engineering, in the Department of Materials Science & Engineering.

Provisional Recommendations

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.

www.iupac.org/reports/provisional

Metrological Traceability of Measurement Results in Chemistry

In commerce, society, and science, metrological comparability of measured quantity values and various published values is essential to determine their spatio-temporal differences, ratios, and drifts. Achieving metrological comparability of measurement results requires definition of calibration hierarchies providing metrological traceability chains which enable the establishment of metrological traceability of measured quantity values to a common metrological reference.

Experience has shown that the understanding of the concepts involved, their relation, role, definition, and use is insufficient and varied. Consequently, an attempt is made in this study to arrive at a set of consistent concept systems with associated terminology for measurement in chemistry. The systems build on definitions of concepts and associated terms from the new 3rd edition (2007) of the *International Vocabulary of Metrology—Basic and General Concepts and Associated Terms*, such as quantity, measurand, calibration, measurement procedure, measurement uncertainty, measurement standard, calibrator, and reference material. Additional concepts such as metrological equivalence of measurement results are also given.

Flow charts of generic calibration hierarchies are presented as well as a variety of examples.

The establishment, assessment, and reporting of metrological traceability are discussed, including the needed metrological institutional hierarchy and the role of interlaboratory comparisons.

Recommendations are made about the essential steps in planning and performing a measurement, and reporting a measurement result.

Comments by 29 February 2008

Prof. Paul De Bièvre
TEL: +[32] 14 851 338
FAX: +[32] 14 853 908
E-MAIL: paul.de.bievre@skynet.be

www.iupac.org/reports/provisional/abstract07/fajgelj_290208.html

Molecules that Matter

September 2007–April 2008
Skidmore College, Saratoga Springs, New York, USA

Organic molecules are the stars in a new exhibit that opened on 8 September 2007 at The Frances Young Tang Teaching Museum and Art Gallery at Skidmore College in Saratoga Springs, New York, USA. Titled ***Molecules that Matter***, this new traveling exhibit—created in partnership with the Chemical Heritage Foundation of Philadelphia—tells the story of organic chemistry in the 20th century using molecular models, art, and material culture objects. Each organic compound represents a decade of the century just passed to show the influence of organic chemistry on everyday life.

The exhibit demonstrated that organic chemistry can draw an enthusiastic audience. *Molecules that Matter* opened with a panel discussion in front of more than 150 people. A larger crowd filed the gallery and reception areas to talk with the artists, archivists, scientists, and other experts who contributed to this dramatic blend of art, science, and artifacts.

John Weber, Dayton Director of the Tang Museum, said that after three years of planning, he is delighted at "how well the art cohabits with the huge molecular models and the material culture objects. People responded to different aspects of the exhibit and to how it all fits together. You don't know until the opening if you got the blend right. Now we know it works. It feels great."

Introducing the exhibit and moderating the panel discussion were Weber and Ray Giguere, the Skidmore chemistry professor who proposed the original concept and serves as the exhibition's co-curator and scientific overseer. Giguere explained that the exhibit grew out of a class he taught on the history of science in the 20th century.

The 10 molecules in the exhibit were chosen to represent each decade of the 20th century and collectively represent the cultural changes organic chemistry made in America and around the world. The molecules in order by decade are aspirin isooctane, penicillin, polyethylene, nylon, DNA, progestin (The Pill), DDT, Prozac; and the buckminster-fullerene (carbon 60).

At the end of the panel discussion, Weber and Giguere fielded such questions as "Why not Taxol?" and "What other molecules were considered?" Giguere said the initial list of 200 was pared to 100 then 50 then 20, "then things got difficult." Others that did not make the cut in addition to Taxol (which was second to Prozac for the 1980s) were cortisone and polystyrene.

The Exhibit at the Tang

Molecules that Matter inhabits 3 000 square feet of the second floor of the Tang, with huge molecular models hanging from high ceilings. Next to the staircase hangs the most popular (judging by crowd reaction) of the molecular models, the seven-foot-diameter bucky ball (C-60 carbon sphere). The material culture objects that accompany this model, such as a carbon bike frame, represent the many ways carbon nanotubes and buckminster fullerenes have been employed since their discovery by Richard Smalley, Robert Curl, and Sir Harold Kroto.

On the bridge between the stairs and the main gallery are amber and green stalagmites and stalactites made by artist Jean Shin from thousands of prescription bottles. Three displays hang from the ceiling and four are mounted on the floor, making a dramatic entrance to the main second-floor gallery. Her work introduces the viewer to penicillin.

Off in a corner is the isooctane model. Four-

A new view of DDT. Photo by Philip Scalia <philipscalia.com>; reprinted with permission of Skidmore College.

and six-cylinder engines and an old Texaco gas pump are among its material culture objects. This high-octane exhibit also is darker than the others, allowing for better viewing of the two-hour video highlight loop that includes car chases from 40 different films representing more than five decades of movie mayhem.

"It really does look like a mosquito" was the comment several of the exhibit-goers made when one of the many black-clad Tang staff members pointed out the shape of the DDT molecule. Beneath that ominous molecular model were first edition copies of the truly ominous *Silent Spring*—a book that brought public scrutiny to organic chemistry.

Photo by Philip Scalia <philipscalia.com>; reprinted with permission of Skidmore College.

The Chemical Heritage Foundation (CHF) contributed expertise and artifacts to the exhibit, with staff curators providing materials from CHF's collections and advising on other exhibit materials and on the choice of molecules. Four CHF staff members also contributed articles to the exhibit catalog that will be released soon. The Camille and Henry Dreyfus Foundation, the Hach Scientific Foundation, Friends of the Tang Gallery, and donors to Chemical Heritage Foundation supported the exhibit.

Molecules that Matter will remain on display at the Tang until April 2008 when it will travel to Philadelphia to become the first exhibit in CHF's new Hach Gallery. In 2009 the exhibit will travel to the College of Wooster in Ohio and other destinations.

Written by Neil Gussman <NeilG@chemheritage.org> of the Chemical Heritage Foundation <www.chemheritage.org>.

http://tang.skidmore.edu/pac/mtm

Environmental Technology and Renewable Energy

31 January–1 February 2008
Vienna, Austria

Envietech2008 is the first-of-its-kind international congress and exhibition on Environmental Technology and Renewable Energy. It will be held at the Austria Center Vienna, 31 January–1 February 2008 under the auspices of the Austrian Federal Ministry of Agriculture, Forestry, Environment, and Water Management, and in cooperation with the European Commission's Energy Week 2008.

The congress and exhibition will give new impulses and present new opportunities for the emerging sector of sustainable environmental technologies and renewable energy resources. The newest developments and trends, their socio-economic impact, and implementation will be presented in four tracks:

- Environmental Technology
- Renewable Energy
- 4th European Forum on Eco-innovation
- Business Lounge

Following are likely topics to be covered:

1. WHO climate report and impact on energy use
2. fossil and renewable energy resources
3. CO_2 reduction/renewable energy
4. environmental technology as an economic impetus for Austria, Europe, and the global economy
5. EU funded research in the areas of environment and energy within FP6 and FP7
6. EU Technology Platforms collaboration for successful developments:
   - ETP for Plants for the Future
   - European Biofuels Technology Platform
   - ETP for Renewable Energy
   - European Solar Thermal Technology Platform
   - European Wind Energy Technology Platform
   - Forest-Based-Sector Technology Platform
   - Coordinated Action on Ocean Energy
   - Photo-Voltaic Technology Platform
7. bio fuels: raw materials, technology, use, and market
8. alternative pathways to secure energy sustainability and new technologies
9. research projects, industry presentations, and financing strategies

www.envietech.at

Data Mining

16–18 July 2008
Leipzig, Germany

The **8th Industrial Conference on Data Mining** (ICDM'2008) is the eighth conference in a series of industrial conferences on data mining. Experts from different fields will present their applications and the results obtained by applying data mining. In addition, newcomers to the field can get a fast introduction to data mining by taking the tutorial that will run in connection with the conference. In a problem/solution hour, attendees will have the opportunity to present their applications and ask for support or cooperation from others in solving the problem.

www.data-mining-forum.de

Thermophysical Properties

31 August–4 September 2008
Pau, France

The **18th European Conference on Thermophysical Properties** (ECTP2008) is jointly organized by the University of Pau, France; the University of Bordeaux 1, France; the Slovak Academy of Science, Slovak Republic; and the Constantine the Philosopher University, Slovak Republic.

The conference will provide a forum for academic and industrial researchers to meet and exchange valuable experiences in the field of thermophysical properties of a wide variety of systems covering fluids and solids. Abstracts are due by 31 January 2008 and registration is due by 15 June 2008.

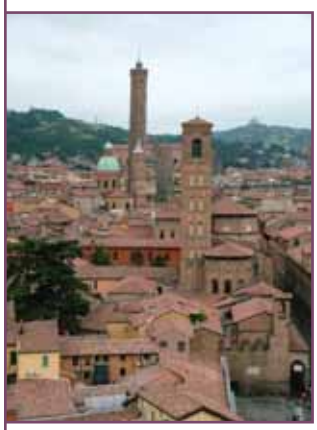
For more information, contact conference chairman Jean-Luc Daridon <ectp@univ-pau.fr>.

http://ectp.univ-pau.fr

Luminescence Spectrometry

7–11 September 2008
Bologna, Italy

The **XIII International Symposium on Luminescence Spectroscopy** (ISLS 2008)—"Analytical Luminescence: New Diagnostic Tools in Life Science, Food Safety and Cultural Heritage"—will be held on 7–11 September 2008 in Bologna, Italy. It is being organized by the University of Bologna Alma Mater Studiorum.



ISLS represents a traditional scientific appointment for scientists involved in all the aspects of luminescence spectrometry, from photoluminescence and electrogenerated luminescence to bio- and chemiluminescence. The meeting will create a forum for in-depth, informed discussions regarding both basic science and applications in biosciences, pharmaceutical, environmental, and food analysis.

Bologna is an ideal setting for scientific, social, and cultural experiences. Its rich artistic tradition, numerous gastronomic specialities, and the warm-heartedness of its citizens have been appreciated by visitors from all over the world. The University of Bologna–Alma Mater Studiorum is the oldest university in the Western world.

Contributions are invited for oral and poster presentations at the ISLS 2008. The abstract submission deadline is 15 April 2008.

Topics:

- basic and molecular mechanisms of fluorescence, TR-fluorescence, bio- and chemiluminescence, electrogenerated luminescence
- new luminescent probes and substrates; selectivity in luminescence detection
- far-red and NIR luminescence; laser-induced fluorescence
- instrumentation for light emission measurements; multiplexed hybrid devices
- miniaturized systems; luminescent chip-based technologies, microarray, point-of-care testing
- nanomaterials and quantum dots
- high-throughput and high-content screening; biomarker and drug discovery

- cellular process monitoring; in vitro/in vivo reporter gene luminescent techniques
- luminescent immunoassays and nucleic acids detection
- molecular luminescent imaging
- (miniaturized) capillary electrophoresis and chromatographic techniques, hyphenated methods
- luminescence in flow-assisted analysis
- new luminescence detectors and principles in separation sciences
- biosensors and whole-cell biosensors; resonance energy transfer techniques
- luminescent analysis: method validation and regulatory issues; chemiometric tools, computer-assisted luminescence
- luminescence applications: environmental, forensic, counterterrorism, occupational medicine, food, drug, clinical chemistry, proteomics, genomics, materials, industry

Workshops:

- luminescence-based detection methods to improve food safety
- noninvasive luminescent techniques for cultural heritage science and preservation
- point-of-care testing (POCT) devices based on luminescence
- light on the crime scene: forensic applications

www.isls2008.unibo.it

Green Chemistry

14–20 September 2008
Moscow-St. Petersburg, Russia

The **2nd International IUPAC Conference on Green Chemistry** (ICGC-2) will be held 14–20 September 2008 aboard the ship "Mikhail Kalinin," which will travel from Moscow to St. Petersburg, Russia.

The IUPAC ICGC-2 will take place under the auspices of IUPAC, Russian Academy of Sciences, Russian Foundation of Basic Researches, Russian Ministry of Education and Science, and M.V. Lomonosov Moscow State University. The conference will be organized by the Chemistry Department of Moscow M.V. Lomonosov State University, Russian Academy of Sciences, and Scientific-Educational Center "Sustainable-Green Chemistry."

It is intended that the topics of the conference will attract academicians, researchers, industry representatives, as well as students interested in green chemistry. The conference will be based on plenary lectures, invited lectures, and oral and poster presentations. Work groups discussions will be organized as well. The conference is expected to attract participants from all over the world.

The main topics will include:

- benign synthesis routes (heterogeneous catalysis, homogeneous catalysis, enzymatic catalysis, alternative solvents, new reagents)
- future green energy sources (hydrogen technology; fuel-cell technology; energy saving)
- use of renewables (new biomass technologies; plant polymers; biofuels)
- benign process technology (microreactor technique; microwave technology; photo chemistry)
- education in green chemistry

One of the stops on the boat trip is Kizhi Island, which features The Church of the Transfiguration and The Church of the Intercession, two 18th-century wooden churches.

The deadline for abstract submission is 30 March 2008.

See Mark Your Calendar on page 37 for contact information.

www.icgc2008.ru

Mark Your Calendar

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

2007

IUPAC poster prizes to be awarded

5–7 November 2007 • Infrared Spectroscopy • Buenos Aires, Argentina
International Workshop on Infrared Spectroscopy Applied to Biological and Biomimetic Systems: From the Isolated Molecule to the Cell
Prof. Andrea Gómez-Zavaglia, Universidad de Buenos Aires, Facultad de Farmacia y Bioquímica, Catedra de Quimica General e Inorganica, Junin 956. 2 P, C.P. 1113. Buenos Aires, Argentina, Tel.: +54 11 4964 8249, E-mail: angoza@interar.com.ar

28 November–1 December 2007 • Metallomics • Nagoya, Japan
International Symposium on Metallomics
Prof. Hiroki Haraguchi, Department of Applied Chemistry, Graduate School of Engineering, Nagoya-University, Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan, Tel.: +81-52-789-5288, Fax: +81-52-789-5290, E-mail: haraguch@apchem.nagoya-u.ac.jp

2–5 December 2007 • Food Security in Africa • Stellenbosch, South Africa
CHEMRAWN XII—The Role of Chemistry in Sustainable Agriculture and Human Well-being in Africa, Ms. Christelle Snyman, Tel.: +27 21 938 9245, Fax: +27 21 933 2649, E-mail: conference@chemrawn.co.za

2008

IUPAC poster prizes to be awarded

8–11 January 2008 • Agrochemicals • New Delhi, India
International Conference on Agrochemicals Protecting Crop, Health and Natural Environment,
Dr. N.A. Shakil, Division of Agricultural Chemicals, IARI, New Delhi 110 012, India, Tel.: +91 009818196164, Fax: +91 11-25843272

2–8 February 2008 • Photodynamics • Havana, Cuba
5th International Meeting on Photodynamics
Prof. Jesús 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@instec.cu

9–12 March 2008 • Heterocyclic Chemistry • Gainesville, Florida, USA
9th 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

2–6 June 2008 • Molecular Order and Mobility in Polymer Systems • Saint-Petersburg, Russia
6th International Symposium on Molecular Order and Mobility in Polymer Systems,
Prof. T.M. Birshtein, Institute of Macromolecular Compounds, Russian Academy of Sciences (IMC RAS), Bolshoi pr. 31, Saint-Petersburg, RU-199004 Russia, E-mail: birshtein@imc.macro.ru

22–27 June 2008 • Organic Synthesis • Daejeon, Korea
International Conference on Organic Synthesis (ICOS-17)
Prof. Sung Ho Kang, Department of Chemistry, KAIST, Daejeon 305-701, Korea, Tel.: +82-42-869-2825, Fax: +82-42-869-2810, E-mail: shkang@kaist.ac.kr

13–18 July 2008 • Biodiversity and Natural Products • Charlottetown, Prince Edward Island, Canada
International Conference on Biodiversity and Natural Products (ICOB-6 & ISCNP-26)
Prof. Russell Kerr, Department of Chemistry, University of Prince Edward Island, 550 University Avenue Charlottetown, PEI C1A 4P3, Canada, Tel.: + 1 902 566 0565, Fax: +1 902 566 0632,
E-mail: rkerr@upei.ca. Ann Worth, Conference Manager, E-mail: info@iupac-icbnp2008.com

27 July–1 August 2008 • Carbohydrates • Oslo, Norway
24th International Carbohydrate Symposium (ICS 2008)
Prof. Berit Smestad Paulsen, School of Pharmacy, University of Oslo, P.O. Box 1068 Blindern, N-0316 Oslo, Norway, Tel.: +47 22 856 572, Fax: +47 22 854 402, E-mail: b.s.paulsen@farmasi.uio.no

28 July–1 August 2008 • Photochemistry • Gothenburg, Sweden
XXII IUPAC Symposium on Photochemistry
Prof. Devens Gust, Department of Chemistry and Biochemistry, Arizona State University, Tempe, AZ, USA, 85287-1604, USA, Tel.: +1 602 965 4547, Fax: +1 602 965 2747, E-mail: gust@asu.edu

3–8 August 2008 • Chemical Education • Pointe aux Piments, Mauritius

20th International Conference on Chemical Education: Chemistry in the Information & Communications Technologies Age, (20th ICCE)

Dr. Ponnadurai Ramasami, Department of Chemistry, University of Mauritius, Reduit, Mauritius, E-mail: p.ramasami@uom.ac.mu

3–8 August 2008 • Chemical Thermodynamics • Warsaw, Poland

20th International Conference on Chemical Thermodynamics

Questions should be addressed to E-mail: info@icct2008.org. Comments, concerns, proposals, etc., should be addressed to E-mail: secretariat@icct2008.org.

14–20 September 2008 • Green Chemistry • Moscow, Russia

2nd IUPAC Conference on Green Chemistry

Prof. Valery V. Lunin, Chairman Russia Chemistry Department, M.V. Lomonosov Moscow State University, Leninskiye Gory 1, build. 3, 119992 Moscow Russia, Tel.: +7-495-9394575, Fax +7-495-9394575, E-mail: vvlunin@kge.msu.ru

14–20 September 2008 • Humic Substances • Moscow, Russia

14th Meeting of the International Humic Substances Society (IHSS-14)

Prof. Irina V. Perminova, Department of Chemistry, Moscow State University, 119992 Moscow, Russia, E-mail: iperm@org.chem.msu.ru, Tel: +7 495 939 5546, Fax: +7 495 932 8846

12–17 October 2008 • Biotechnology • Dalian, China

13th International Biotechnology Symposium (ISB 2008): "Biotechnology for the Sustainability of Human Society"

Prof. Fengwu Bai, Dept. of Bioscience & Bioengineering, Dalian University of Technology, 2 Linggong road, Dalian 116023, China, Tel.:+86 411 84706329, Fax:+86 411 84708083, E-mail: fwbai@dlut.edu.cn

26–30 November 2008 • Soil Science • Pucon, Chile

International Symposium of Interactions of Soil Minerals with Organic Components and Microorganisms

Dra. Maria de La Luz Mora, Universidad de La Frontera, Ciencias de Recursos Naturales, Temuco, Chile, Tel: +56 45 325479, Fax: +56 45 325053, E-mail: mariluz@ufro.cl

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